FRIENDS OF ROCKAWAY

Building Resilience to Natural Disasters on the Rockaway Peninsula

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Preface

Columbia University's School of International and Public Affairs offers a Master of Public Administration degree in Environmental Science and Policy. The program provides students with coursework in Earth systems sciences, policy analysis, and management and concludes with a capstone project entitled The Workshop in Applied Earth Systems Policy Analysis. This semester-long project connects students with real-world clients from the public and non-profit sectors. The Workshop provides clients with graduate-level analysis of issues challenging their organizations and provides students with a hands-on consulting experience.

The following document reports the findings of one workshop from the Spring 2014 semester, in which the community development organization Friends of Rockaway charged students with providing a community engagement plan to build disaster resilience on the Rockaway peninsula, an area of New York City severely damaged by Hurricane Sandy in 2012.

Acknowledgements

We would first like to express our sincere gratitude to Friends of Rockaway and our contact at the organization, Director Todd Miner. This capstone project strengthened our academic understanding by providing us with practical experience in building coastal resilience and climate change adaptation for urban areas. We also take pride in our association with an organization that has provided so much assistance to Rockaway residents who were severely affected by the destruction caused by Hurricane Sandy. Our team would also like to thank our faculty advisor, Professor Kathleen Callahan. Throughout the semester, she provided us with incisive guidance in examining the issues of resilience affecting Rockaway and in preparing our recommendations to the client. We would also like to thank Professor Cindy Gom, a geographer at Columbia University's Mailman School of Public Health, and our colleague Katie Edmond for their assistance in preparing our maps using geographic information systems software.

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Executive Summary

Rockaway (also known as the Rockaways) is a peninsula that sits at the southern border of the borough of Queens, New York. Historically a resort destination, the Rockaways is now home to 130,000 residents in twelve neighborhoods. The area has always been vulnerable to coastal storms, often becoming inundated during extreme weather events. Hurricane Sandy was no exception, when it hit the mid-Atlantic coast in 2012. The storm swept over many parts of the Rockaway peninsula with a twelve-foot storm surge. The ensuing fires and lack of access to emergency services exacerbated the situation. Nearly two years later, the peninsula continues to recover from the impacts of the storm.

Friends of Rockaway is a non-profit organization formed in the aftermath of Sandy to assist Rockaway residents with rehabilitation. The organization has primarily focused on getting people back into their homes. As their involvement in the community progressed, Friends of Rockaway realized that they also needed to focus on building long-term recovery and resilience in the Rockaways. To do this, Friends of Rockaway approached the Columbia University's Master of Public Administration degree program in Environmental Science and Policy to help define long-term recovery for the Rockaways and to compile a set of tools that could help the organization residents. This report details the work completed for Friends of Rockaway.

The report's beginning focus gives insight into climate change and the concepts of adaptation and resilience and considers the plans of both New York City and New York State as case studies. The focus here is on *PlaNYC: A Greener, Greater New York*, a report outlining the principles, actions, and goals to make the city more sustainable and a post-Sandy initiative entitled *A Stronger, More Resilient New York*. Our focus then narrows to the Rockaways and how the region will be impacted in an era of climate change. The current resilience plans in the Rockaways are then assessed in parallel with a case study of the Netherlands, a country renowned for its accomplishments in water management.

The focus then moves to identifying resilience frameworks that can be adapted to the Rockaways. The community capitals framework, which involves a community development strategy relying on civic engagement, is discussed. It is followed by an analysis of the civic ecology framework that considers the need to look at resilience as comprising hardware (infrastructure) and software (trust and sense of community) with a goal of enhancing social capital and civic engagement. This provides grounding for the introduction of the Social Vulnerability Index, a quantitative approach to assessing community vulnerability to environmental hazards. The section concludes with a case study of resilience planning in New Jersey.

The report then discusses community engagement and provides a useful charting of objectives that covers who needs to be engaged, how they should be engaged, and how to lead a successful planning coalition. We also discuss our community outreach efforts, including interviews with community members and the development of a survey. The section ends with an analysis of Dauphin Island and the resilience efforts conducted there.

The final component of the report discusses the maps created using geographic information system software. We were specifically asked to develop these maps for Friends of Rockaway to allow them to depict visualizations of climate change, sea-level rise, and social vulnerability in easy-to-understand images.

Although Rockaway is still vulnerable, there is immense potential for the peninsula to bounce back from Sandy stronger, more connected, and more resilient. With the material presented here and the additional resources given to Friends of Rockaway, we hope to help the community not only recover from Sandy but find ways that will allow them to remain steadfast in the face of future extreme weather events.

Introduction

In 2012, the devastating impacts of Hurricane Sandy on the mid-Atlantic coast heightened the level of attention local political leaders had been paying to disaster mitigation and management. New York City expanded its sustainability plan, New York State opened a new office focused solely on recovery from major storms, and the release of new flood maps created by the Federal Emergency Management Agency sparked national dialogue on the organization's flood insurance program.

Friends of Rockaway, though, did not think that these initiatives adequately addressed the needs of the organization's namesake community. After Sandy slammed into New York City, eight Rockaway natives formed Friends of Rockaway to help residents rebuild their lives through construction and financial assistance for homebuilding. In 2013, Todd Miner, the Director of Friends of Rockaway, decided that short-term housing assistance and even the government's existing resilience plans would not sufficiently protect the community against future natural disasters—especially when compounded with the effects of climate change.

To develop a path for building a resilient community, Friends of Rockaway enlisted a graduate student consulting team from Columbia University's School of International and Public Affairs in the Master of Public Administration program for Environmental Science and Policy. Mr. Miner charged the team with two tasks: (1) to define long-term recovery for the Rockaways and (2) to develop a set of tools to foster community engagement for resilience planning.

Developed through community outreach, the creation of detailed maps of the Rockaways, case study analysis, and a literature review, the project findings indicate that an adaptation plan for the Rockaways can be improved by including non-tangible elements of resilience, such as reinforcing the social and cultural links binding the Rockaways together as one large community. Furthermore, a cohesive, peninsula-wide plan would also serve to unite the community, as opposed to the current separate, compartmentalized initiatives for building resilience.

By utilizing the Community Engagement Toolkit, Friends of Rockaway can effectively communicate the issues involved in resilience planning and lead Rockaway residents to acknowledge that a changing climate will significantly alter their community. Rather than applying short-term fixes in attempts to salvage current perceptions of Rockaway, the recommendations provided in this report can help community members reimagine their vision of the peninsula and, in doing so, ensure its longevity.

Methodology

Todd Miner, the Director of Friends of Rockaway, wanted the organization to start looking ahead towards longer-term, community-inclusive resilience planning while the peninsula continues to recover from Sandy. Mr. Miner wanted the graduate consulting team to help him define what long-term recovery is and, more importantly, what that might look like for Rockaway.

We divided our workshop group into 3 teams: a GIS mapping team, a community engagement team, and a research team, each made up of two or three graduate students.

Since Friends of Rockaway lacked adequate visualizations, Mr. Miner needed a set of maps to engage the community in future meetings. He saw these visuals as the most compelling way to involve community members because of the easily conveyable information. Sea-level rise, for example, can be a fairly opaque topic of conversation, but showing a map that details how sea water will slowly consume Rockaway's present coastline makes the subject more relatable. The maps our team constructed range from EPA-monitored sites, to sea-level rise, to maps identifying which populations might be the most vulnerable in the event of another extreme weather event like Sandy.

The GIS mapping team gathered data from several publicly available sources, including the University of South Carolina, the National Oceanic and Atmospheric Administration, and the United States Census, to create the maps that were most relevant to Rockaway. Layering different data visualizations helped portray vulnerabilities in the community so that Friends of Rockaway could use these visuals in addressing communities and also in identifying areas where extensive planning was needed.

Mr. Miner also asked our team to provide information collected from Rockaway residents. Our community engagement team developed a survey that could be administered through a website, telephone questioning, or social media networks. We created the survey questions to be easy-to-understand and non-intrusive but still informative for Friends of Rockaway.

The community engagement team also developed questions for community member interviews, which had an anecdotal focus. Despite being unable to collect a large sampling, the team did obtain feedback from prominent community members. We then used this information to identify what might be helpful for Rockaway, both in terms of the peninsula's needs and its opportunities.

While the GIS and community engagement teams developed maps and questionnaires, the research team examined case studies from which Rockaway could learn about different approaches to resilience and adaptation planning. This research included reviewing New York City and New York State policies and plans, as well as initiatives from the Netherlands, New Jersey, and Dauphin Island, Alabama.

The Netherlands has a long history of extreme storms and devastation caused by flooding. Over the past half-century, though, the country has rapidly implemented comprehensive environmental engineering solutions to water management. We looked towards New Jersey because of its close proximity to New York and because the state has developed several projects examining the feasibility of coastal adaptation. Dauphin Island, by comparison, sits in the Gulf of Mexico and, as such, is very vulnerable to hurricanes. In addition, government officials there had recently undertaken initiatives to revitalize the island's slumping economy.

To complement these studies of ground-based applications for resilience planning, our research team also reviewed sociological methods for building resilient communities and social cohesion. The frameworks we identified included taking a comprehensive view of a community's various capitals, such as its built environment in addition to its cultural features. We also considered civic ecology, which looks at the interconnectedness of a society, and social vulnerability, which identifies areas and populations most susceptible to damage from environmental hazards.

Overview of the Rockaways

Background

The Rockaways is a slender peninsula that juts out from the borough of Queens and adjacent Nassau County, on Long Island, NY, and acts as a barrier between the Atlantic Ocean and Jamaica Bay. Although originally inhabited by American Indians, the area came under European influence in the 17th century.[1]

Throughout the latter half of the 1800s and into the twentieth century, the peninsula's isolation and beaches framed the Rockaways as a resort destination. Reaching the Rockaways required long trips in horse-drawn carriages or on horseback until the 1880s, when a steam engine ferry began bringing visitors from other boroughs.[2] Slowly, other means of transportation reached the peninsula, including railroads, automobiles, bus lines, and eventually, a connection with the subway system.[3] After World War I, New York City suffered housing shortages as migrants and immigrants rushed to the city. Many of the new residents relied on public assistance, and the municipal government began using the urban periphery as areas for relocation. For example, the Rockaways was home to 0.05% of the population of Queens, but the peninsula contained over 50% of the borough's public housing.[4]

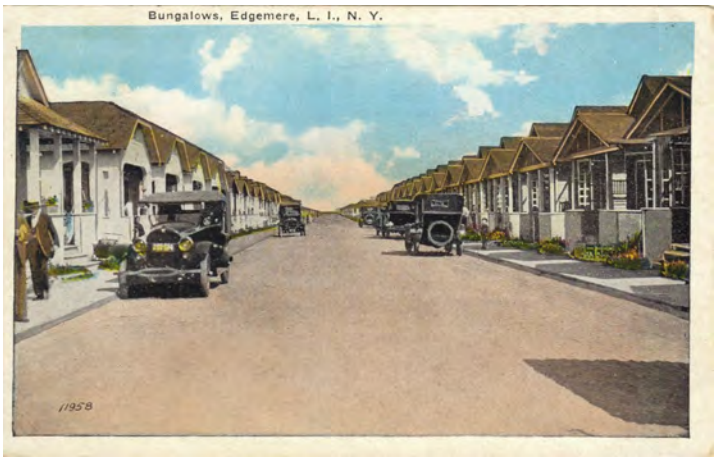
By the 1950s, vacation goers no longer viewed the community as a resort destination but sought more distant locations made accessible by advances in transportation, and the Rockaways slowly transformed from a seasonal community to having a substantial permanent population.[5] Without the resort economy, small manufacturers disappeared, and the long commute to the city's industrial center further entrenched a depressed economy.[6]

Today, a peninsula-wide population of 130,000 people spread across a dozen neighborhoods makes up the Rockaways.[7] Although a majority of residents are Caucasian, the Rockaways has large, growing populations of Hispanic, African-American, and other minority groups.[8] Residents of Rockaway primarily live in small, single-family homes or small apartment residences (1-4 families).[9] However, multi-unit dwellings, including the abovementioned public housing facilities, also exist and are primarily located on the eastern end of the peninsula.[10] With few routes off of the peninsula, the Rockaways continues to be a relatively isolated area[11] with a small economic base,[12] as many residents are retirees living on a fixed income,[13] business-owners dependent on seasonal tourism,[14] or commuters traveling out of the area for work.[15]

History of Extreme Weather

Compounding the problems of a depressed economy, the geography of the Rockaways has also made the peninsula vulnerable to extreme storm events. One of the first storms to produce recorded damage to the Rockaways occurred in 1893, when a Category 2 hurricane made landfall at the present location of John F. Kennedy International Airport. The storm pushed a thirty-foot storm surge across southern Brooklyn and Queens, destroying buildings and infrastructure.[16] The hurricane, which swept ashore on August 23rd, also washed away a small island next to Rockaway named Hog's Island. By the morning of August 24th, Hog's island was virtually non-existent.[17]

Figure 1. Image of Early-twentieth Century Rockaway.

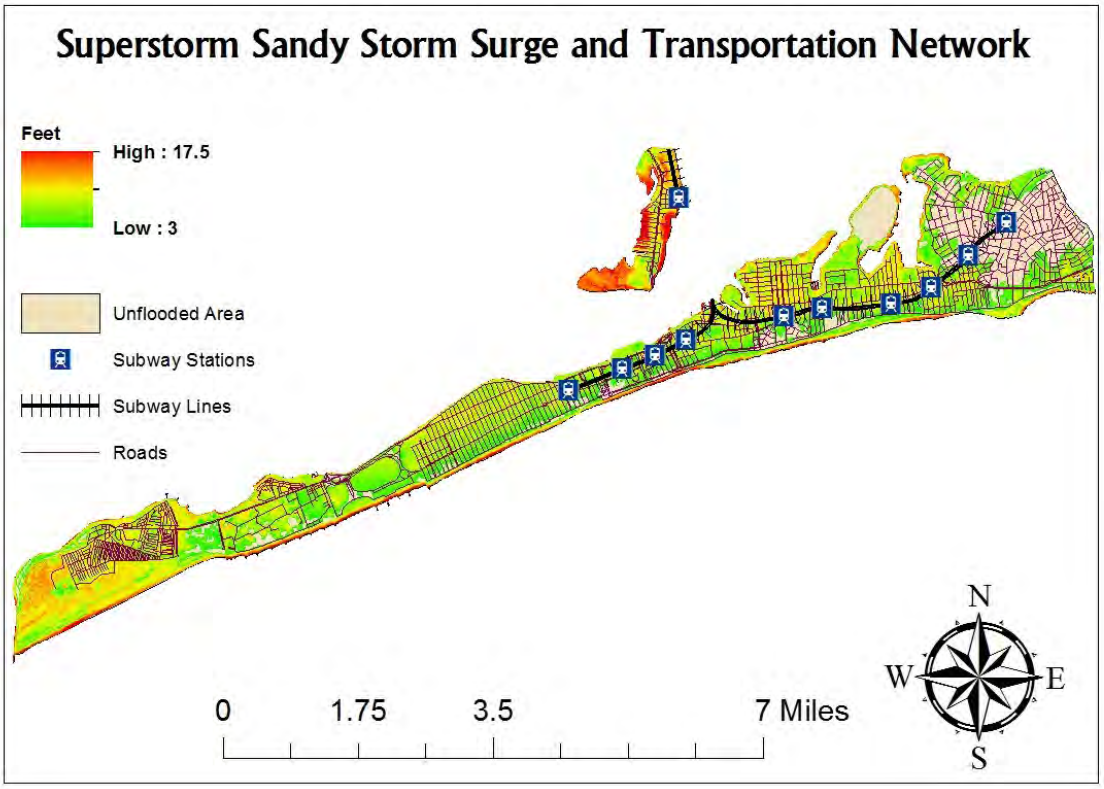


Source: All Around NYC

Although other hurricanes hit the mid-Atlantic coast over the course of the twentieth century, Hurricane Irene (2011) was the next major storm to hit the Rockaways, forcing New York City to issue its first-ever mandatory evacuation of coastal areas, including the entire Rockaway peninsula. The storm swept through the area with 65-mile-per-hour winds and dropped 7 inches of rain, ultimately costing the city $100 million in damages.[18]

The most remarkable storm to batter the Rockaways was Hurricane Sandy, which made landfall on the evening of October 29th, 2012. The storm dropped less than an inch of rain in some parts of the city, while totally devastating other neighborhoods and nearby states. Flood zone maps constructed by the Federal Emergency Management Agency greatly underestimated the surge of a storm of Sandy's magnitude, displaying certain areas in Brooklyn as outside potential flood zones, although they were heavily inundated by the surge.[19]

Figure 2. Map of Sandy Storm Surge and Rockaway's Transportation Network



Prepared by P. Barker, R. Copley, & P. Johnson; Data Sources: USACE, USGS, FEMA

Meteorologists recorded 85-mile-per-hour winds in New York City, with a storm surge in lower Manhattan that topped seventeen feet.[20] The storm's destruction caused 8.5 million residents to lose power and stranded more than 23,000 people in temporary shelters. Roads, tunnels, and transportation corridors were blocked, and debris dotted the coastline.[21] Ultimately, the storm swept away $75 billion of infrastructure throughout the affected regions.[22]

The Rockaway peninsula felt the devastation of Sandy especially acutely. Not only was the peninsula inundated by a twelve-foot storm surge[23] but in Rockaway's westernmost neighborhood, Breezy Point, fires consumed 126 homes.[24] Occupy Sandy, a non-profit organization performing relief and recovery work in the storm's aftermath, reported that the area's elderly residents were among the most severely affected, with many trapped in their homes without medication or professional care for days following the storm. This problem was further aggravated by the long distance to medical facilities.[25] In East Rockaway, raw sewage spilled into homes after sewage treatment facilities lost power, consequently causing mold and other housing recovery issues that continue to plague many Rockaway residents.[26]

Challenged by this catastrophe but also recognizing an opportunity to provide hope and housing recovery, eight natives of the peninsula formed Friends of Rockaway. Later, the organization became associated with St. Bernard Project, a New Orleans-based non-profit that helps to rebuild homes damaged by Hurricane Katrina. A year and a half after Sandy, the Rockaways and its homeowners continue to rebuild. After observing recovery and resilience planning efforts on the peninsula, Friends of Rockaway recognized the need for a more strategic, long-term plan for disaster resilience and climate adaptation that places the concerns of local residents at its center.

