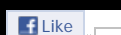


November 15, 2012

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By John Rudolf, Ben Hallman, Chris Kirkham, Saki Knafo and Matt Sledge

On the night that Hurricane Sandy hit the East Coast, Vinny Baccale was in his Staten Island living room, plotting a last-minute escape and regretting not evacuating, when his kids shouted to him from another room. Their neighbor was outside, trying to start his car in the rising water.

As Baccale stepped to his window, a six-foot wave swept down his block and over the man's car, propelling it down the dark street. As the wave fell back, a flashlight in the car blinked on and off in distress. Then the waters surged again and covered the car. The light went out.

"We watched a neighbor drown," said Baccale, 35. "Maybe things like this happen in Florida, places like that. But never here."

With historic ferocity, Sandy pounded the shorelines where people like Baccale lived, leaving a trail of destruction without parallel in New York and New Jersey, two states that bore the brunt of the impact. The storm's most destructive feature was a wind-driven wall of water that swept in at high tide and engulfed low-lying coastal areas with an unrelenting fury.

The surge flattened whole communities on New Jersey's barrier islands, causing

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untold billions in damage, and topped seawalls in lower Manhattan and throughout the metropolitan area, plunging millions into darkness. It also claimed lives, especially on Staten Island, where 21 people drowned during the storm.

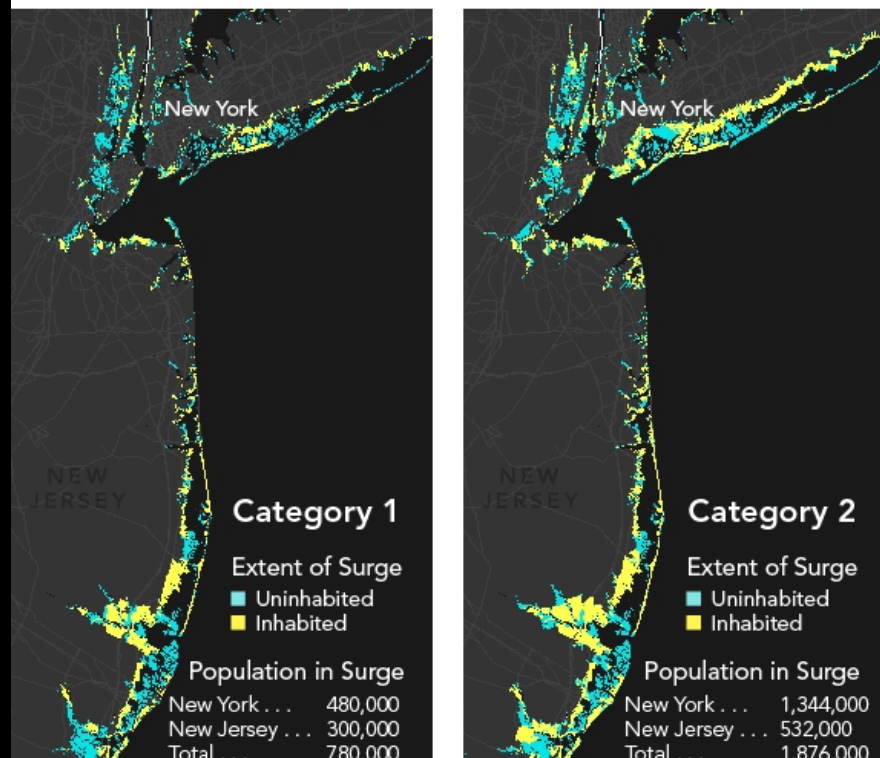
Given the size and power of the storm, much of the damage from the surge was inevitable. But perhaps not all. Some of the damage along low-lying coastal areas was the result of years of poor land-use decisions and the more immediate neglect of emergency preparations as Sandy gathered force, according to experts and a review of government data and independent studies.

Authorities in New York and New Jersey simply allowed heavy development of at-risk coastal areas to continue largely unabated in recent decades, even as the potential for a massive storm surge in the region became increasingly clear.

In the end, a pell-mell, decades-long rush to throw up housing and businesses along fragile and vulnerable coastlines trumped commonsense concerns about the wisdom of placing hundreds of thousands of closely huddled people in the path of potential cataclysms.