Climate Change, Adaptation, and Resilience

Defining Adaptation and Disaster Resilience

In light of these natural hazards, understanding how to adapt is essential in creating community resilience. The U.S. Environmental Protection Agency defines adaption as "efforts by society or ecosystems to prepare for or adjust to future climate change. These adjustments can be grouped into two categories: protective (i.e., guarding against negative impacts of climate change), or opportunistic (i.e., taking advantage of any beneficial effects of climate change)."[27] Adaptation measures include restoring natural ecosystems, such as wetlands, to protect against storm surges and enhancing infrastructure to improve energy efficiency and coastal protections.[28]

"I witnessed the beach meet the bay as I reside directly in the middle of the two. The apartment below mine was completely engulfed in water, and my apartment had heavy rains break through my bathroom and kitchen ceilings. To this date, my apartment is still not repaired."

—Marissa Bernowitz, Rockaway resident and director of the Sandy Relief Free Flee Market, which provides a place where people affected by Sandy can donate and pick up relief supplies[31]

If adaptation involves how communities actively respond to external, uncontrollable changes such as sea-level rise, achieving resilience requires that the community assess its internal features that will allow "the capacity of [the] system, community, or society potentially exposed to hazards…to reach and maintain an acceptable level of functioning and structure" in light of those changes.[29] In other words, resilience is a "measure of the ability of systems to absorb change…and still persist."[30]

Lessons Learned

Although climate change, discussed below in detail, has the capacity to severely affect the present conditions of the Rockaways, community members are determined to remain on the peninsula. Doing so will require comprehensive planning that prepares the community to effectively respond to natural disasters. In addition to planning for natural disasters...

...community members should also consider their long-term economic goals for the peninsula. One path for revitalization is that the Rockaways transforms itself from a community heavily reliant on relatively sparse summer tourism to a locally based economy, considering that the future economy must be adaptable to changing weather patterns and other effects of climate change.

Case Study: New York City and New York State

New York City

Less than two months after Sandy hit New York, Mayor Michael Bloomberg announced the formation of the Special Initiative for Rebuilding and Resilience (SIRR).[32] Previously in 2007, the city had released *PlaNYC: A Greener, Greater New York* outlining the principles, actions, and goals to make the city more sustainable and compatible with social, infrastructural, and environmental concerns.[33] The mayor's office had even updated the report in 2011 to reflect progress to-date and its amended goals and actions, based on the previous four years of lessons learned.[34]

Mayor Bloomberg acknowledged that Sandy "set the bar higher."[35] As a response, just eight months after the storm hit New York City, SIRR released *A Stronger, More Resilient New York* with goals to assess the damages, to analyze the impending risks of climate change for both the medium-term (2020s) and the long-term (2050s), and to set specific strategies to drive the city to become more resilient and adaptable to a changing climate.

The report addresses a multitude of issues applicable to citywide planning, including coastal protection, healthcare, transportation networks, and economic recovery, among others. In direct response to damage inflicted by Sandy, SIRR also laid out rebuilding and resilience plans for the hardest hit areas of the city. One of the communities specifically addressed was South Queens,[36] namely the district served by Community Board 14, including the Rockaway Peninsula and the island of Broad Channel, and two of the neighborhoods directly north of Jamaica Bay.[37]

Case Study: New York City and New York State (continued)

In addition to reviewing the demographics and economy of the Rockaways, the plan also analyzed the risks posed by storm surges and a rising sea level to infrastructure, housing, and the landscape. During the development of *A Stronger, More Resilient New York*, SIRR met with approximately fourteen elected officials from South Queens each month, met every four-to-six weeks with local organizations, and held three public workshops to give voice to local residents and officials in planning the future of their communities.[38]

Out of these analyses came more than fifty initiatives to improve resilience and build adaptation for South Queens.[39] Many of these initiatives were drawn from citywide plans, such as retrofitting public housing for flood resilience, launching economic recovery programs, and working with the United States Army Corps of Engineers to harden the coastline.[40] Other plans addressed the specific needs of the Rockaways, including completing the Arverne East Project design competition, expanding ferry service, and building a new surgical center.[41]

Figure 3. Rendering of the Winning Design of the FAR ROC Competition

Source: FAR ROC

Many of the initiatives identified in *A Stronger, More Resilient New York* have already been set in motion. The following list highlights a few of those projects:

- The New York City Department of Parks and Recreation has initiated replacement of the wooden boardwalk with a new concrete design.[42] The agency plans to complete the construction in five phases with a scheduled end-date in 2017.[43]
- The United States Army Corps of Engineers began replenishing beach sand in 2013 and continues this year with a longer-term replenishment strategy scheduled to finish in 2015.[44] The Corps is also finalizing plans to strengthen the dunes along the beach and to install hard infrastructure to prevent shifting sands on the ocean-side of Rockaway. By summer 2014, the Corps hopes to have selected feasible options for protecting Jamaica Bay and the surrounding lands from storm surges.[45]
- On October 23, 2013, FAR ROC (For a Resilient Rockaway) announced the winner of the design competition to imagine a resilient, multi-use complex along the southern oceanfront of the peninsula.[46] No final plans yet exist to construct the design.
- In December 2013, a Workforce1 career center opened in Far Rockaway's branch of the Queen's Library.[47]

New York State

Much like New York City's Special Initiative for Rebuilding and Resilience, New York's state government created the Office of Storm Recovery in June 2013 in direct response to the damage caused by the recent disasters of Hurricane Irene (2011), Tropical Storm Lee (2011), and Hurricane Sandy (2012).[48] New York Governor Andrew Cuomo established the office to determine appropriate allocations for $3.8 billion in federal funding provided by the U.S. Department of Housing & Urban Development's Community Development Block Grant Disaster Recovery Program,[49] which provides flexible funds designed to give munities financial paths to reach their needs. NY's Office of Storm Recovery focuses on four specific

Case Study: New York City and New York State (continued)

areas: housing recovery, small businesses,community reconstruction, and infrastructural improvements.[50]

One of the programs initiated by the Office of Storm Recovery is the New York Rising Community Reconstruction Program, which aims to empower community members to develop plans for recovery from storms and to increase resilience for the future.[51] The program, which began in the fall of 2013, engaged community officials and local organization leaders by establishing committees to guide the process of developing tailored, local plans. The state supported this process with experts in land-use planning, coastal protection, economic development, and healthcare.[52] In addition, the program held several public meetings in each of the communities over the course of five months, inviting local residents to provide input on the process, to identify goals, and to voice opinions on their visions for resilience.

Rockaway has four areas involved in the program: Rockaway East, Rockaway West, Breezy Point, and Broad Channel. The Community Reconstruction Program has already allotted a combined $61.86 million for these four localities to implement their finalized plans,[53,54,55,56] which are scheduled to be released in the spring of 2014.57 Although some comments gathered through the initial stages of planning were unique to each locality, there were several common themes. These included increased access to the city-center, hardened barriers for storm protection, development of the economy, and improved water drainage.[58,59,60,61]

Lessons Learned

Both New York City's *A Stronger, More Resilient New York* and the New York State Community Reconstruction Program's conceptual plans address the multifaceted needs of adaptation and resilience planning—an idea reinforced by their often overlapping themes. Yet, neither of them is without shortcomings. First, the city and state plans need to resolve their differences on long-term planning, since the municipal plan envisions the 2050s as long-term, whereas the state's plan recognizes 2019-2024[62] as long term. 2050 provides a viable option for long-term planning because the timeline allows enough time for major changes to the built environment yet still falls within residents' lifetimes. Community members, therefore, would have a vested interest in planning the future of the Rockaways. Yet, more important than allowing external planners to define long-term, Rockaway residents need to reach a consensus on their definition of long-term.

Moreover, the state's Community Reconstruction Program divided the Rockaways by neighborhood. While advantageous in conducting outreach, segmenting the peninsula's overall plan for resilience neglects to recognize the interconnected system of the Rockaways. Instead of targeting individual components, neighborhoods, or initiatives for development, the entire Rockaway system needs strengthening—not the components alone.

Furthermore, in the face of limited resources, officials and community members could benefit from prioritizing their initiatives. In many ways, the city's and state's efforts were duplicative, indicating a lack of cooperation and a waste of resources. By uniting resources and providing a central hub of information, Friends of Rockaway can advance a strategic, peninsula-wide prioritized list of actions. In turn, this process could create more cohesion within the Rockaways and would strengthen the networks between the different elements involved in building a resilient system.

Climate Change and the Potential Impacts on the Rockaways

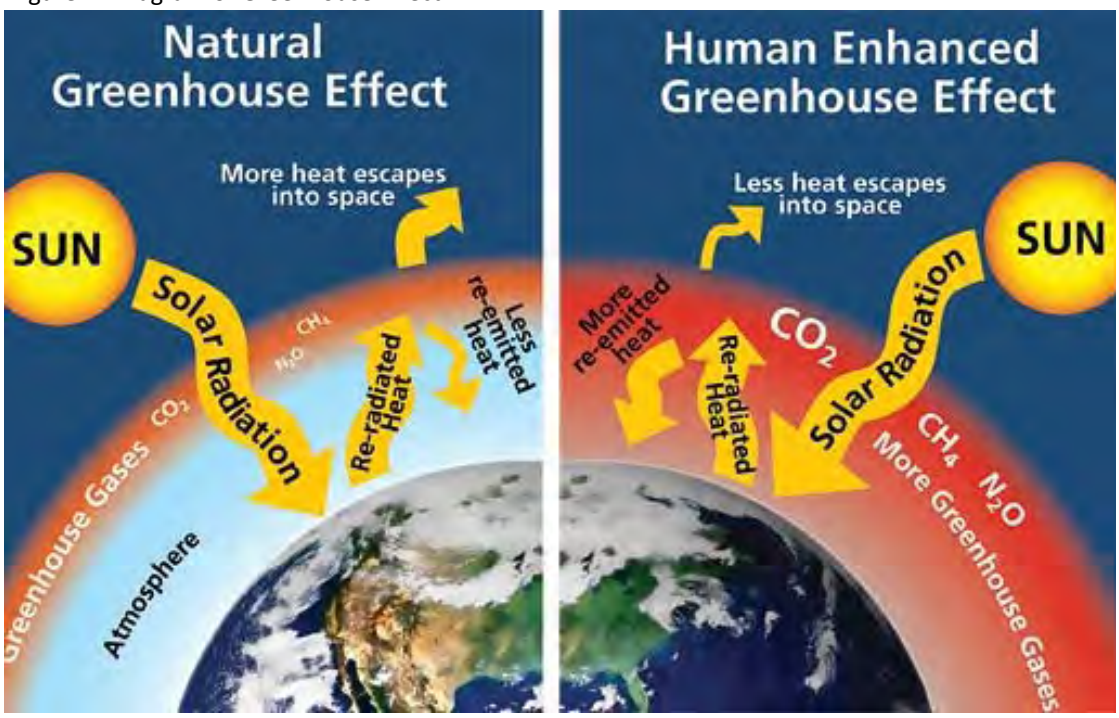
> *"One major thing I've noticed though is that I don't think the Rockaway community is prepared to make meaningful lifestyle changes to live more sustainably- even as they recognize that climate change may have played a role in the storm that devastated their lives. I find this very odd but not exactly surprising."*
>
> —Jamie Jordan, co-founder of Rockaway Help, a journalism project whose goals are to promote open data, open news, and civic engagement[76]

Understanding how to create a community resilient to disaster and adaptable to a changing climate requires understanding how and why the climate is changing. Gases such as water vapor, methane, and carbon dioxide, among others, compose planet Earth's atmosphere. These particular gases trap heat radiating from the sun, a process known as the greenhouse effect, which in turn creates an environment where plants and animals can thrive. Since 1750, human activities, such as deforestation and the combustion of fossil fuels, have caused the concentration of greenhouse gases in Earth's atmosphere to rise to levels not reached in at least 650,000 years.[63] The increasing concentration of greenhouse gases has also led to a rise in Earth's average surface temperature. During the 1900s, the global average temperature increased by 1.3°F, the sharpest increase in temperatures in 1,300 years. In addition to melting glaciers, rising seas, and altered blooming seasons for plants,[64] Earth's warming has begun to change the planet's long-term weather patterns—i.e. Earth's climate.

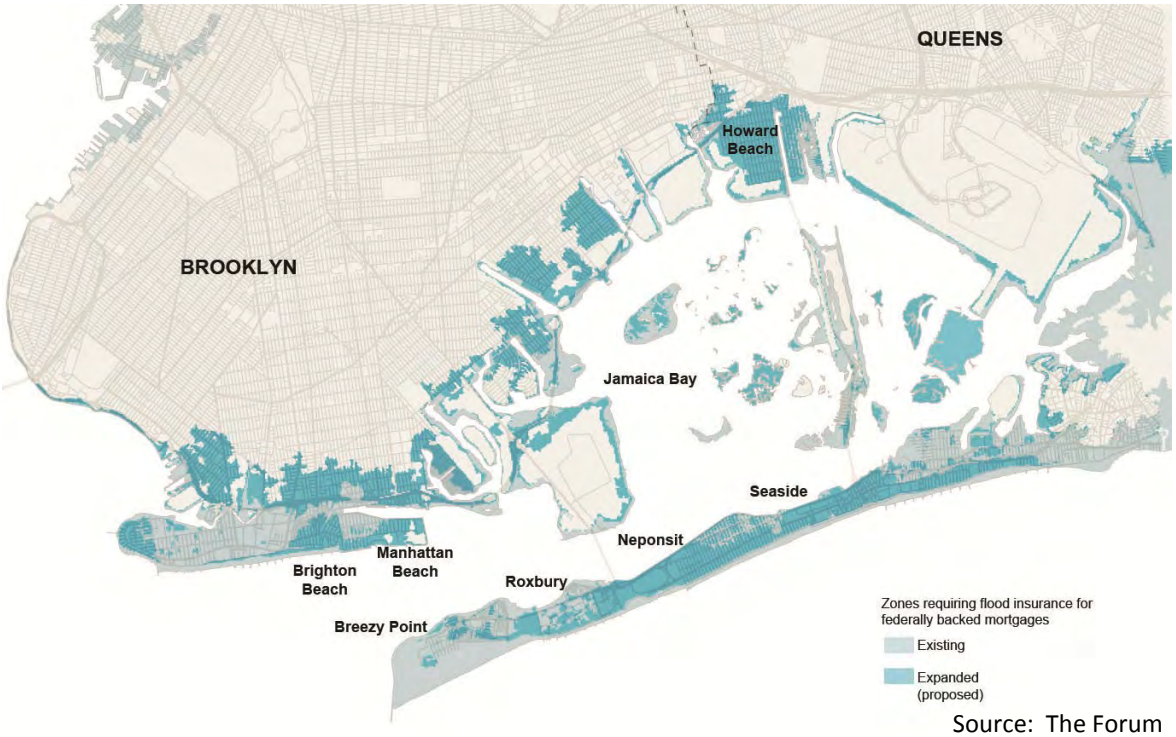
Climate change will have consequences across the United States. While parts of the Midwest have already experienced record-breaking floods, the Southwest can expect more intense droughts.[65] A warming planet will cause the surface level of the Great Lakes, which hold 20% of Earth's fresh surface water, to drop by a foot by the end of the century.[66] In the Southeast, rising sea levels will lead to increased salinity of estuaries, coastal wetlands and tidal rivers, drastically altering the composition of these ecosystems.[67] In the Northeast, annual average temperatures have risen 2°F above the long-term average, while winter temperatures have risen twice as high, resulting in reduced snow and increased rain and more days with temperatures above 90°F in the summers.[68]

While climate scientists hesitate to identify climate change as the cause of Hurricane Sandy or any individual extreme weather event, they generally

Figure 4. Diagram of Greenhouse Effect



Source: United States National Park Service



Source: The Forum

Figure 5. Map of Existing and Proposed FEMA Flood Zones

The data upon which these new zones have been identified does not take into account the sea-level rise effect of climate change. The map below shows the areas that are projected to be affected by sea-level rise over the course of the twenty-first century.

agree that climate change likely played an important role in the development of Sandy and the resulting storm surge.[69] Studies already indicate that sea-level rise along the mid-Atlantic coast is outpacing the global average, which can occur as ocean currents and wind patterns shift.[70] As sea levels rise, weaker storm systems than Sandy could have the same impact, since the base of the storm surge would be higher than that of 2012.[71] Moreover, scientists have calculated that the frequency of extreme storm surges like Sandy's doubles with only 0.72°F increase in temperature[72] and that climate change could increase the frequency of once-in-a-hundred year storms to once every few decades.[73] In a worst case scenario, scientists predict that former once-in-a-century coastal floods in New York City will occur twice as often by the middle of the century and once per decade by 2100.[74] Climate change and the consequent storms, therefore, make New York City and its $2.3 trillion in insured coastal property particularly vulnerable to rising sea levels and extreme weather events.[75]

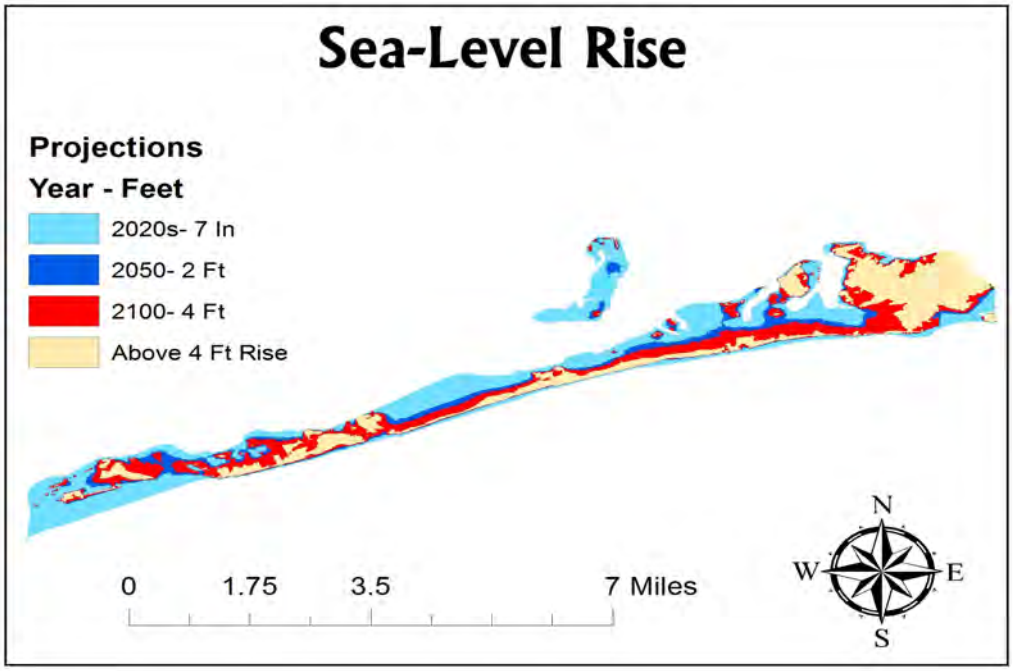


Figure 6. Map of Projected Sea-level Rise on Rockaway

Prepared by P. Barker, R. Copley, & P. Johnson; Data Source: NOAA, NYC *PlaNYC,* USGS

Case Study: The Netherlands

The Netherlands is a recognized expert in water management,[77] and for good reason. The recorded history of floods in the Netherlands dates back centuries. English author Daniel Defoe, famous for writing *Robinson Crusoe,* described a storm that hit the Netherlands in 1703 as one of the most terrible storms the world ever witnessed.[78] Two-and-half-centuries later, in 1953, rampaging floods would again devastate the country, killing more than a thousand people and destroying more than 47,000 homes.[79] This destructive event served as the starting point to one of human civilization's most ambitious and long-term projects in water management. Implementing this program resulted in newly built infrastructure across the entire country, ranging from relatively uncomplicated sea walls to state of the art hydrological engineering projects, such as the North Sea Protection, which has more than 62 gates to control the entry and exit of North Sea waters into the country's low-lying southwestern provinces.[80]

Figure 7. Photograph of the Dutch "Sand Motor"

Source: Dutch Water Sector

Another innovative project constructed by the Dutch is the "sand motor." Rather than regularly dredging and dumping sand to replenish beaches, engineers deposited 28 million cubic yards of sand into a central location. Over the course of 20 years, currents and winds will slowly re-deposit the sand along a twelve-mile stretch of coastline, creating beaches and natural buffers against sea storms at 50% less cost than regular dredging and replenishment.[81]

To complement these infrastructural projects, resilience planners in the Netherlands have developed community engagement tools including a board game that challenges residents on how they would react to certain severe weather events such as river flooding or collapsed bridges. Dutch Municipal governments have established telecommunication systems to alert residents of specific communities about impending natural weather events and have also developed online tools that allow potential volunteers to become aware of how they can contribute to resilience efforts.

Lessons Learned

The Netherlands has approached water management with a robust portfolio of innovative technologies and environmental engineering projects. These projects have not all been the result of recent changes in global climate nor have they been quickly developed or constructed. Rather, the Dutch have taken a very long view of their relationship with water, with ingenuity at the grand scale and in-depth preparedness at the local level.

The Rockaways, while not in total control of the engineering projects that will affect their local environment, must weigh short-term desires against the long-term protection of their community. Regular sand replenishment is not sustainable. Adequate infrastructural protection against raging storms and a rising sea level will most likely require major changes to the shoreline.

Additionally, Rockaway residents could benefit from more actively preparing for extreme weather events. Relying solely on institutions and government agencies could be catastrophic. By imagining and preparing for worst-case scenarios, Rockaway residents have the potential to avoid them.

Frameworks for Building Community Resilience

Understanding the basic concepts of resilience does not create a resilient community. Successful planning requires an in-depth exploration of a community's various characteristics. The frameworks that follow offer Friends of Rockaway the necessary vocabulary and strategies to elicit community-identified strengths, weaknesses, threats, and opportunities to begin building resilience on the peninsula.

Community Capitals

Historically, there have been two general approaches to community development. The original approach was community reinvention, involving industrial and commercial recruitment, i.e. enticing businesses to establish a local presence. A more recent approach has focused on a community economic development strategy that relies on civic engagement. The consideration of community capitals is central to this strategy, with capital defined as "a property that results from the characteristics (flows, reservoirs, and sinks) of subsystems, components, structure, and interactions."[82]

Jan Flora of the Department of Sociology at Iowa State University was part of the team that first developed a widely accepted framework for identifying and assessing community capitals, which include:[83]

- Natural capital: assets that abide in a location, including resources and natural beauty
- Cultural capital: the dynamics of who we know and feel comfortable with, what heritages we value, the influences that determine which voices are heard and listened to, and how creativity, innovation, and influence emerge and are nurtured; features might include ethnic festivals, multilingual populations, or a strong work ethic
- Human capital: the skills and abilities of people to increase, identify, or access understanding and promulgation of promising practices, including leading across divides, inclusive participation, and proactive shaping of a community's future
- Social capital: the connections among people and organizations or the social glue to make things happen
- Political capital: the ability to influence rules and enforcement, reflecting access to power
- Financial capital: the financial resources available to build capacity building, to invest in business development, to support civic entrepreneurship, and to accumulate wealth for future development
- Built capital: the infrastructure supporting a community, such as roads, drainage systems, telecommunications, and industrial parks

Lessons Learned

By acknowledging the different categories of components that comprise any community, Friends of Rockaway can address all of the elements that the peninsula needs to consider when developing plans for resilience and adaptation. The current New York City and state plans address issues mostly related to protective infrastructure, the built environment, and economic initiatives at the micro-scale. The community capitals, by contrast, suggest that the Rockaways should also consider the internal social, cultural, and political dynamics, in addition to reviewing the current relationship between residents and their natural environment. Without sufficiently addressing these areas of concern, resilience plans will likely fail the community's most vulnerable populations.

Civic Ecology

Another framework for better understanding a community is civic ecology, which sustainable design expert Tim Smith defines as such: Hardware + Software = Resilience. Under this framework, hardware encompasses the familiar physical infrastructure of a place, such as streets, buildings, sea walls, and other aspects of urban design. Software, on the other hand, involves looking at "future flows of energy, food, water, waste, money, and the local economy."[84] Ideally, the two factors unite to create an atmosphere of civic engagement fuelled by a local and sustainable economy, a web of resources, innovative and sustainable design, and healthy social capital.[85]

The civic ecology framework suggests that "citizens envision and manage their future by creating webs of resource flows and interactions to localize shared wealth."[86] Embodied within this vision is a community's connectedness and its potential for change.[87] Establishing a viable web of resources requires undertaking specific initiatives:[88]

- Approach the community as a whole system, in which the economy is part of the socio-cultural fabric and versa.
- Focus on the specific community place and consider appropriately scaled resource flows.
- Initiate a new social contract involving all of a community's individuals to build a sense of togetherness, trust, and commitment.
- Identify opportunities to blend personal needs ("what is good for me") with communal needs ("what is good for us").
- Maintain an open and adaptive framework so that all designs can be improved .

Lessons Learned

Civic ecology, as the term implies, suggests that Friends of Rockaway approach the peninsula's different populations as an interconnected system relying on the continued health of a common environment. Through attending community meetings and through a review of the city's and state's resilience plans, our team observed that residents and community planners do not recognize the peninsula as a system but rather as components situated next to each other on the same landmass. Whereas the community capitals framework identifies categories comprising any given community, civic ecology promotes forging strong links between those capitals.

Rockaway is intimately connected with New York City, but residents can find strength in identifying themselves as one community, rather than several neighborhoods on one peninsula. Friends of Rockaway can engender this sentiment by highlighting to residents the subtle connections linking their different neighborhoods.

"Coastal protection and aid from the government on all levels should be discussed and put in place. Disaster preparedness information is important as well, but honestly, if warned by another storm like Sandy maybe this time it is best to evacuate completely (the issue there though is many residents have nowhere else to go as this is where our homes, family and friends are)."

—Marissa Bernowitz[89]

Social Vulnerability Index

Applying frameworks such community capitals and civic ecology offers an opportunity to learn about, establish, and strengthen the positive features of a community. The planning process must also consider the features of a community that make it vulnerable—that directly detract from its resilience to disasters and climate change.

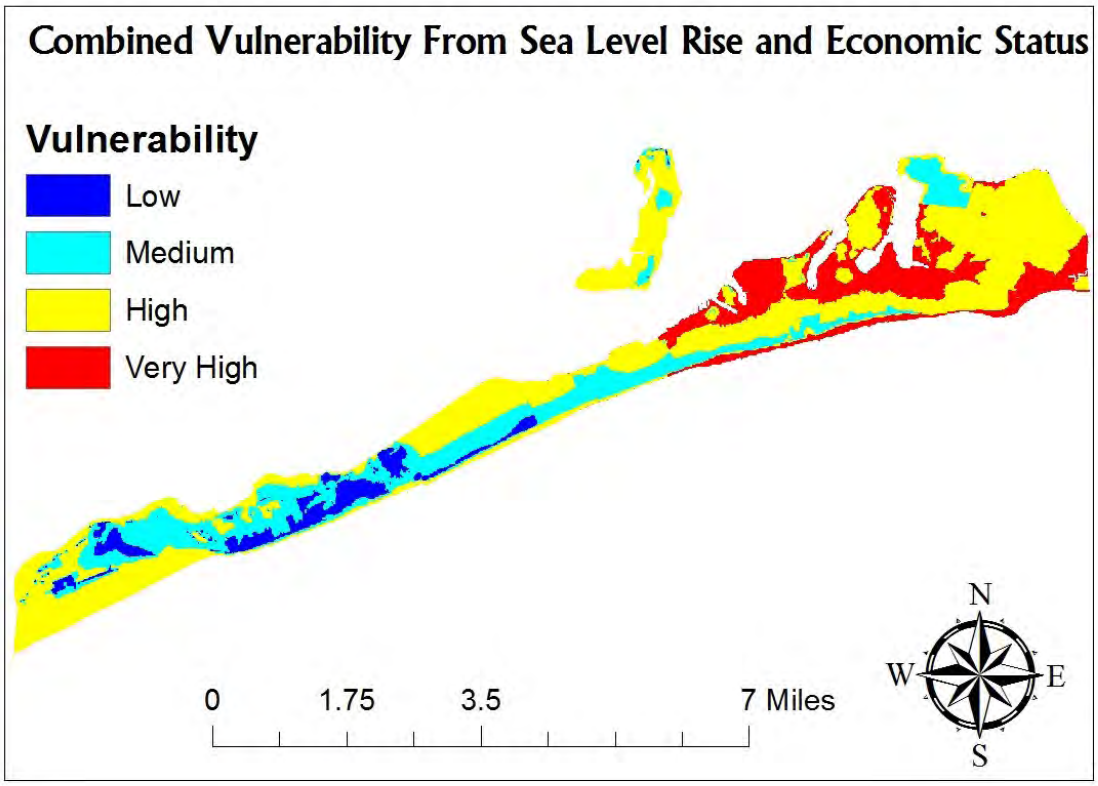
Historically, disaster mitigation looked mostly at the physical components of resilience to natural disasters, namely the infrastructure and technology available to a community. The typical formula was composed as such: Risk = Hazard*(Vulnerability – Resources), in which Risk was the likelihood or expectation of loss, Hazard was a condition posing the threat of harm, Vulnerability was the extent to which persons or property were likely to be affected and Resources were those assets that diminished the effects of hazards.[90]

Beginning in the 1970s, the focus of disaster mitigation and management shifted to the socioeconomic factors that determine a community's ability to endure and respond to extreme events.[91] The shift occurred primarily when researchers noticed that the impact of a natural disaster had variable impacts on a population, with some areas recovering easily while other areas had a much longer recovery time. This led to a review of the factors previously considered relevant to the potential impacts of a disaster on a population,[92] which in turn led to the introduction of the term "social vulnerability."

Social vulnerability encompasses "the characteristics of a person or group in terms of their capacity to

Figure 8. Map Combing Vulnerability due to Sea-level Rise and Economic Status

Prepared by P. Barker, R. Copley, & P. Johnson; Data Sources: NYC *PlaNYC*, US Census, USGS



anticipate, cope with, resist, and recover from the impacts of a natural hazard. [It] involves a combination of factors that determine the degree to which someone's life and livelihood are put at risk."[93] Three widely accepted tenets of fully understanding vulnerability to environmental hazards include an exposure model that identifies conditions that make people or places vulnerable to extreme natural events, the view that vulnerability is a social condition that needs to be understood as a measure of societal resistance to hazards, and the integration of potential exposures and resilience with a focus on specific areas.[94]

Building off of the idea of social vulnerability, experts have embraced the quantification of the subject by establishing the framework of a Social Vulnerability Index (SoVI). SoVI is a metric that helps tailor policies to deal with natural disasters by comparing the differences in social vulnerability between distinct areas, which reveals the areas that are most resilient or, conversely, most vulnerable. Effective use of SoVI allows governments to identify how they should allocate resources.[95]

One of the models used to create SoVI is the Hazards-of-Place Model of Vulnerability. This model allows risk, defined as an objective measure of the likelihood of a hazardous event occurring, to interact with elements that can either increase or decrease vulnerability, such as level of income, ethnicity, and age. The overall place vulnerability is a composite of these factors.[96]

Susan Cutter and the team at the Hazards and Vulnerability Research Institute at the University of South Carolina have been at the forefront of establishing indices for social vulnerability. For more than a decade, the institute's team has created several indices mapped onto counties and census tracts across the United States. Although the number of variables has differed between the indices, a typical index addresses a range of social factors (e.g. race, age), economic factors (e.g. level of income, employment), and others (e.g. medical services, special needs populations), with researchers designating each factor as positive (increasing vulnerability) or negative (decreasing vulnerability).[97] SoVI, therefore, provides resilience planners with a tool to identify vulnerable communities in advance of a natural disaster. The recognition of site-specific vulnerability can allow for the creation of tailored disaster management plans that account for a community's unique characteristics.

Lessons Learned

In light of the growing amount of information on the potential impacts of climate change and considering the various resilience-building frameworks previously outlined, planners have a wealth of opportunities to understand the impacts of natural disasters on a community. This can allow them to improve disaster preparedness and management plans. A key component of climate change preparedness is the multiplicity of scales along which it is created, ranging from future global climate conditions to neighborhood disaster planning.[98] The extrapolation and interpolation of data across these scales can pose challenges to successful adaptation. Considering these issues, building resilience should envision different scenarios, in terms of socioeconomics and climate change impacts, so as to more accurately capture the future reality of a community.[99] (See Appendix A on conducting a scenario planning exercise.)

The most recent Hazards-of-Place SoVI model developed at the census tract level for the Rockaways relies on data from the 2000 census. While useful for identifying socially vulnerable areas on the peninsula, the outdated data could upset a prioritized set of actions and goals to build resilience throughout the peninsula. Moreover, this pre-constructed model relies on a weighting of factors that may not necessarily reflect the reality of life in the Rockaways. To best utilize a Hazards-of-Place SoVI model, Friends of Rockaway could weight the established factors based on internal decisions or instead could allow community residents themselves to define factors contributing to vulnerability. In addition to using this data to visualize vulnerable areas, Friends of Rockaway can also motivate residents to consider the SoVI factors in assessing their individual situation within a spectrum of vulnerability.