Millions in Danger of Storm Surge

The extent of Hurricane Sandy's storm surge did not exceed scientific projections. According to the SLOSH (Sea, Lake, and Overland Surges from Hurricanes) model developed by The National Weather Service, much of the coast is in danger of being flooded during a Category 1 hurricane. In the extreme case of a Category 4 storm, based on 2010 census information, homes of nearly 4 Million people could be hit by a surge.



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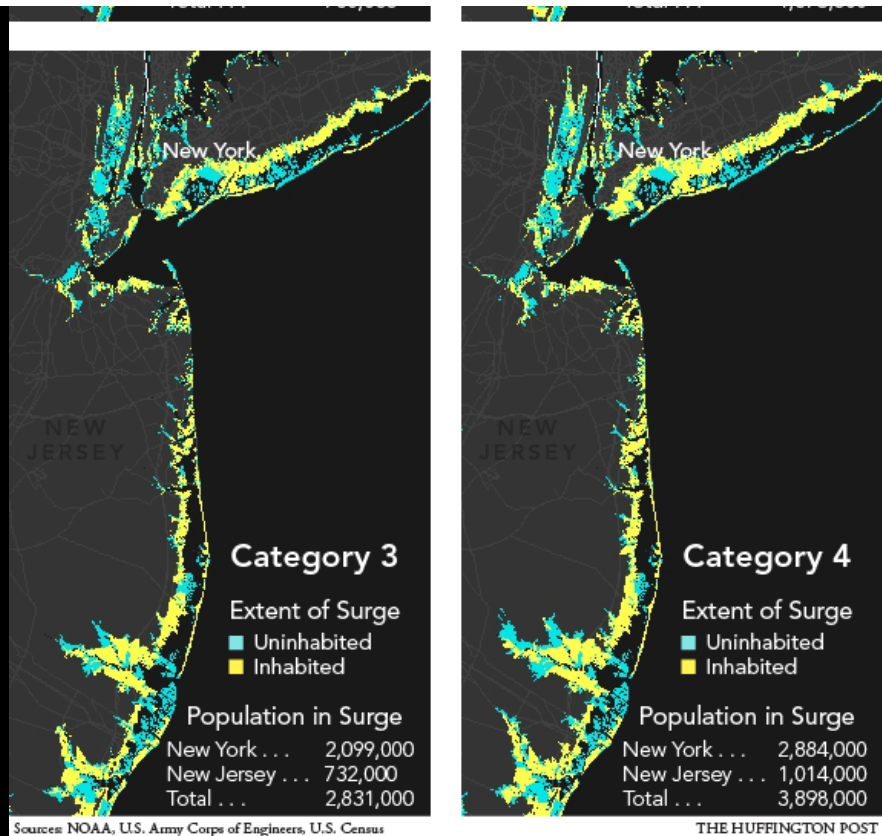


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On Staten Island, developers built more than 2,700 mostly residential structures in coastal areas at extreme risk of storm surge flooding between 1980 and 2008, with the approval of city planning and zoning authorities, according to a review of city building data by scientists at the College of Staten Island. Some of this construction occurred in former marshland along the island's Atlantic-facing south shore.

The 21 people who drowned in the storm surge on Staten Island were clustered along the south shore, and died after becoming trapped in their homes or while attempting to flee the rising water by car or foot, according to the New York City Medical Examiner's Office. While many of those who drowned lived in small bungalows built many decades ago, at least two victims were residents in a large-scale planned community completed in the 1990s.

"The city allowed development and growth to happen in areas that probably shouldn't have been developed," said Jonathan Peters, a professor of finance at the College of Staten Island. "I think the fact is that you put a lot of people in harm's way with the zoning."

The city did not respond to a question about recent development on Staten Island or on the Rockaways. It noted that experts on zoning and code had been dispatched to the field to respond to the aftereffects of Sandy. But it said that newly constructed

buildings in the city are required to be flood-proofed to the FEMA-designated flood elevations.

"As a part of our long-term sustainability initiative, PlaNYC, and our extensive climate change work, the City is reviewing both its building and zoning codes to better prepare for weather events and is continuing to develop measures that lower our risk and mitigate the impact of climate change," said Lauren Passalacqua, a spokeswoman for the city.

Developers built up parts of the Jersey Shore and the Rockaways, a low-lying peninsula in Queens, N.Y., in similar fashion in recent years, with little effort by local or state officials to mitigate the risk posed by hurricanes, experts said. Real estate developers represent a powerful force in state politics, particularly in New Jersey and New York, where executives and political action committees have been major donors to governors and local officeholders.

This coastal growth took place even as public and private sector leaders in both New York and New Jersey began expressing growing concern over the potential for climate change to intensify storms and accelerate already rising sea levels. New York City officials in particular were well aware of the ways in which climate change would make the potentially destructive effects of a major hurricane worse, scientists said.

The city is "one of the leaders of the country and the world," on climate change, said Cynthia Rosenzweig, a senior research scientist at NASA Goddard Institute for Space Studies. She has worked with both the international Intergovernmental Panel on Climate Change and the local New York City Panel on Climate Change, a body the mayor convened in 2008 specifically to look at how to adapt the city and its infrastructure to rising sea levels.

Despite the known risks and a push for quick action by some experts, however, only limited protective steps were taken, even as development in at-risk coastal areas boomed.

"It's just horrendous that there's been all this research and all this analysis and so little action," said Suzanne Mattei, former chief of the New York State Department of Environmental Conservation's New York City regional office. "It's a shame that we seem never to take the kind of action we need to until something really awful happens."

In New York City, the mayor's office and the city council had entertained plans since 2009 for a massive harbor barrier, like those built in London and in The Netherlands, to deflect storm surges. But studies on such a massive and costly undertaking were only in their first stages. Higher concrete sea walls, meant to address the new dangers introduced by climate change, were also discussed but not pursued.

More immediate steps, like using more submersible cables in Consolidated Edison's electrical network in New York, or protecting the Metropolitan Transportation Authority's urban subways against flooding, received only a fraction of the hundreds

of millions of dollars required for adequate protection. And advocates in places like the Rockaways said that their pleas for more beach replenishment there, which might have blunted the impact of Sandy's furious waters, went largely unheeded.

Policymakers in New Jersey had their own warnings that a severe storm surge posed a major risk to the state's densely populated coastline. In a series of reports over the past decade, the state's Department of Environmental Protection warned in stark terms that increased risk of hurricanes from climate change, coupled with a continued population expansion along New Jersey's coast, had set the stage for an enormously expensive disaster.

For decades, critics pushed for greater scrutiny of new development by state and local officials along the New Jersey coastline. Yet new construction continued unabated, as state law requires only lenient reviews of smaller developments in coastal areas.

"There's plenty of information out there about the risk on the Jersey Shore," said Ken Mitchell, a professor of geography at Rutgers University who has studied hurricane risks in New Jersey and throughout the world. "But it doesn't seem to have reached deep enough in the public policy system to do anything to handle the magnitude of this storm."

For example, Ocean County, N.J., home to devastated communities including Seaside Heights and Toms River, has been one of the fastest growing counties in the nation's most densely populated state. Between 1980 and 2010, the county's population increased nearly 70 percent, from 346,000 to nearly 577,000. **More residential building permits were issued** in the county in 2010 than anywhere else in New Jersey.

The intensity of development along the coast clearly influenced the scale of the disaster, said Bill Wolfe, a former analyst for the state's Department of Environmental Protection who now leads the watchdog group New Jersey Public Employees for Environmental Responsibility.

"There needs to be an acknowledgement that we can't keep on doing what we've done in the past," Wolfe said. "We have to face up to the problem."

Despite ample warning from forecasters that conditions were set for a record storm surge, when Sandy finally swept ashore on the eastern seaboard two weeks ago it still caught many officials and residents badly off guard. Evacuations stumbled in places like Atlantic City, where mixed messages from city and state leaders convinced many to ride out the storm with little understanding of its expected severity.

New York City, which saw the most deaths directly linked to the surge, also faltered in its efforts to get residents to safety. City officials waited until the day before the storm hit to order a mandatory evacuation of flood zones, then told 40 city-run elderly and adult care facilities in mandatory evacuation zones to ignore the order and ride out the storm.

Some residents said the last-minute evacuation order and the decision not to evacuate the city's nursing homes fed a belief that the storm would not be much more severe than Hurricane Irene, which caused only moderate flooding in the city.

"When the city didn't come for the patients, I figured it must not be too bad," said Diane Castiglione, who lives by Park Nursing Home, a 182-patient facility in the Rockaways, an ocean-facing neighborhood badly battered by the surge.