Case Study: New Jersey

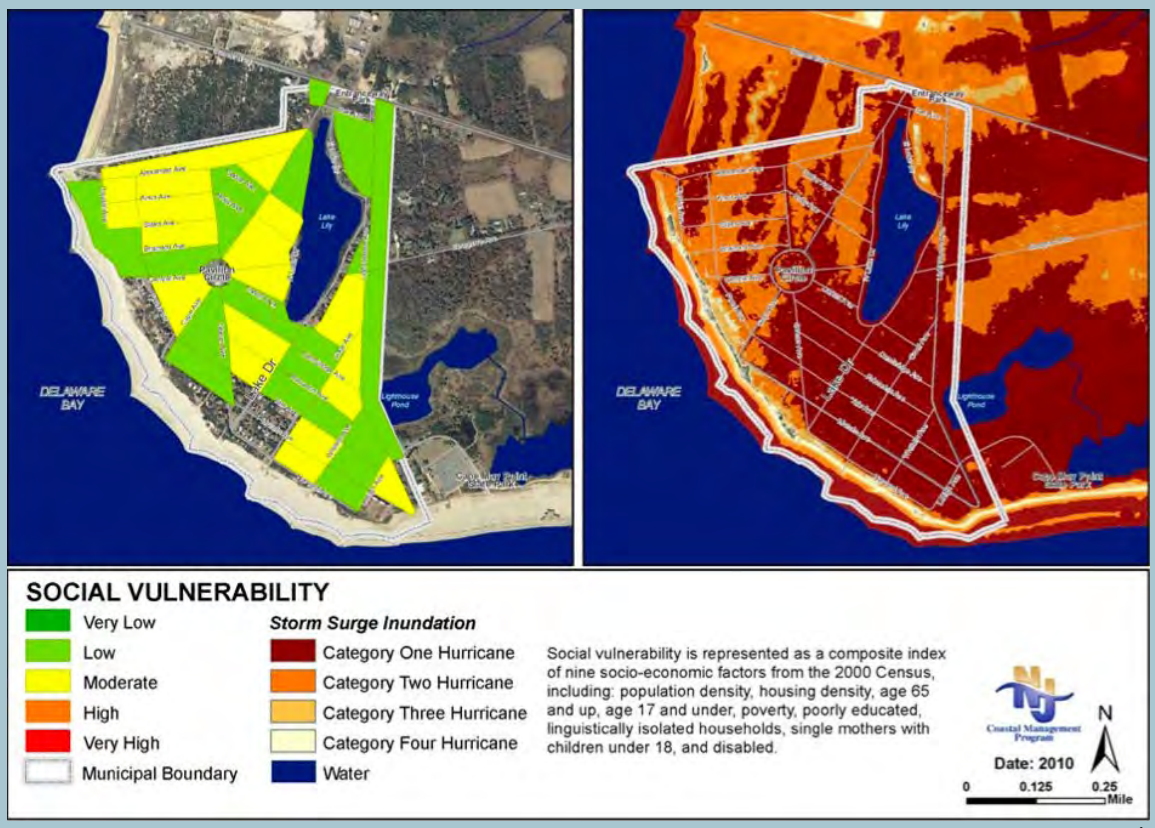
With a diverse, dense population, a history of proactive resilience planning, and geographic proximity that makes it vulnerable to the same storms as New York City, New Jersey was an obvious choice for a case study. New Jersey's shoreline stretches for 127 miles, with approximately 1.8 million people living in coastal communities.100 The state's coastal economy, including tourism and maritime industries, brings in more than $68 billion annually.[101,102]

To develop community preparedness for disasters, government agencies, along with universities in the state, established The New Jersey Coastal Community Resilience Demonstration Project to study methods for assessing local resilience. The project constructed detailed maps, held collaborative meetings, and conducted questionnaires to examine existing resilience plans.[103] The plan had three phases:

- Phase 1: meetings with communities to review project objectives, to identify variables and other relevant social, geographic, and environmental factors, and to review existing community plans
- Phase 2: mapping using Coastal Community Vulnerability Assessment Protocol to show vulnerable areas and to present these results to the community leaders
- Phase 3: administration of a questionnaire that assesses local officials' plans for resilience and final summary reports and presentations

In Cape May, one of the communities involved in the project, the New Jersey Sea Grant Consortium's *Coastal Community Vulnerability Assessment Protocol* was used to validate the risk and vulnerability protocol, allowing partners to identify infrastructure, natural resources, and vulnerable populations that may be exposed to storm surges and sea-level rise. The application of the protocol also informed the partners of the local governments' data and technical needs regarding coastal hazards and sea-level rise.[104]

Figure 9. Map of Cape May's Social Vulnerability and Projected Storm Surge



Source: Wood

Lessons Learned

While largely focused on assessing government plans for disaster responses, recovery, and resilience, this project demonstrated the benefits of using SoVI and extensive community assessments to inform decision-making. Likewise, Friends of Rockaway can engage local officials across the peninsula to make them aware of the different levels of vulnerability throughout the Rockaways and to highlight the neighborhoods' interdependence.

Community Engagement

Engaging an entire community to generate ideas and resolve conflicts is a difficult task. When dealing with controversial issues such as climate change and community development projects, this assessment holds especially true. Whereas previous sections in this report provided strategies and outlooks on how to define and build resilience, the following section offers tactics on whom to engage in community planning, how to engage audiences at meetings, and how to build and guide an effective coalition. In addition, the Community Engagement Toolkit (see Appendix A) contains a slideshow on climate change and existing adaptation efforts, offers specific exercises for planning resilience at meetings, and provides Friends of Rockaway with an uncomplicated questionnaire to survey residents on the subject of climate change and adaptation.

Who to Engage

Successful adaptation and resilience planning first identifies both the interest and influence of different community stakeholders. Stakeholders with high influence and high interest in the topic must be prioritized.[105] Such individuals and groups are essential to attracting others to the coalition and setting and accomplishing goals. An example of such a stakeholder in the Rockaways is a local lawmaker. Having an individual such as a state senator or a borough president involved in a coalition gives weight and influence (i.e. political capital) to planning activities. Individuals with low influence but high interest are also valuable to pursue.[106] While these individuals may not be local leaders, their fervor and energy can become influential in numbers (i.e. human capital).

One of the largest and most valuable stakeholders to engage in a coalition is local businesses and their owners. Businesses can provide unique opportunities to create partnerships and initiatives in the local community.[107] Local businesses carry a great amount of influence over awareness and preparedness in a town or region, not only by selling products and services valuable to the cause but also by disseminating information. In a recent study, 86% of businesses identified responding to climate risks and investing in adaptation as a valuable business opportunity.[108] As such, engaging local businesses in the planning process can spread information and relevant products while also creating economic value (i.e. financial capital) for the community.

Another important stakeholder group to include in community engagement is those living in socially and economically vulnerable areas.[109] These individuals often have unique perspectives on issues regarding climate change and resilience and can be overlooked simply due to their lack of influence and lack of affiliation with organizations. Planners should make individuals from these vulnerable areas fully aware of meetings and how the results of community engagement will be shared. Doing so ensures such individuals have representation in important decision-making.

A final group Friends of Rockaway could engage in building a coalition is other community-based organizations and nonprofits with large membership bases.[110] Involving these groups in the engagement process also involves their members, and individuals involved in community organizations are more likely to involve themselves in regional issues such as coastal resilience planning (i.e. social capital).

How to Engage

When engaging individuals on a one-on-one basis, advocates must walk a fine line. Academic research indicates that individuals have a “finite pool of worry,” i.e. there is a limit to the number of issues about which an individual can worry.[111]

Similarly, engaging people on an emotional level only works for a limited period of time. Instead of relying solely on emotional appeal, advocates must also include locally relevant information[112] by identifying the most pertinent coastal resilience issues affecting a population and then focusing on those topics. Furthermore, advocates should also reassure individuals and groups on the importance of issues that they care most about.[113] By doing so, the advocate fosters a sense of trust and can link these concerns to resilience planning.

When speaking about climate change issues, advocates need to identify the type of audience they are addressing: skeptics, opportunists, or believers.[114]

Believers identify climate change as a major and pressing issue; skeptics are adverse to any information related to climate change; and opportunists believe in climate change, but feel no sense of urgency. An advocate must employ different tactics when speaking to each party. With skeptics, advocates should talk about risk aversion and protection of assets but avoid discussing costs and taxation.[115] With opportunists, talk about local impacts and entrepreneurial opportunities but avoid far off effects.[116] With believers, the coordinator should speak about civic engagement and stewardship but avoid infrastructure -only solutions.[117] By following these basic guidelines, advocates have the opportunity to interest any party.

Finally, when speaking to an individual or an audience, always set a goal for the conversation. This goal can include such things as informing the party, inspiring action, resolving a conflict, or invoking a feeling of community. Regardless of the goal, going into a meeting or a presentation with a set plan will improve clarity and focus. [118]

How to Build a Coalition

A coalition necessarily involves joining people with a common cause. For Friends of Rockaway, a coalition will band the community together to combat numerous issues regarding resilience and climate change. When building a strong coalition, as with starting a meeting, a solid plan and goal is essential.

In a case study performed by the Pacific Institute, a practical and relevant step-by-step process was laid out. A coalition should (1) set goals, (2) plan a project, (3) recruit participants, (4) train participants, (5) collect and analyze data, (6) present findings, and (7) evaluate outcomes.[119] ICLEI's guide for municipal climate adaptation mirrors this process by (1) initiating, (2) researching, (3) planning, (4) implementing, and (5) monitoring and reviewing.[120] Both of these frameworks stress the importance of performing climate adaptation based on a sequenced, planned-out process. Planning for resilience in a programmatic, organized manner focuses the attention of the coalition and keeps them from straying to other tasks or ideas, even if those tangents are related. The coalition needs to focus on one accomplishment at a time.

Community Outreach in the Rockaways

For the community-based research element of our project, we intended to contact a wide-range of residents, including interviews with community leaders. Friends of Rockaway provided a list of 36 community leaders with contact information. These leaders would be our primary contacts with the community. This list included government officials, religious leaders, heads of nonprofit organizations, and local community residents .

Surveys

To obtain data, we intended to use a multi-pronged approach, including performing an email, telephone, and door-to-door survey, attending community meetings, cold-call canvassing, and posting on community message boards on social media sites. The intent of this strategy was to provide Friends of Rockaway with a cross-section of the local opinions on climate change and adaptation.

After obtaining the data, our team would display the findings on a map produced through geographic information system (GIS) software to visualize the opinions and strength of the opinions of hoe each community felt regarding climate change. After meeting with Columbia University's Institutional Review Board, our team determined that the nature of the survey fell within the board's oversight, and as such, our survey required review and approval from the board. Due to time restrictions, our team was unable to perform the survey through any of the abovementioned methods. (The link to the still-active survey is http://eSurv.org?u=the_rockaway_project. The survey is also included in this report in Appendix A.)

Interviews

To complement the surveys, we developed a series of open-ended and opinion-based questions to be asked in interviews with stakeholders identified through our community contact list. Being unable to perform a large-scale survey of Rockaway residents, these interviews with community leaders gained more significance for our project. We felt these opinions could reflect the general knowledge and concerns of local residents and ultimately provide our team with a better picture of community awareness regarding climate change and resilience.

The response rate to interview requests was poor, with only four responses, i.e. about 11%. The recipients who did respond were helpful, however, in revealing local attitudes about climate change. The interviewees carried an inherent bias of opinions and level of climate change knowledge, however, due to the fact Friends of Rockaway provided the entire contact list. As such, the interviewees did not represent a sufficient sample size of the peninsula's residents. Nevertheless, our team valued the responses and insights provided by the interviewees. (Excerpts from the interviews can be found throughout the report. A compilation of the complete responses from interviewees who agreed to be quoted in this report can be found in Appendix B.)

Lessons Learned

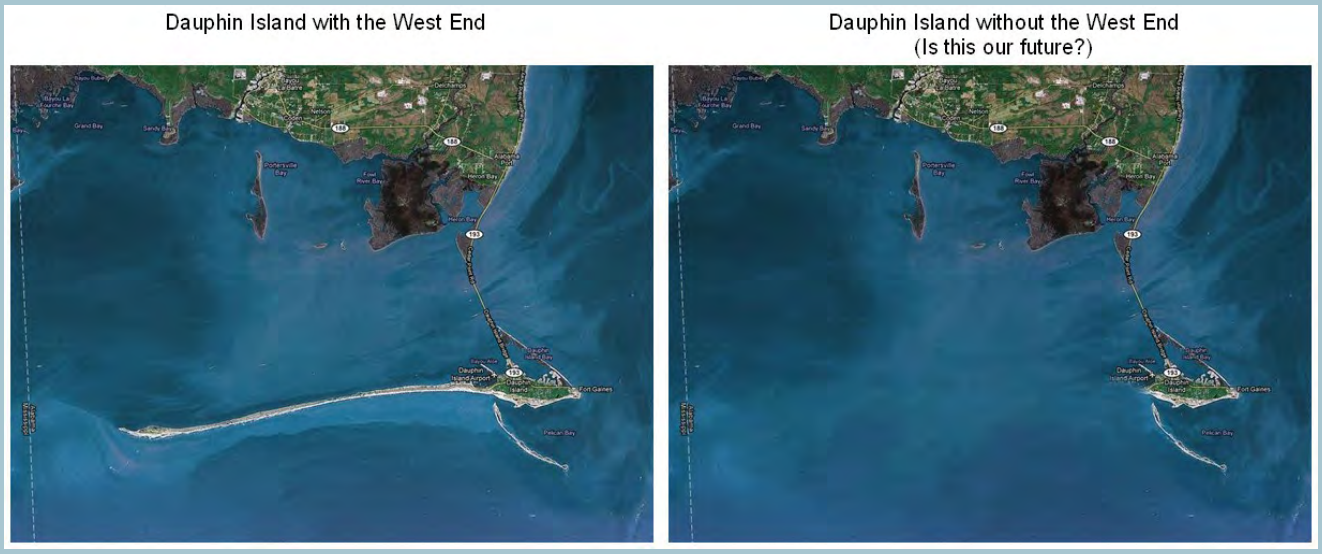
The community engagement process has been useful in providing a snapshot of community awareness regarding resilience in Rockaway. The belief that climate change is real and that Sandy will likely not be the last major storm to impact the area was voiced by all interview respondents. All of the interviewees supported the use of a community forum to promote resilience ideas, although they were skeptical about how effective a forum would be in driving actionable results. As discussed above, producing results through community engagement will require focused attention on the process. Setting small, quickly attainable goals at the beginning of the process can encourage coalition members to persist with long-term planning.

One of the more exciting ideas identified in an interview was the creation of grade school curriculum to engage local children on the effects of climate change. With community engagement being a key goal for Friends of Rockaway, emphasizing the role of youth in this process could be a high impact method of building awareness and support for resilience projects.

Case Study: Dauphin Island, Alabama

Dauphin Island, Alabama, has many similarities to Rockaway. At 14 miles long and under two miles wide, the island's slender shape is much like Rockaway and reflects Rockaway's land-uses, with a mixture of developed, undeveloped, public, and private lands.[121] Located just three miles south of Mobile Bay in the Gulf of Mexico, the island has a permanent population of only about 1,300 residents, while its population of visitors experiences dramatic swings depending on the season.

Figure 10. Satellite Image and Rendering of Dauphin Island



Source: Dauphin Island Restoration

Dauphin Island has seen an economic downturn in recent years and was in need of a multi-pronged revitalization plan. Being vulnerable to sea-level rise and hurricanes, the island's residents also needed to consider their ability to become resilient to disasters. In 2007, several federal, regional, state, and local organizations, along with the consulting firm Five E's, came together to create a strategic plan for the island to envision the next 20-30 years.[122] The planning process involved approximately 1,000 stakeholders from Dauphin Island through surveys, workshops, and personal conversations. These interviews helped the planning committee "to identify the important focus areas and strategic actions that will move the community toward sustainability."[123]

Using the stakeholders' responses and looking at economic, ecological, and social change and needs, planners came up with a mission, set specific goals, and engaged the community. Their report notes that "Wanting to be in control of their own destiny with regard to anticipated change has motivated stakeholders to engage in a strategic planning process and build consensus on sustainable development programs that will collectively improve resource management, land-use, economic vitality, and community growth over the next several decades for the well being of all stakeholders."[124]

Lessons Learned

Dauphin Island's plan underscored the need to place residents at the center of envisioning resilience plans. Focusing on community members' concerns and ideas encourages participation and emphasizes commonalities. By setting achievable goals and asking residents to imagine the future of their community over a specific timeframe, Friends of Rockaway can guide the community along a path that incrementally builds resilience.