In a statement to The Huffington Post, a city spokeswoman defended the decision not to evacuate many nursing homes, saying it was made with the best information available at the time. But the day after the storm, as the death toll began to climb, Mayor Michael Bloomberg appeared to acknowledge that the city's early warning and evacuation efforts could be improved.

"I think that the best thing we can do for those that we lost is to make sure that we do everything we can, the next time we have a big storm, to do an even better job of protecting people, giving them more warning," he said. "Maybe people will find different ways to communicate with them."

A more clear-eyed view of the interplay of haphazard development and natural forces would also help, analysts say.

Research by Princeton University in 2005 -- seven years before Sandy arrived -- found that **New Jersey's rapid population growth in coastal counties was setting the scene** for monumental environmental damage and property loss. The report argued that much of the hazards were man-made, and predictable.

"In New Jersey, and the U.S. at large, there remains a significant lack of public understanding of the predictability of coastal hazards," the report read. "Episodic flooding events due to storm surges are often perceived as 'natural disasters,' not failures in land use planning and building code requirements."

IN THE BULL'S EYE

At the height of the roaring storm that accompanied Sandy's arrival, some of the night nurses at Park Nursing Home in the Rockaways got down on their knees in the darkened hallways to pray.

Waves broke against an exterior wall facing the beach, causing the whole building to shudder. Water surged into the evacuated first floor, throwing sand onto beds and flooding the lobby. One block away, a fire sparked by an exploded power transformer raged, engulfing an entire row of small businesses in towers of flames.

Patrick Russell, the administrator of the care facility, rushed from window to window, watching the ocean on one side and the roaring flames on the other. The fire "burned like a blowtorch," he said. "I've never been so scared."

The Rockaways, a narrow, low-lying peninsula in southern Queens with a largely working class population of about 130,000, were badly flooded by the storm, its streets covered in sand and the mangled remains of trees, boardwalks and cars. At least six people in the area drowned, including a disabled man with cerebral palsy

who couldn't escape the water rushing into his first-floor apartment.

More than a dozen care facilities in the area lost power and heat and weathered a miserable 24 hours before they were finally evacuated. Two weeks later, thousands of residents still remain without power or heat.

Park Nursing Home was fortunate. Its back-up generator didn't flood out, unlike those at other care facilities, and its kitchen, on relatively high ground, stayed mostly dry. But a week after Sandy hit, it, too, was evacuated, out of fear that another looming winter storm would damage a huge generator provided by the Army Corps of Engineers.

The lingering misery in the Rockaways, and the harrowing experiences of Russell and others who rode out the hurricane, owe largely to the incredible power of Sandy. But here, and all along the coast, the storm's destruction was magnified by the failure of local authorities to prepare for a massive storm surge that scientists had long warned was inevitable.

Before World War II, the Rockaways were a playground for New York City's middle class, an 11-mile spit of white beach with hotels, spas, amusement parks and a grand boardwalk. In the 1950s, suburbanization and car culture took vacationers elsewhere, and the area became something else: the place to send the city's most vulnerable populations.

On the eastern end of the peninsula, the city built huge public housing complexes. The Rockaways contained 57 percent of all low-income housing in the borough of Queens by 1975, though it contained only five percent of its population, [according to a history of the region in the publication City Limits](#).

Nursing homes, many established in the pre-air conditioning era when ocean breezes were welcome, crowd the narrow peninsula. Today, half of all such facilities in the city are in the Rockaways, many directly adjacent to the ocean.

All of this construction happened in an area that had been battered by two major hurricanes, in 1893 and 1938, which caused massive flooding and devastation in the Rockaways and other beach communities in Brooklyn, Queens and Staten Island.

Over the past few decades, scientists have developed a greater understanding of the particular risks hurricanes pose to New York City. Though big storms are rare, they tend to be larger than southern hurricanes, and attack on a straight line coming in from the east. As happened with Sandy, storm water gets pushed into New York harbor and is then boxed in, with nowhere else to go but onshore, into the flood zones.

One [2010 study by geologist Alan Benimoff](#) found that Staten Island sat in the "bull's eye" for a storm surge in New York harbor. Development had intensified that threat, as landscapes that once served as natural storm buffers were paved over and populated.

Development on Staten Island

slowed in the past decade, but only due to local and national economic conditions, experts said. Between 2001 and 2008, nearly 700 new structures went up in a high-risk storm surge zone on Staten Island, according to Benimoff's study.