Maps of the Rockaways

Although Friends of Rockaway possesses qualitative data about the community, the organization not have visual data to help identify vulnerabilities, define resilience, and present visualizations of these findings to residents. Friends of Rockaway identified the creation of these maps as an essential tool for the organization's plans for community engagement. Maps visualize data and highlight the relevance of community features that could otherwise be meaningless to local residents. As a result, maps can elicit meaningful information from individuals and allow Friends of Rockaway to connect to a wider audience.

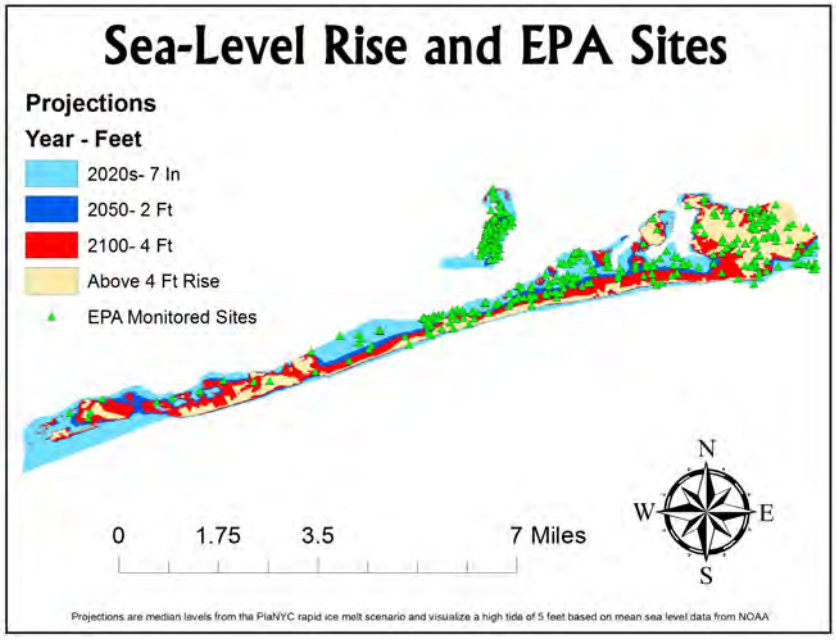


Figure 11. Map of EPA-monitored Sites and Projected Sea-level Rise on Rockaway. Prepared by P. Barker, R. Copley, & P. Johnson; Data Sources: NOAA, NYC *PlaNYC*, USEPA

Due to the relatively short duration of our project, our team focused not on gathering new data or creating new maps but instead on collecting existing data and maps to display information pertinent to building resilience and adaptation for the Rockaways. Considering the project's goals, our team focused on hurricane-related data, climate change predictions, and local socioeconomic data. Because much of this data had already been compiled and because many of these maps already existed, our team focused on visualizing the data so that the maps present relevant information in an uncomplicated, easily comprehensible image. Although our team has included in this report certain maps that identify community vulnerabilities and that will help residents to define their vision for resilience, our team has also provided Friends of Rockaway with a package of GIS layers that can be customized to specific community engagements. (All of the maps prepared for this project can be found in Appendix A.)

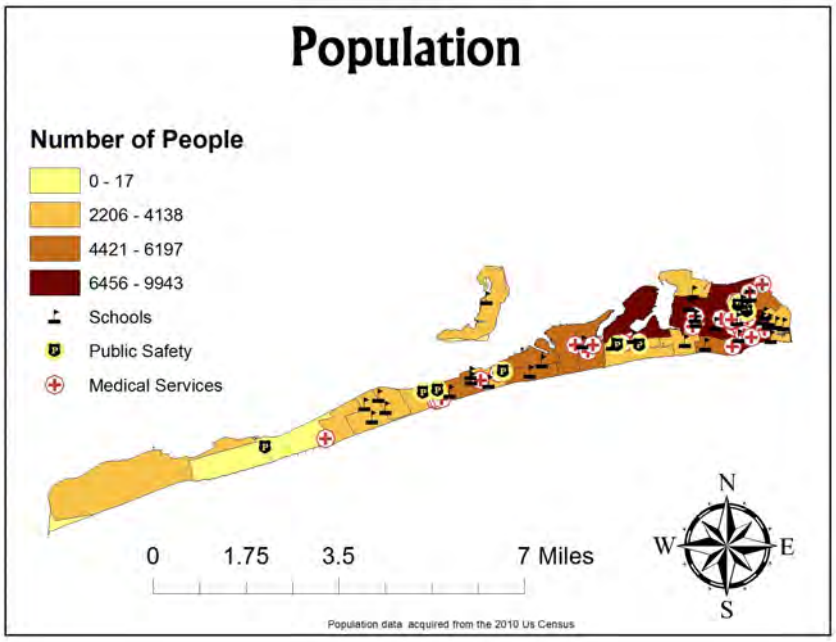


Figure 12. Map of Rockaway Population and Selected Public Services on Rockaway

Prepared by P. Barker, R. Copley, & P. Johnson; Data Sources: NYC DCP, US Census

Conclusion

Since Sandy struck nearly two years ago, Rockaway has made significant progress towards becoming more resilient. Government began construction on new infrastructure. Public meetings let citizens voice their desires for neighborhood improvements, and citizens have become more aware of their vulnerabilities to extreme weather events. Still, successful resilience planning requires more effort and action.

To develop a community engagement plan for Friends of Rockaway to meet this challenge, our team examined a range of resources and developed engagement tools for the organization.

Literature Review and Frameworks for Building Resilience

Our team reviewed contemporary sociological approaches to community planning, including methods for strengthening cohesion and assessing vulnerabilities. We specifically focused on building community capitals, applying a framework of civic ecology, and quantifying social vulnerability through an index.

Case Studies

We examined the history of water management, environmental engineering, and disaster planning in the Netherlands, and then focused on a resilience planning project in New Jersey which emphasized the involvement of local governments. Finally, we reviewed an example from Dauphin Island, Alabama, where adaptation and revitalization plans placed engagement with community members foremost.

Community Outreach

Our team was fortunate to have attended a community board meeting in the Rockaways, in addition to a meeting of a long-term recovery group. We also interviewed residents of the Rockaway who survived Sandy and continue to live on the peninsula

Toolkit

Complementing these activities, our team also developed a set of tools that will allow Friends of Rockaway to learn about the concerns of Rockaway resident and to effectively engage community members. These tools include a presentation template, a GIS maps suite, a survey, and directions for conducting different learning exercises to build adaptation.

Recommendations

Climate change will drastically affect the Rockaway sliver of New York City. Adaptation will entail a dramatic re-envisioning of the peninsula to ensure its sustainability. In creating this vision, community members should not be afraid to reimagine their shoreline. On the contrary, creative thinking will allow residents to mold Rockaway as they see fit.

The first steps of resilience planning in the Rockaways will involve residents' coming to a consensus on the timeline for fulfilling their long-term vision. Setting short-term goals with tangible results will provide community members with measureable accomplishments on the way to becoming resilient.

In envisioning a resilient Rockaway, residents should also remember their abstract resources, including social, cultural, and human capitals, because built infrastructure alone does not make a community resilient. Examining the characteristics that exacerbate the vulnerabilities of certain areas or populations will also strengthen Rockaway's resilience. Failing to address weak links in social connections could leave some residents exposed to the hazards of climate change.

Equally important, the members of the peninsula's different neighborhoods will find benefits in recognizing the interconnected system that is Rockaway—not only its roads and utilities but also the financial, social, and cultural threads that tie their neighborhoods together.

Even with adequate preparation, storms will still sweep over Rockaway and natural disasters will occur. To prevent catastrophe, preparation should include establishing disaster plans with families, friends, and community organizations. Through the development of contingencies, Rockaway's population can overcome the challenges brought on by climate change and become stronger and more united. By relying on resilience-building frameworks and employing the Community Engagement Toolkit, Friends of Rockaway can play a leading role in transforming the peninsula into a resilient, vibrant community.

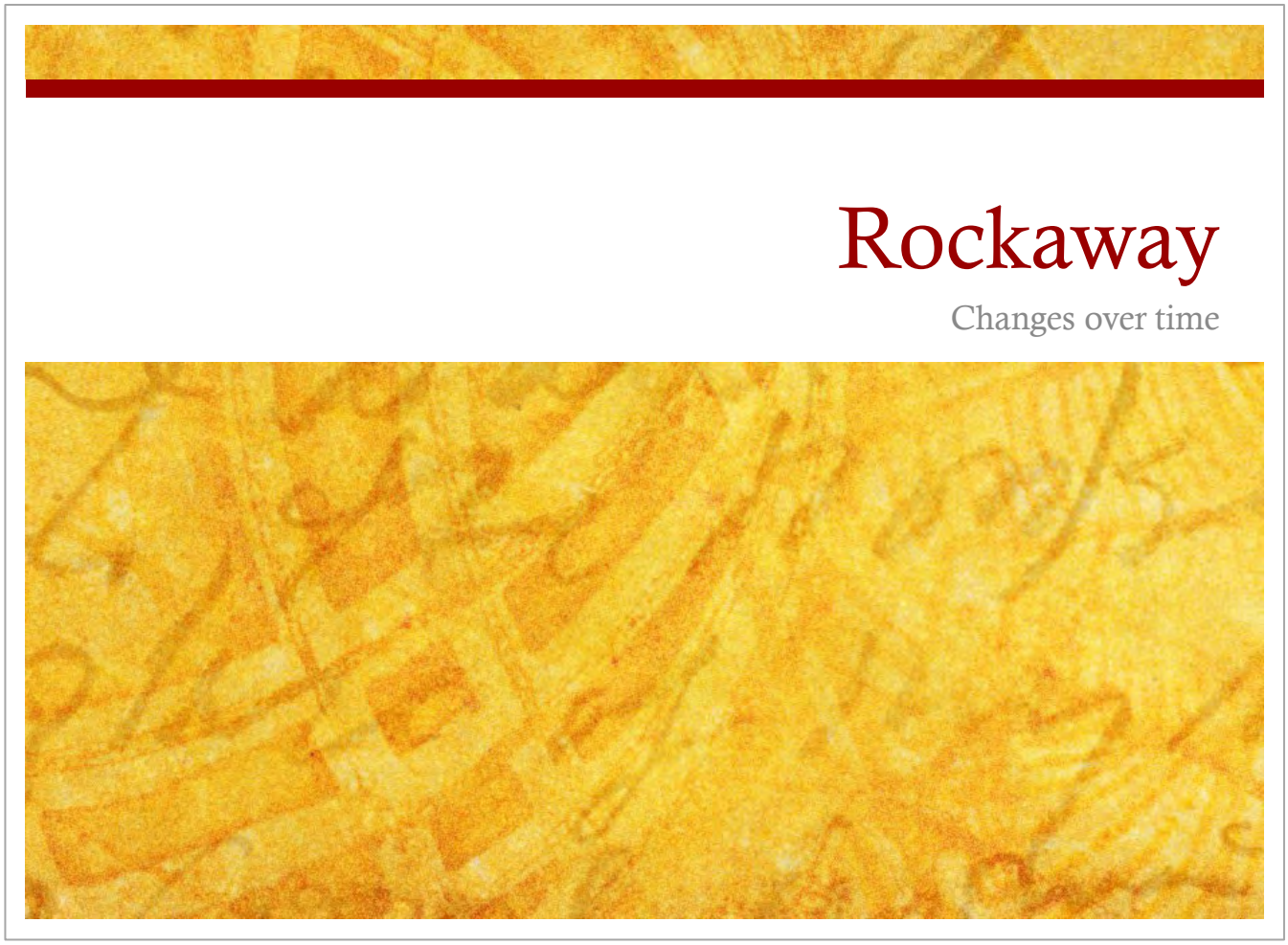
APPENDIX A: Community Engagement Toolkit

Community Meeting Presentation Template

The section that follows provides a basic presentation template that Friends of Rockaway can use in its initial meetings with community members. The slides, also provided to Friends of Rockaway in a PowerPoint file, discuss a brief history of the changing shape of the Rockaway peninsula and an overview of the New York City and New York State resilience plans. We have intentionally not included slides on climate change so as not to exclude or offend any potential community members, since this topic can create tension between individuals and factionalize groups.

Using this presentation as a jumping-off point, Friends of Rockaway can modify community meeting presentations based on audience concerns, perceptions, and goals.

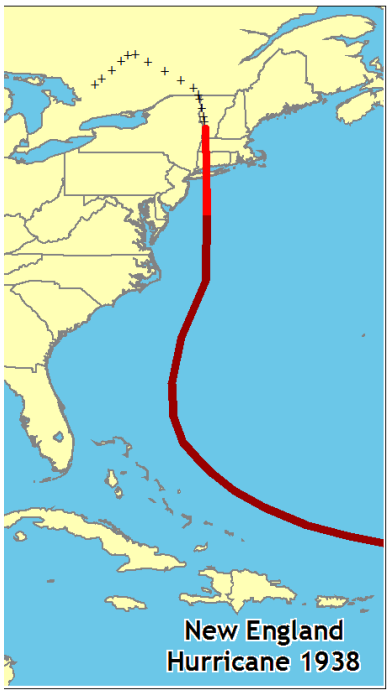
Community Meeting Presentation Template (continued)



Community Meeting Presentation Template (continued)

Community Meeting Presentation Template (continued)