Atisha Paulson

Peters, the College of Staten Island professor, said a succession of city administrations, including Bloomberg's, had taken a laissez-faire attitude to coastal development on the island. The city should have rezoned these areas to forbid new construction, and required existing buildings to meet basic storm-resistant standards or be condemned, Peters said.

In Oakwood, one of those coastal neighborhoods, a student in Peters' department, John Filipowicz Jr., drowned with his father when the storm surge filled their home. The two were found clinging to each other.

"The developers are just going to do what they do," Peters said. "You have to manage them."

Development along Staten Island's south shore has been rapid since 1980, but was done largely in piecemeal fashion, as local builders tore down vacation bungalows and subdivided existing lots to make room for more densely-packed year-round homes. The most recent large-scale construction on the south shore occurred in the late 1980s and early 1990s, when the city cleared developers to build hundreds of closely-packed condominiums and master-planned communities just feet from the high-tide line.

One such community was Port Regalle, a 65-unit condominium project on the tip of Great Kills Harbor built by the Lockton Corporation, a Manhattan real estate development firm. The development was badly damaged by Sandy's surge, and two elderly residents drowned while attempting to flee after failing to heed evacuation warnings until the storm was already upon them, according to the New York Police Department and the New York City medical examiner's office.

Police said the bodies of the couple, an 89-year-old man and his 66-year-old wife, were found several blocks from their home, under a washed-up powerboat near their water-filled car.

"They thought they could outride the water," said Ellen Borakove, a spokeswoman with the medical examiner's office.

Another development on the south shore, called Captain's Quarters, sits directly on the water. It was built by Muss Development, which bills itself on its website as one of New York City's largest real estate developers. Many homes in the community sustained serious flooding damage during the storm.

A spokesman from Muss Development declined to comment. Messages left for an executive at the Lockton Corporation requesting comment were not returned.

Both developments were cleared by the city despite opposition by local conservation groups, said Richard Lynch, a biologist and environmental activist. "It's literally been a pitched battle between conservationists and the developers," Lynch said. "We've seen a lot of money going around."

These and other waterfront developments, along with the wide-scale subdividing of lots and the infill of vacant land in existing neighborhoods, magnified the power of the surge, by clearing vegetation and wetlands that act as buffers during storms.

"We've hardscaped those sponges, so that they no longer naturally slow down the impact of that incoming surge," said William J. Fritz, a geologist and president of the College of Staten Island.

In the wake of Sandy, the city should explore rezoning the most at-risk residential areas on the south shore, and restoring natural barriers, as part of a broader effort to prepare for future and potentially more powerful storms, Fritz said. "I think we need to consider rezoning high risk areas," he said.

The Bloomberg administration declined to comment on development and zoning on Staten Island.

Not far from Staten Island, the Rockaways, too, have boomed -- with new construction catering to a younger, hipper crowd excited by the chance to live on the ocean a subway ride away from midtown Manhattan.

The largest new development there is Arverne by the Sea, a 117-acre complex of townhomes and condos built to house 13,000 residents in what was previously an urban wasteland.

The project, which broke ground in 2003, was the brainchild of the New York City Department of Housing and Urban Development, which sold the land to Benjamin-Beechwood LLC after a bidding process for \$1,000 per housing unit. The goal was to revitalize mostly empty and torn-down urban blocks with affordable, attractive housing. Federal stimulus dollars even helped bring a grocery store to the neighborhood.

Yet here, as in beach communities around the region, planners appear to have paid little attention to the risks involved in building in such a vulnerable area.

The Arverne neighborhood, like the rest of the Rockaways, is a known flood zone. The two previous hurricanes caused major damage to the area. The surge from the first, in 1893, was so powerful that it obliterated an island off the coast of the Rockaways -- the only known incident of a hurricane wiping an island off the map, according to Nicholas Coch, a coastal geology professor at Queens College.

Neither the developers nor the city responded to a request for comment about the project, but an environmental impact study conducted prior to construction gave the

project a green light, noting that the complex was built one foot above the 100-year floodplain "as a requirement to provide for the safety of residents and tenants."

It's not clear what qualifies as a "100-year storm," but Sandy wasn't even hurricane strength when it came ashore. Nevertheless, the complex flooded with several feet of water.

Coch said he didn't want to single out any one development for criticism, but said it is impossible to reconcile new coastal development throughout the region with what scientists know about the changing climate. "People love a view of the ocean but don't understand what every geologist knows," he said. "Sea levels are rising. Storms are becoming more fierce and unpredictable."

Possibly even more irresponsible, he said, is that no one -- the city, the state or federal authorities -- have made what he thinks are obvious fixes to protect the peninsula as best as possible from storm surges.

"I see suicide," Coch said, when asked to describe the Rockaway peninsula today. "I see very weak protections. The seawalls are cracked and ready to fall over. The roads are open at the beach end, allowing water to rush down the street. I see an almost total lack of flood protection."

This summer, New York City allocated \$3 million to rebuild a section of beach in the Rockaways with sand dredged by the Army Corps of Engineers, but the project was delayed until next year. A federal study on solutions to the area's beach erosion was started in 2003 and never finished due to a lack of funding.

"Sand would have helped prevent the massive surge," said John Cori, a Rockaways activist who started a campaign to rebuild local beaches. "The ocean wants to eat something. We'd rather it eat the beach before it eats homes."

'WE SHOULD HAVE LEFT'

Even as the storm closed in on the East Coast, New York City still struggled with its best remaining tool to protect the populace: the evacuation of flood zones.

On Saturday night, two days before Sandy made landfall on the Jersey Shore, Bloomberg had told the city that no evacuations at all were planned, and that a "sudden surge" of ocean flooding was unlikely.

"Although we're expecting a large surge of water, it is not expected to be a tropical storm or hurricane-type surge," Bloomberg said. "With this storm, we'll likely see a slow pileup of water rather than a sudden surge, which is what you would expect with a hurricane, and which we saw with Irene 14 months ago."

Hours later, the mayor's rhetoric shifted dramatically. "If you refuse to evacuate, you're not only putting yourself at risk, but also the first responders who will have to assist you in an emergency," he said.

The Bloomberg administration did not respond to a request for comment about procedures for warning coastal residents to evacuate.

Many heeded the mayor's evacuation order, but thousands did not. Some paid with their lives, as floodwaters engulfed their homes or swept them to their deaths in the street.

Philip Ferrante, a pilot who lives on the south shore of Staten Island, about 100 feet back from the flood zone, said he understood why some in the most dangerous areas stayed, and called the city's storm warnings inadequate.

"On Saturday, the mayor said it was going to be like Irene and we didn't have to evacuate," said Ferrante, who took a leading role in the relief effort, gathering supplies and delivering them to people who'd stayed in their battered homes. "On Sunday he's acting like you should have evacuated yesterday."

Adding to the confusion was the decision by the city to waive the evacuation order for thousands of patients and staff at the 40 nursing and adult care homes located in mandatory evacuation zones. These facilities, which house the city's most vulnerable population, were told by the city's Office of Emergency Management to "shelter in place," or stay put.

Samantha Levine, a spokeswoman for the mayor's office, said in an email that city officials made the decision that the homes should shelter in place on the Friday night before the storm, "at which time the most up to date information indicated that the storm was weakening and would be less severe than Irene."

"The City worked hard in advance to make sure those staying in place were safe by making personal visits to check that centers had extra staff," Levine said. "We remained in contact before, during and after the storm so we could respond as soon as possible to any problems."

Russell, the rest home administrator, said the decision not to evacuate his and other facilities was a mistake, and may have lulled some in vulnerable areas into believing they could safely ride out the storm.

"It's incongruous to tell all residents they are under a mandatory order to leave but then the nursing homes stay," he said. "We should have left."

Meteorologists also said they saw no sign of an abating threat as Sandy approached the Northeast. Gary Szatkowski, the meteorologist in charge of the National Weather Service's Mt. Holly, N.J. station, about 75 miles southwest of New York City, said that early satellite tracking led to projections that the storm would be far more dangerous than Irene.

"By Thursday, when the storm was still south of the Bahamas, we started talking about how there was the potential for record flooding along the New Jersey and Delaware coast, which would exceed anything that we saw with Irene," he said.

On Monday, Oct. 29, when the storm finally hit, the Rockaways were under a mandatory evacuation order from the city, along with roughly 300,000 residents of other low-lying areas in the five boroughs. But that evacuation order had come only the day before.

Some believe a more robust effort by the city to inform those living in threatened areas about the specific risks they faced might have saved lives. In hurricane-prone states like Florida, it is common for public safety workers to go door-to-door in low-lying coastal areas urging people to evacuate.