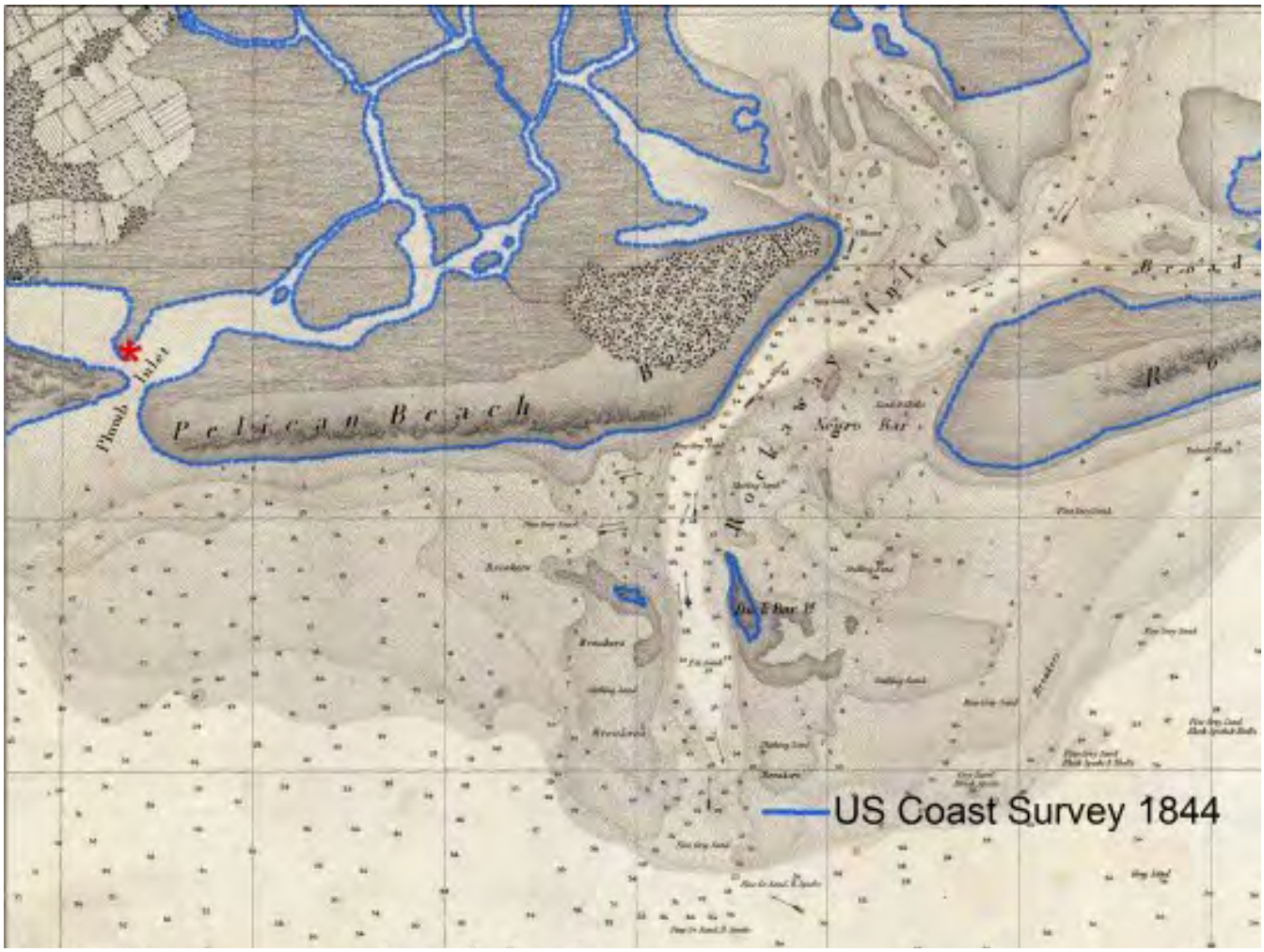
Hurricane History



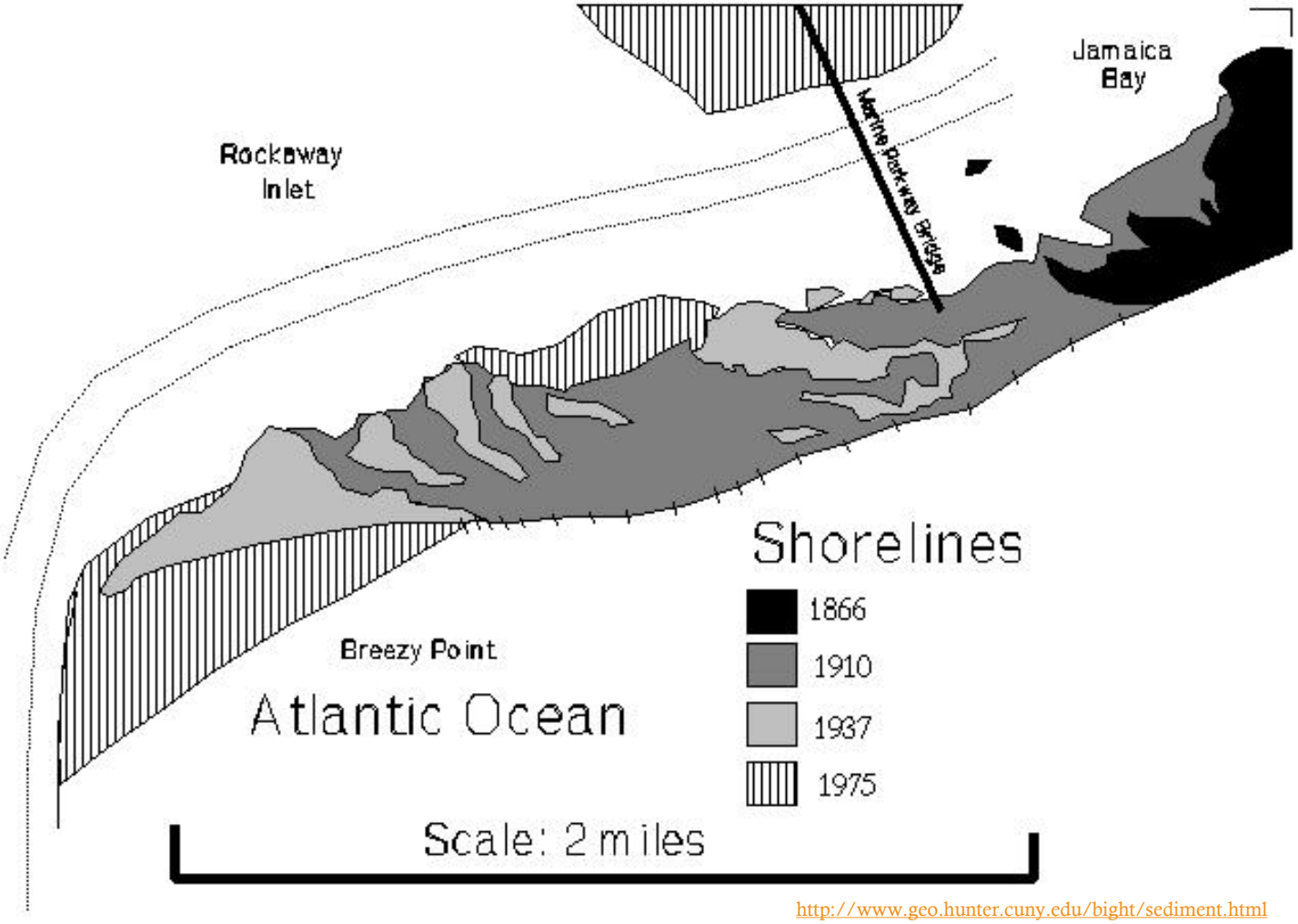
- 1938 Category 3- most powerful to ever hit NY
- 1950-1960 Carol, Connie, & Diane- mostly rain and flooding
- 1960- Donna- 11 foot storm tide surge that flooded Rockaway (see video)
- 12 Significant hurricanes since 1950 (6 since 1990)

http://www.nyc.gov/html/oem/html/hazards/storms_hurricanehistory.shtml
http://www.nhc.noaa.gov/outreach/history/new_england_1938_map.gif

Community Meeting Presentation Template (continued)

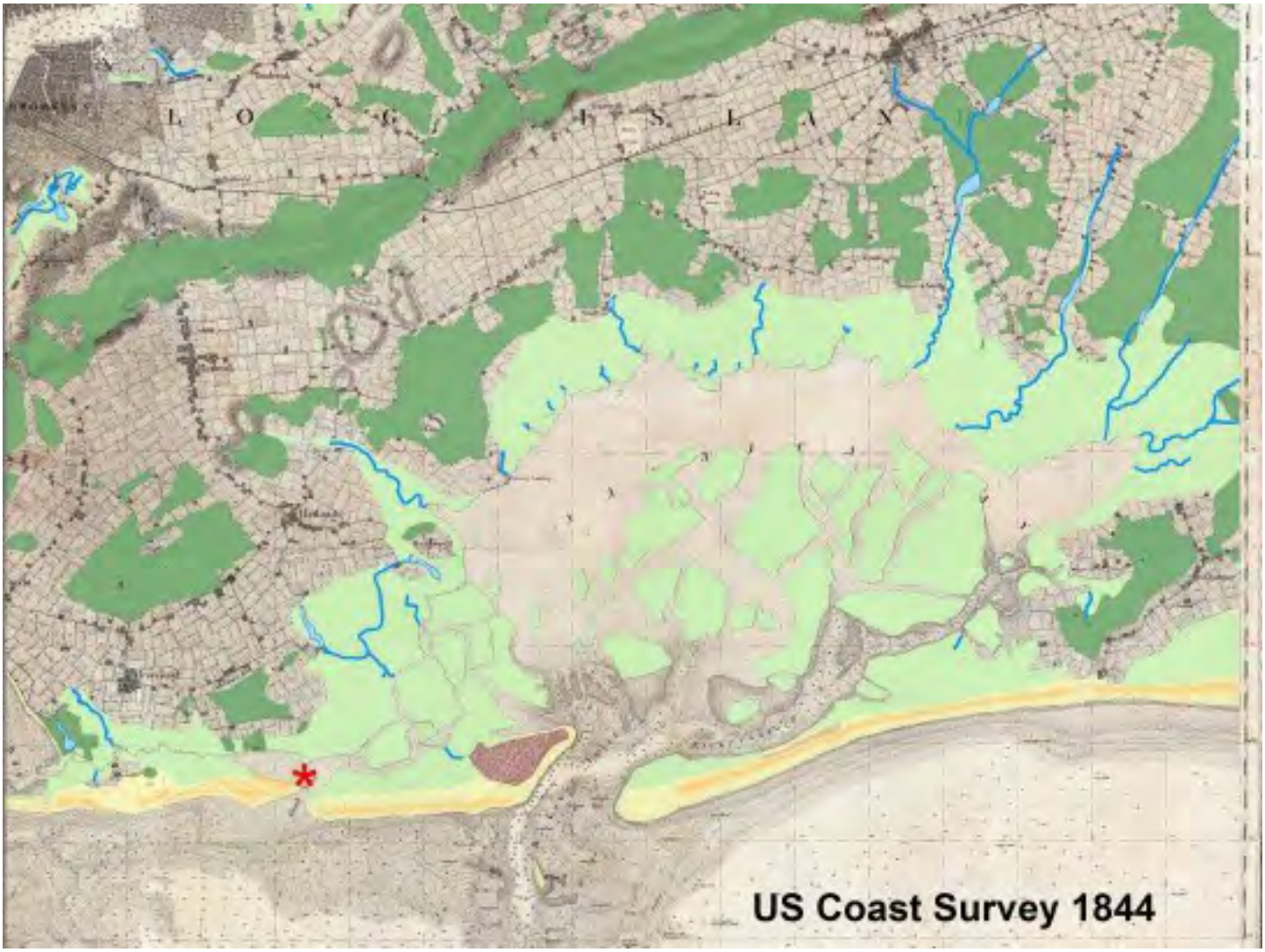


Community Meeting Presentation Template (continued)



http://www.geo.hunter.cuny.edu/bight/sediment.html

Community Meeting Presentation Template (continued)



Community Meeting Presentation Template (continued)

New York City Plan

- *A Stronger, More Resilient New York (2013)*
  - Builds off of PlaNYC (2011) but directly responds to Sandy's impacts
  - Developed through the Mayor's Special Initiative for Rebuilding and Resiliency, including community outreach and meetings
  - Identifies more than 60 initiatives in the Rockaways in the areas of coastal protection, infrastructural and building improvements, and community and economic development

South Queens community outreach workshop

Source: New York Special Initiative for Rebuilding and Resiliency

Community Meeting Presentation Template (continued)

New York State Plan

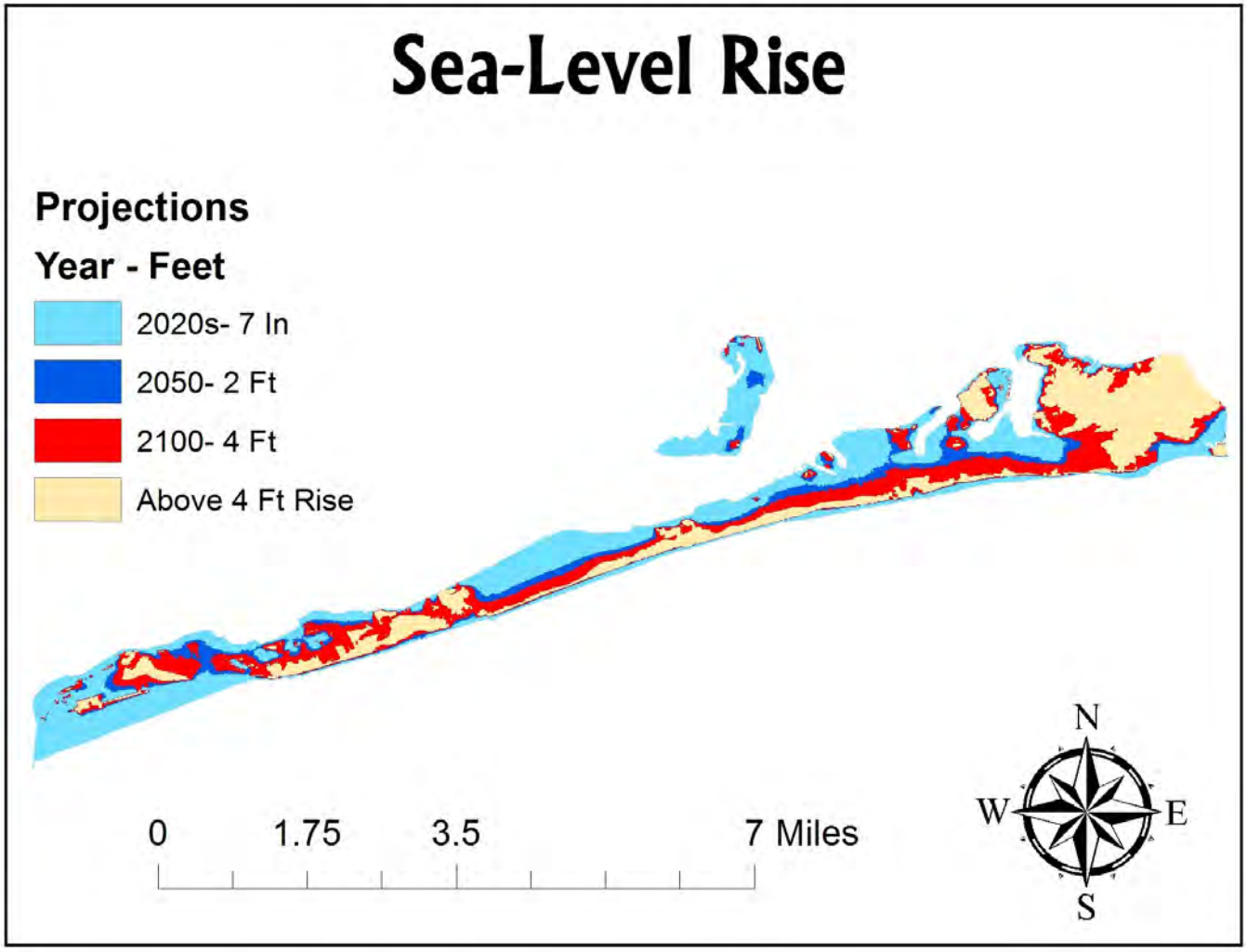
- New York Governor's Office of Storm Recovery
  - U.S. Department of Housing & Urban Development has made available up to $3.8 billion through the Community Development Block Grant program for communities affected by Sandy, Irene, and Lee
  - NY Rising Community Reconstruction Program
    - Identifies $61.86 million for the Rockaways
    - 8-month long planning process with experts, local committees, and public meetings
    - Initial plans (October 2013) identify similar initiatives as NYC report
    - Final plans to be released Spring 2014

Source: Sea by the City

GIS Maps Suite

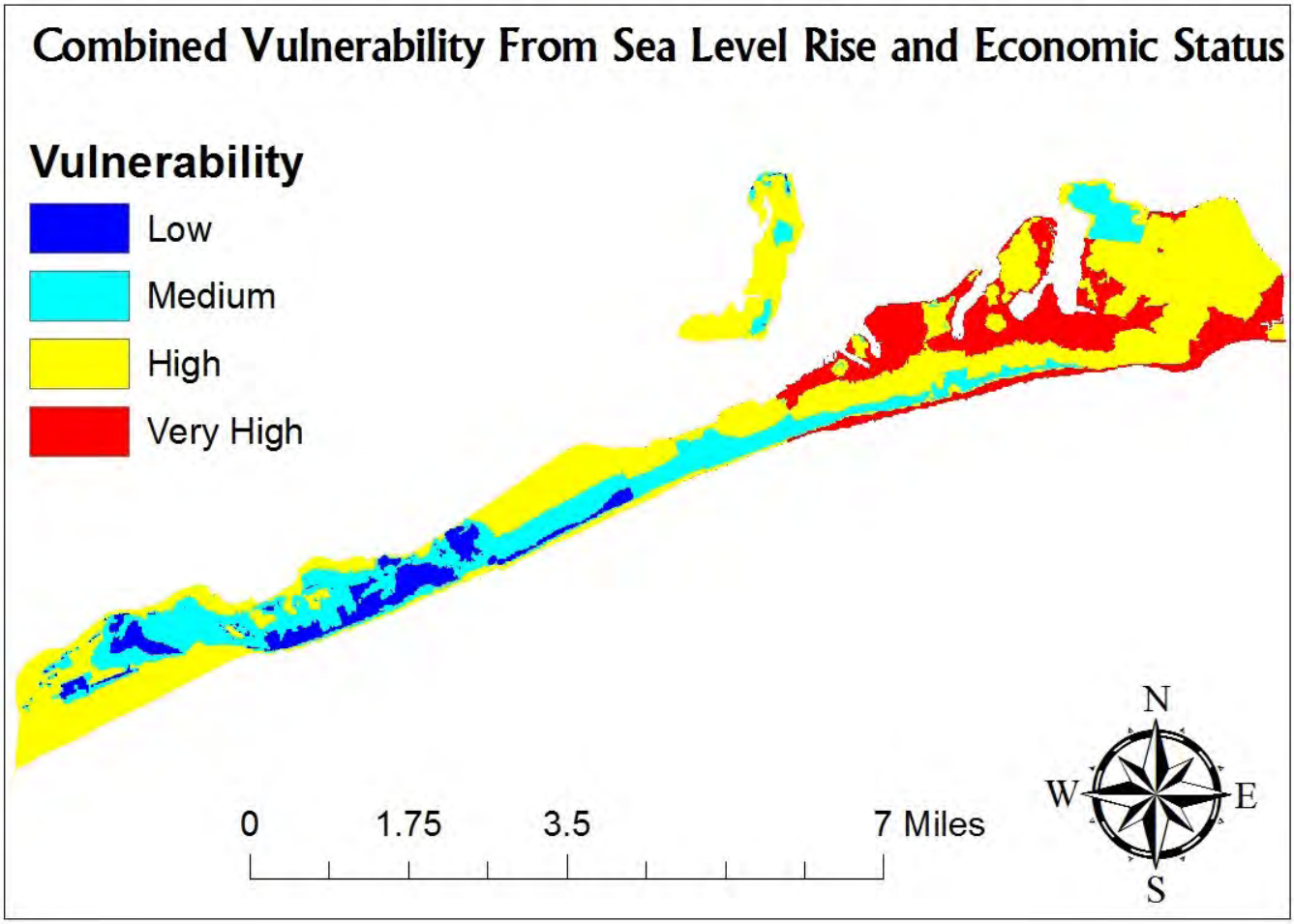
Peter Barker, Paul Johnson, and Robbie Copley of our workshop team constructed the following maps based on publicly available data from a wide range of sources, including the National Oceanic and Atmospheric Administration, the New York City Department of City Planning, and the United States Geological Survey. These maps address a wide range of issues pertaining to Rockaway, including sea-level rise, the extent of the Sandy storm surge, the location of public services, and the application of a social vulnerability index. Using these maps, which we have also provided to Friends of Rockaway in GIS files, Friends of Rockaway can better tailor their presentations to connect to audiences during community engagements.