In some New York neighborhoods, police and firefighters did directly warn residents against staying. But some combination of the late order to get out, and the city's immense size, meant that many residents didn't learn until Sunday evening or even Monday that they were supposed to evacuate.

Residents also complained that they didn't know about evacuation buses parked in some neighborhoods to take people to shelters.

"Notification is a problem in every place," said Jay Baker, a geography professor at Florida State University who studies hurricane evacuations. "But being able to go door-to-door to directly warn people is by far the most effective way to convince people to leave."

Prior to the landfall of Hurricane Irene last August, Baker and other academics called 355 New Yorkers who live in beach communities and asked a set of basic hurricane preparedness questions. The takeaway, he said: Most people underestimated the potential damage from hurricane-force winds, but still ranked wind as a more dangerous hazard than flooding.

Beryl Thurman, an environmental activist on Staten Island, said the warnings by the city before Sandy's impact lacked detail, and left her shocked by the intensity of the surge when it arrived.

"It kind of helps if you have someone who can explain to you how a storm surge and flooding is going to affect you directly," said Thurman. "If they had said this is going to be somewhat similar to New Orleans and Katrina, people would have got up and moved."

Instead, she said, "we did the same exact thing New Orleans did: we waited."

SOUNDING THE ALARM

In 1992, an environmentalist named Suzanne Mattei was working on a report for the New York City comptroller about whether building garbage incinerators would contribute to greenhouse gas emissions.

That answer was relatively clear -- yes -- but when Mattei looked further into the then-young science of climate change, she was shocked to discover what it might do to New York City's coastline.

She discovered that the unique geography of the New York Bight -- the right angle made by New Jersey and Long Island, with the city its sharp tip -- would greatly magnify the effects of a hurricane. Were a strong storm to whip up the coast, its surge would have nowhere else to go other than straight into the city.

Alarmed that few had taken the issue seriously, Mattei inserted a section into the report about the damage rising sea levels could inflict. The biggest concern: the nightmare scenario of a "combined sea level rise/storm surge event."

"Significant areas" would be flooded in Brooklyn, Lower Manhattan would be "vulnerable" and the surge would "endanger the underground subway system," the report noted. All of this, of course, is exactly what happened when Sandy slammed into the coast.

Even as the city continued to reorient its residential development toward the waterfront, others sounded alarms about dangers from the sea.

In 1995, a joint study by the U.S. Army Corps of Engineers and New York City's Office of Emergency Management warned of fast-rising storm surges that could easily flood subway tunnels.

"Coastal storms that would present moderate hazards in other regions of the country could result in heavy loss of life and disastrous disruptions to communication and travel in the Metro New York Area," the report concluded.

More recent studies have factored in the impacts of climate change, arguing that rising sea levels will only worsen the hazards. In a **2011 report for the state**, Klaus Jacob, a disaster expert at Columbia University, warned that even without climate change, almost all of New York city's major subway tunnels would be flooded as a result of a Category 1 storm -- a prediction that came to pass.

Over the last decade, engineers started to seriously consider for the first time how New York City might react to the challenges posed by storm surges. In 2008, researchers at Stony Brook University's Storm Surge Research Group **recommended that a massive barrier in lower New York Harbor be built** to protect residents and businesses against hurricanes.

At a **2009 seminar attended by Joshua Friedman**, a hazard impact modeler in the city's Office of Emergency Management, participants reviewed the wide variety of death and destruction that could be expected to result from a major hurricane. Engineers then detailed a variety of surge barriers that might protect the city -- at a price tag of at least \$6.5 billion, **according to a summary of the event** provided by the American Society of Civil Engineers' New York City chapter.

In a **2010 report by the city's Panel on Climate Change**, officials acknowledged that the city might need to consider such barriers, although construction would entail "significant economic, environmental, and social costs." The city says it is working with the Army Corps of Engineers to further investigate them along with more modest "soft edges."

But none of these proposals are near the point where they could garner the necessary federal aid to cover their enormous costs.

Meanwhile, the city says new developments it is managing, like Willets Point in Queens and the Sims Municipal Recycling facility in Brooklyn, are being elevated out

of the floodplain. A recently passed amendment to the zoning code will make it easier to elevate electrical equipment to building roofs. It is also working with FEMA to update flood plain maps, which inform planning and zoning and trigger building code requirements.