GIS Maps Suite (continued)



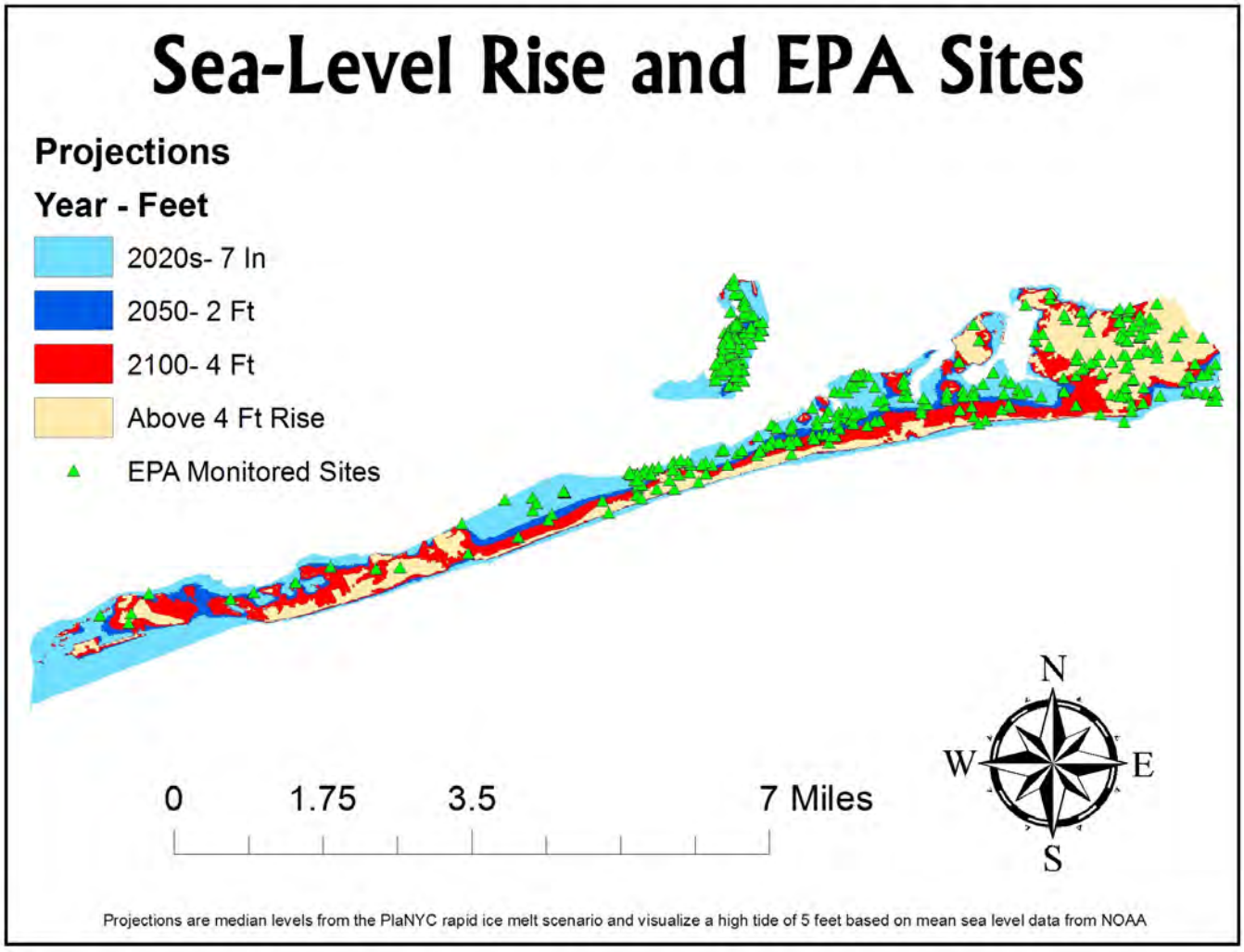
The sea-level rise projections are median levels from New York City Mayor's Office of Long Term Planning and Sustainability *PlaNYC* rapid ice melt scenario. The projections were created with national elevation data acquired from the United States Geological Survey. Sea level rise is represented with a high tide of five feet based on average sea level and tidal data from the National Oceanic and Atmospheric Administration.

GIS Maps Suite (continued)



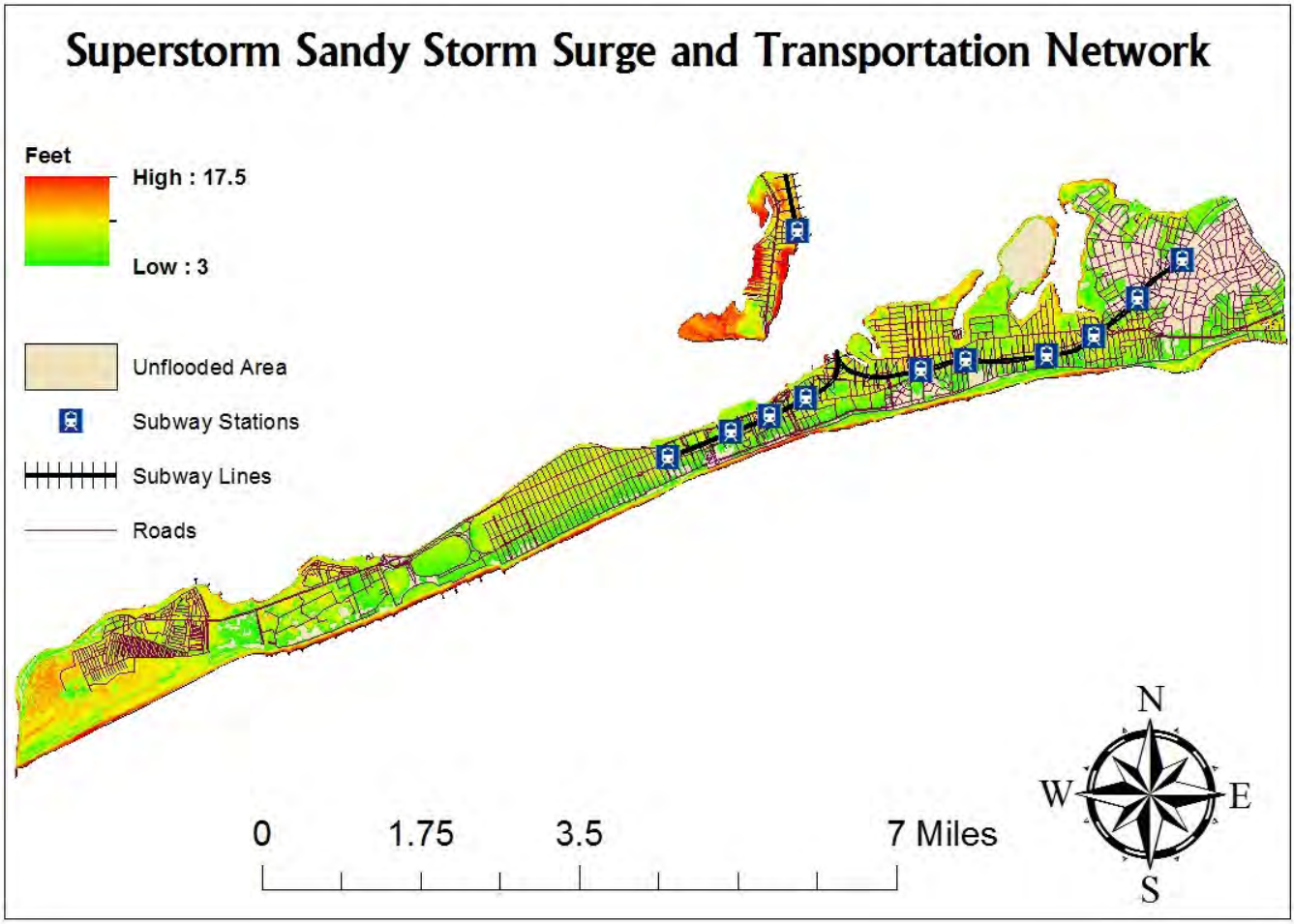
This map combines the number of households under the poverty line (based on 2010 US Census data) with areas that are vulnerable to sea-level rise. The areas of low elevation and number of homes under the poverty line are treated as equal contributors to the overall vulnerability of Rockaway. The elevation data used was acquired from the United States Geological Survey (USGS). These projections are median levels from the New York City Mayor's Office of Long Term Planning and Sustainability *PlaNYC* rapid ice melt scenario. Sea-level rise is visualized to represent a high tide of five feet based on average sea level and tidal data from the National Oceanic and Atmospheric Administration.

GIS Maps Suite (continued)



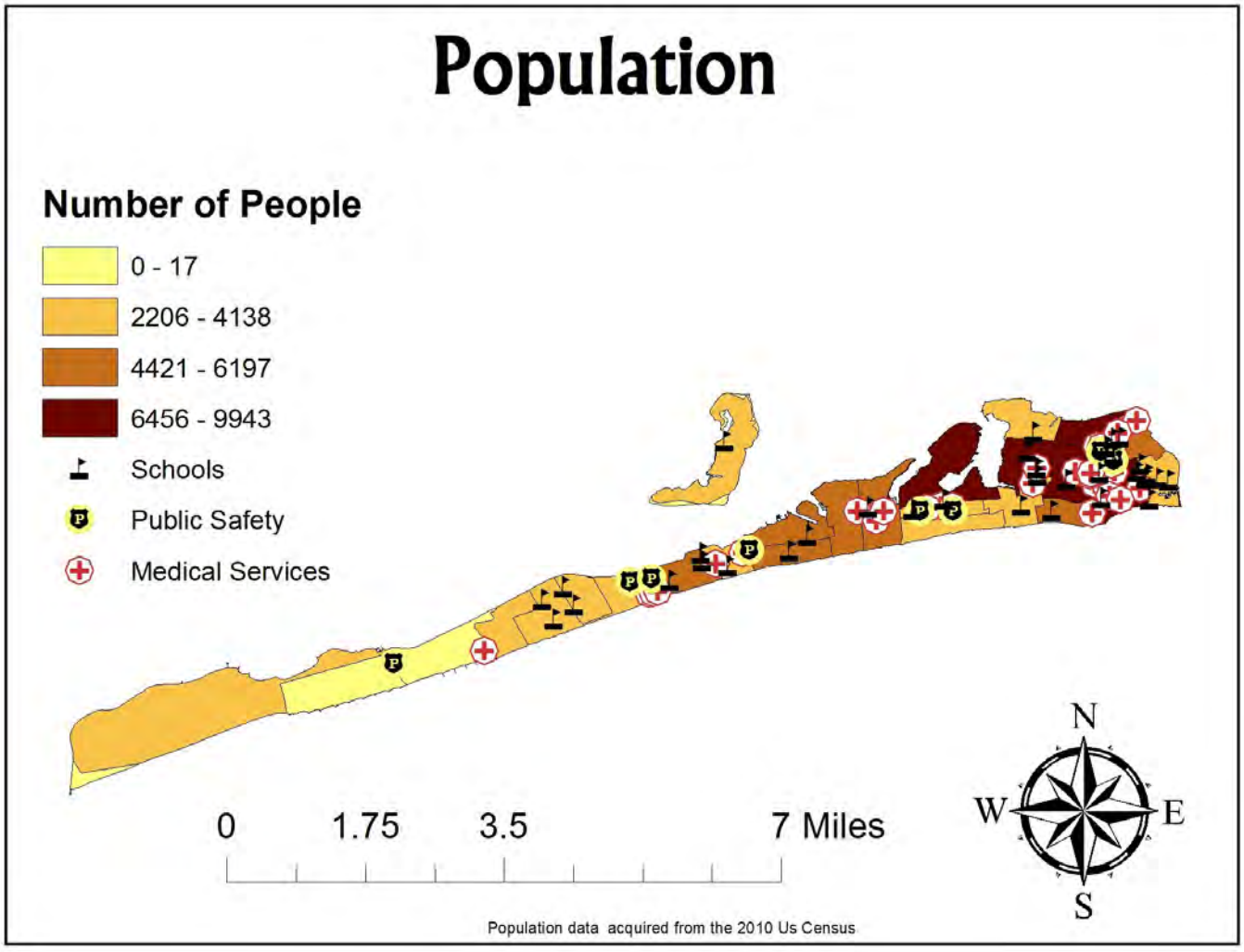
The map represents information about facilities, sites, or places subject to environmental regulation or of environmental interest by the United States Environmental Protection Agency. The sea-level rise projections are median levels from New York City Mayor's Office of Long Term Planning and Sustainability *PlaNYC* rapid ice melt scenario. Sea level rise is represented with a high tide of five feet based on average sea level and tidal data from the National Oceanic and Atmospheric Administration.

GIS Maps Suite (continued)



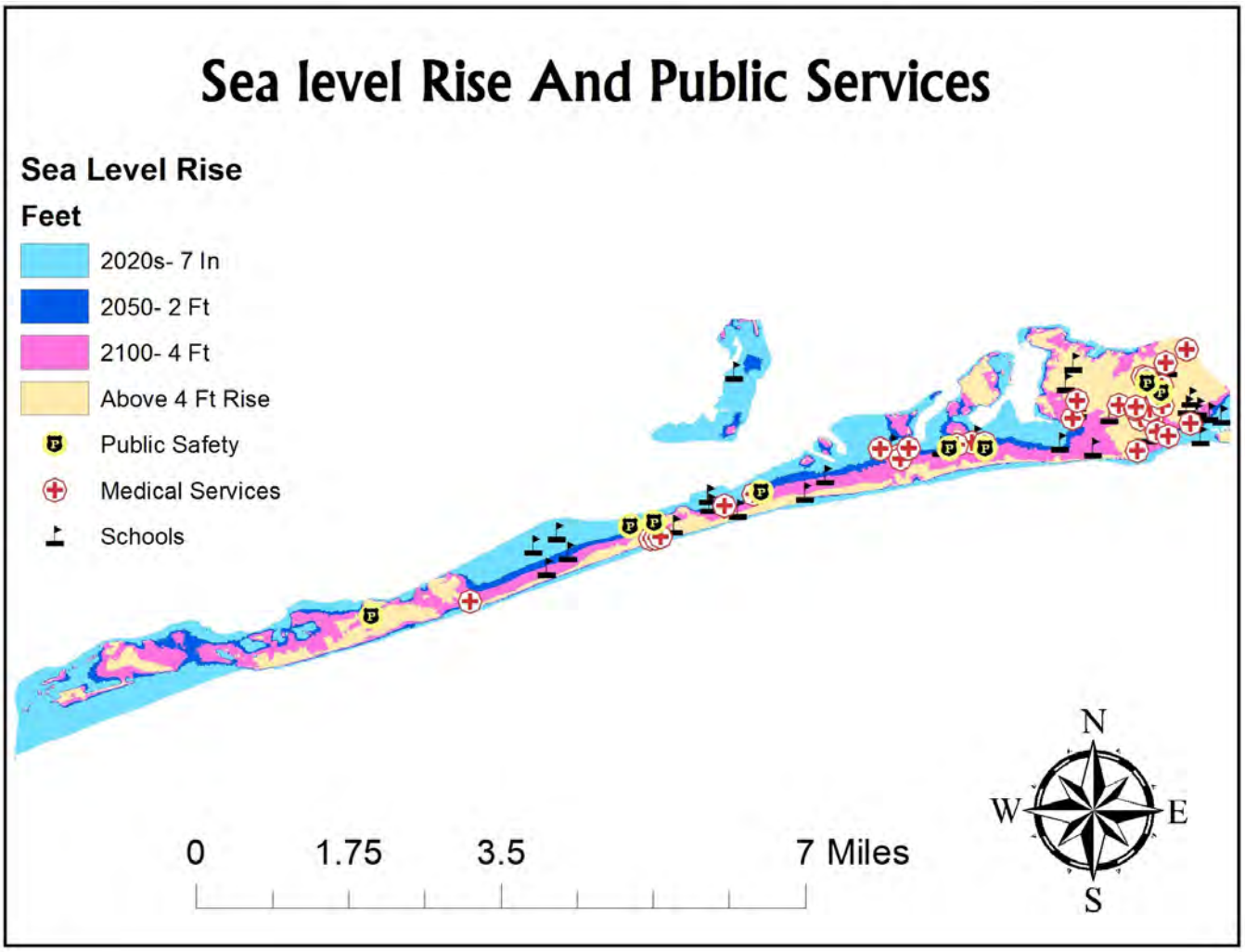
The above map displays the maximum height of inundation during Superstorm Sandy and the public transportation network on the Rockaway peninsula. The data was gathered and put into a geospatial format in a joint effort from the United States Army Core of Engineers, the Federal Emergency Management Agency, and the United States Geological Survey. The transportation network includes a road map and the subway lines with stations.

GIS Maps Suite (continued)



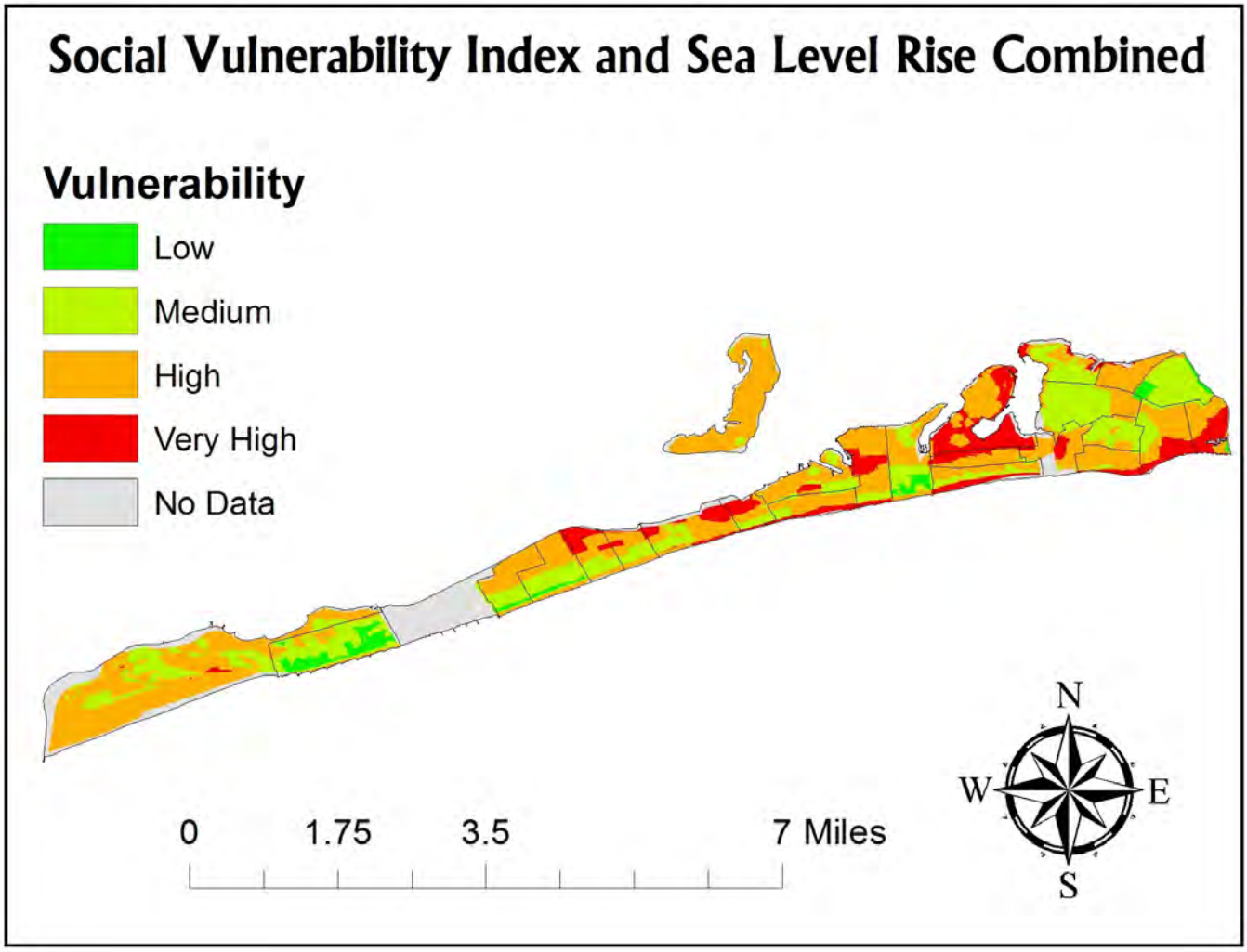
The above map colors census tracts based on the population. This data came from the 2010 U.S. Census. Overlaid on this are icons indicating the locations of certain public services, including schools, public safety facilities (e.g. police stations), and facilities that provide medical services. This data was provided by the New York City Department of City Planning.

GIS Maps Suite (continued)



The above map is used to show the impact sea level rise will have on the local public service locations to represent impacted services and as prominent points of reference for the community. The elevation data used to create the sea-level rise projections was acquired from United States Geological Survey. These projections are median levels from New York City Mayor's Office of Long Term Planning and Sustainability *PlaNYC* rapid ice melt scenario. Sea-level rise is visualized to represent a high tide of five feet based on mean sea level and tidal data from National Oceanic and Atmospheric Administration.

GIS Maps Suite (continued)



The above map shows which areas of Rockaway are most vulnerable based on the social vulnerability index created by Susan Cutter of the Hazard and Vulnerability Research Institute at the University of South Carolina and areas of low elevation which are most susceptible to sea–level rise. The elevation data acquired from the United States Geological Survey and is classified into four categories of sea level rise projections. These projections are median levels from New York City Mayor's Office of Long Term Planning and Sustainability *PlaNYC* rapid ice melt scenario. The sea-level rise visualized represents a high tide of five feet based on average sea level and tidal data from the National Oceanic and Atmospheric Administration.

Friends of Rockaway
Community Engagement Survey

1. What community do you identify yourself as living in on Rockaway?
    - O Arverne by the Sea
    - O Arverne/Sommerville
    - O Bayswater
    - O Belle Harbor
    - O Broad Channel
    - O Deerfield
    - O Edgemere
    - O Far Rockaway
    - O Neponsit
    - O Rockaway Beach
    - O Rockaway Point
    - O Other _____

2. For the next series of questions, please answer on a scale from Stongly Disagree to Strongly Agree.

	Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree
A) Climate change impacts the Rockaway peninsula.	O	O	O	O	O
B) Superstorm Sandy impacted you and your property.	O	O	O	O	O
C) An incident like Superstorm Sandy can happen again.	O	O	O	O	O
D) Rockaway can be better prepared for a comparable storm.	O	O	O	O	O
E) You have taken steps to make your property more resilient since Superstorm Sandy.	O	O	O	O	O
F) Rebuilding and reconstruction are important to Rockaway's resilience planning.	O	O	O	O	O
G) If Friends of Rockaway were to organize a community forum on disaster preparedness and coastal resilience, you would be interested.	O	O	O	O	O

3. If you were to attend a community forum on disaster preparedness and coastal resilience, what topics would you most like to discuss? (Answer "N/A" if you are not interested in a community forum.")

Friends of Rockaway
Community Engagement Survey (continued)

4. What is the best weekday(s) for you to attend such a forum? (Answer "N/A" if you are not interested in a community forum.)
    - O Monday
    - O Tuesday
    - O Wednesday
    - O Thursday
    - O Friday
    - O Saturday
    - O Sunday
    - O N/A

5. With which race(s) do you most closely identify?
    - O Asian
    - O African American or Black
    - O American Indian or Native American
    - O Caucasian or White
    - O Hawaiian or Pacific Islander
    - O Hispanic
    - O Other, please specify _____
    - O 2+ race, please specify _____
    - O I prefer not to disclose.

6. What is you approximate household income?
    - O $0—$24,999
    - O $25,000-$49,999
    - O $50,000-$99,999
    - O $100,000+
    - O I choose not to disclose.

Community Mapping

What is Community Mapping?

Community mapping is a process that engages community members and other stakeholders to create maps that yield new information. Rather than mapping data that displays elevation or relative location, a community map gives qualitative information. By sitting down with a community and generating discussion, maps are no longer addresses, streets, and landmarks. Maps become a tangible part of the community and can be used to check the accuracy of official maps and data.

Rockaway, community-mapping projects have the potential to define neighborhood lines and show the evolution of a locality. An area's important cultural and social points are identified when participants highlight features. A map may show a school gym, but locals may recognize this as a meeting place for socializing or making important decisions. Roads may be identified as a possible route but citizens may point out the danger or inability to traverse certain areas or identify areas that are susceptible to flooding.

In other words, a map can extend outside of its two-dimensional boundaries to encompass cultural heritage and local knowledge. Community maps can unite neighborhoods and demographics. During resilience planning, community mapping helps individuals identify robust and valuable parts of the community. For instance, what stores opened immediately after a large storm? Which community facilities were utilized as support centers? Which pre-determined storm routes and emergency centers are actually accessible during extreme weather events? GIS makes community mapping feasible but the data cannot be garnered without local engagement.

How to Conduct a Community Mapping Exercise

Community mapping events are easy to organize and require few resources. The organizer can hold multiple events at once by splitting a community meeting into different demographics.

The process for drawing a community map is simple. The materials required are colored markers, a blank poster paper or pre-printed map, and colored or numbered bits of paper. The meeting coordinator acts proposes questions and ideas that get the community thinking about the neighborhood. Participants mark the important or well-travelled areas on the map using the bits of paper. The coordinator should not be involved in drawing or pointing out locations, though.

Meeting with groups of people with similar characteristics, such as income, gender, or age, allows for patterns to be seen across groups and to emphasize the perceptions held in common. It is often important to have any assemblage define the borders and scale of a map. Groups should be asked to identify places of significance, locations they spend a large amount of time in, and areas that affect their livelihood.

Once the mapping is complete, comparing the maps of different demographic groups can highlight the differences, similarities, and important features of a group's perception of its community. After the meeting, the coordinator can then visualize and quantify the data using GIS.

SWOT Analysis

What is SWOT Analysis?

SWOT analysis is a tool used to evaluate the strengths, weaknesses, opportunities, and threats for any given organization, project, or initiative. It allows the people involved to identify the various issues of a complex problem and to develop a strategy taking into account the most important variables of the problem.

In SWOT analysis, the first two concepts, strengths and weaknesses, concern issues at the present time and are usually considered internal attributes, while the latter two concepts, opportunities and threats, are assessments of future issues and are considered external attributes. For Rockaway, some issues for residents to consider when planning a resilient community are the quality and quantity of staff members, the state of projects' finances, the activities that will best promote adaptation to climate change, previous experiences with extreme weather events, past economic issues and the future of Rockaway's economy, and the potential impacts of future legislation and regulations.

How to Conduct a SWOT Analysis Exercise

In conducting a SWOT analysis exercise, the coordinator should follow these steps:

- Designate a group leader who is open and knows how to listen to the community.
- Depending on the size of the group, the exercise can be divided among smaller groups.
- The group leader should then prompt discussion of each of the SWOT analysis elements.
- Record the findings on a highly visible board or poster, so that all participants can keep track of the session.

Using the findings of the exercise, participants can then prioritize their concerns and develop a strategy that reflects the issues most pertinent to building resilience and reaching goals.

Scenario Planning

What is Scenario Planning?

There are several different kinds of scenario planning, from climate change adaptation, to disaster preparedness, to transportation changes based on economic growth trends and climate change. Scenario planning asks participants to envision several different plausible futures and to examine those scenarios in the context of organizations, policies, and socioeconomics. The project gives insight the decision-making process and build relationships within the community with the goal of developing a strategic plan. Relationship building will help avoid communication errors, anticipate obstacles, and ultimately mitigate disaster by equipping the community with knowledge, strategies, and tactics .

A scenario planning project in Rockaway has the potential to bring everyone together in a somewhat disconnected region and centralize the focus of the many organizations working towards a common goal of resilience. Strategic planning workshops can unite community members from different neighborhoods, and cannot be successful for Rockaway without local engagement.

How to Conduct a Scenario Planning Exercise

The coordinator should locate a central meeting space for the Scenario Planning workshop and establish a regular meeting time. Participants should include stakeholders from public, private, and non-profit organizations, as well as unaffiliated residents. Participants should be dedicated members of the community and should expect to commit to a long-term exercise, of 6 months to 1 year. The expanded timeframe encourages in-depth discussion of key community resources, elaboration of scenarios, and allows participants to become more knowledgeable about the subjects.

Sample Questions

For each individual stakeholder/organization to bring to the group:

- What critical uncertainties face the community or organization?
- What information about the future is needed to make these decisions?

For the Strategic Planning Process:

- Are organizations unknowingly planning to use the same evacuation routes or meeting places?
- Do we have sufficient contingency plans?
- Are there unidentified gaps in telecommunications, utilities, water, fuel supply, shelters, or other areas of shared resources, including backup and redundant systems?
- What is our plan for allowing essential employees to access impacted properties?
- Among public sector agencies and private sector organizations, who is responsible for what? What is the chain of command? What is the system for communications?
- Have we considered all populations including vulnerable populations?

APPENDIX B: Interviews

Interviews

Jamie Jordan, co-founder of Rockaway Help, a journalism project whose goals are to promote open data, open news, and civic engagement; interview conducted April 10, 2014

1. **How long have you worked with Friends of Rockaway and do you feel they are a useful tool for communities looking to rebuild in the wake of Sandy?**
2. **What community do you and those you work with identify themselves as living in on Rockaway?**
3. **How do you feel about the topic of climate change?**
   I am completely and totally obsessed with it. I've become a bit fanatical actually! Whereas previous to Sandy I was kind of blase about the whole thing.
4. **Based on extreme weather such as Sandy, do you and community members you work with feel that climate change impacts the Rockaway peninsula?**
5. **In the wake of Superstorm Sandy, what kind of impacts to community members properties did you witness?**
6. **Do you feel that an incident like Superstorm Sandy can happen again?**
7. **Do you feel that residents and the peninsula as a whole can be better prepared for a comparable storm?**
   One major thing I've noticed though is that I don't think the Rockaway community is prepared to make meaningful lifestyle changes to live more sustainably- even as they recognize that climate change may have played a role in the storm that devastated their lives. I find this very odd but not exactly surprising. On our FB page, I posted the recent climate change findings for that NATO panel- you know that big study that came out I think about a week ago? Anyway, people sort of groaned like- ughhhhhh, this is scary. But Rockaway is still chock full of 8 kid suburbans and Poland Spring bottles. So, that's interesting.
8. **Have members of the community that you work with taken steps to make their properties more resilient since Sandy?**
9. **Do you feel that rebuilding and reconstruction is important to Rockaway's resilience planning or do you have other options in mind?**
   Another really interesting thing is- I find that elementary school aged children are reallllly traumatized by Sandy and what they witnessed- and this is going to sound horrible- but i feel like there is an opportunity here- to turn them into little climate change warriors. hahahaha. I've been thinking a LOT about ways to develop small curriculum to capitalize on their trauma and urgency. And I KNOW that sounds horrible. But it is for the good of humanity. It's not like I'm advocating we turn them into child soldiers.
10. **Do you think that organizing a community forum on disaster preparedness and coastal resilience for the Rockaways would be a valuable endeavor?**
11. **If so, what topics do you think would be most important discuss at such a forum?**
12. **Do you have any other experiences you would like to share with us to better assist our knowledge of the local communities?**

Interviews (continued)

Marissa Bernowitz, Rockaway resident and the Sandy Relief Free Flee Market Director, providing a place where people affected by Sandy can donate and pick up relief supplies; interview conducted April 10, 2014

1. **How long have you worked with Friends of Rockaway and do you feel they are a useful tool for communities looking to rebuild in the wake of Sandy?**
   I have not exactly worked with Friends Of Rockway, but I have referred families (clients) to them and aided Rockaway residents in filling out the initial application online.
2. **What community do you and those you work with identify themselves as living in on Rockaway?**
   I personally reside in the Rockaway Park area (Beach 111 Street). My organization has a distribution set up in the same area (formerly Beach 112 & presently B110) but we serve residents across the entire peninsula (& Broad Channel).
3. **How do you feel about the topic of climate change?**
   I believe climate change is very real and is having an affect on beach communities in particular.
4. **Based on extreme weather such as Sandy, do you and community members you work with feel that climate change impacts the Rockaway peninsula?**
   Answered above, yes I do.
5. **In the wake of Superstorm Sandy, what kind of impacts to community members properties did you witness?**
   I witnessed the beach meet the bay as I reside directly in the middle of the two. The apartment below mine was completely engulfed in water, and my apartment had heavy rains break through my bathroom and kitchen ceilings. To this date, my apartment is still not repaired. The impact on properties around my own are very similar and in quite a few their homes have been demolished or deemed "un-repairable"
6. **Do you feel that an incident like Superstorm Sandy can happen again?**
   Yes I do.
7. **Do you feel that residents and the peninsula as a whole can be better prepared for a comparable storm?**
   There are ways to be as prepared as possible. But no one knows what Mother Nature has in store. The peninsula as a whole sure can benefit from better protective barriers.
8. **Have members of the community that you work with taken steps to make their properties more resilient since Sandy?**
   Many homeowners I know and work with have done their best to be more resilient. For example, homeowners have raised their homes and some have put in higher more resilient "barriers" around their homes.
9. **Do you feel that rebuilding and reconstruction is important to Rockaway's resilience planning or do you have other options in mind?**
   Yes I feel rebuilding and reconstruction is important in resilience planning.
10. **Do you think that organizing a community forum on disaster preparedness and coastal resilience for the Rockaways would be a valuable endeavor?**
    Having a forum is one thing, but having action taken is another.
11. **If so, what topics do you think would be most important discuss at such a forum?**
    Coastal protection and aid from the government on all levels should be discussed and put in place. Disaster preparedness information is important as well, but honestly, if warned by another storm like Sandy maybe this time it is best to evacuate completely (the issue there though is many residents have no where else to go as this is where our homes, family and friends are).
12. **Do you have any other experiences you would like to share with us to better assist our knowledge of the local communities?**
    I am not sure what else you are asking and what knowledge you may be looking for. Feel free to contact me again with any further questions.

APPENDIX C: Endnotes

Endnotes

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