Despite the Bloomberg administration's studies of climate change, however, it dissented from key substantive recommendations made by the [the New York State Sea Level Rise Task Force](#) in 2010 for planning development.

Perhaps most critically in light of Sandy, the report said the state should seek to "reduce incentives that increase or perpetuate development in high risk locations." The report advised making state funding for shoreline development contingent on planning for sea level rise and storm surges. Projects would be subject to review by the Department of Environmental Conservation and the Department of State.

But the city objected, citing "additional burdens to the regulatory process by extending the level of review and approval by the State in local planning efforts." Changes to state law were premature, said a letter from Adam Freed, then the deputy director of New York City Mayor's Office of Long-Term Planning and Sustainability, especially before the state did a cost-benefit analysis of stopping growth on the waterfront:

"As written, the draft recommendations could result in a policy of disinvestment in and promote relocation from existing urban areas," he wrote. "This would have dire economic and environmental consequences for the city and the state. There are over 215,000 people living within the FEMA 1 percent chance flood zone in New York City and more than 185,000 jobs present in this zone."

"Bloomberg has been out in front of these issues well before almost anybody in the country, but still they pushed back," recalled Pete Grannis, the DEC commissioner under Gov. David Paterson who co-chaired the study.

The report, he noted, looked at both the long-term issue of climate change and the short-term risk from storm surges associated with events like hurricanes.

Some of the city's objections were rooted in standard jurisdictional concerns about having more interference from the state, Grannis said. But he said the "huge, huge dollar signs" associated with the report's recommendations and the "tension" between the goals of development and environmental protection also played a role.

When the task force made its many recommendations, they essentially landed with a thud. Newly elected Gov. Andrew Cuomo's administration seemed indifferent, Grannis said. If the state had adopted the recommendations wholesale, Grannis says, it is unlikely that most the damage that Sandy wrought would have been prevented. But he does assert that it would have given city and state officials "more time to focus rather than just the week before the storm was coming."

"We recognized when we put this out, obviously all the strategies all have implications, and for the communities who are strapped for cash, or have elective officials who serve on two-year terms or short terms, it would be somebody else's

problem."

With Sandy, he said, "it became our problem." Some of the steps the sea level rise task force suggested, Grannis said, "are really long range. How do you move a highway?"

On its own track, the city has explored long-range climate questions in a **new waterfront planning document** and a still under-review Waterfront Revitalization Program, which would require large projects that need city approval to plan for sea level rise and storm surges.

But Bloomberg has in general been skeptical about actually limiting development on the water. "People like to live in low-lying areas, on the beach; it's attractive," **he told a reporter after Sandy**. "People pay more, generally, to be closer to the water, even though you could argue they should pay less because it's more dangerous. But people are willing to run the risk."

The city's progress on adapting to storm surge risk has so far consisted mainly of smaller steps, like working with private and public players to harden the electrical grid and seal off the subway system against the threat of flooding.

Indeed, the risks faced by New York's transit system are well known, said Jacob. The MTA, New York City Transit, and Port Authority staff played a part in drafting a 2011 report that includes Jacob's storm impact model and projected the city could lose \$48 billion in economic activity from a subway shutdown.

"The agencies that worked with us sent their engineers, not their board members, not their CEOs," Jacob said. "When you send this information to them the result is always the same, this big silence and shock."

When New York's subway system was designed more than a century ago, the city "did not anticipate water coming over the Hudson River, coming over the banks, being five feet deep on the West Side Highway, and filling subway grates," Cuomo said the day after the storm.

With climate change and storm surge fears in mind, the MTA had been proceeding with small steps since a 2007 rainstorm that shut down parts of the system: it had raised entrances at 30 stations and had begun to raise up ventilation grates. In the authority's most recent budget, \$34 million was allotted for these programs.

Jacob refused to point a finger at any particular elected official. He described both Bloomberg and Cuomo as cognizant of climate change and the threat it poses to transit and other infrastructure.

"You should really give Bloomberg and the whole administration and to some degree the state credit. To keep the science in the spotlight is something," Jacob said. "Where they have failed on this issue is the spending."

The city referred questions about the subways to the MTA.

"We have a team of planners in our headquarters who specialize in sustainability

issues and have long been active in the effort to develop strategies to counteract the climate threat," said MTA spokesman Adam Lisberg. "The MTA knew it needed to do so long before Hurricane Sandy struck. But a comprehensive protection plan for a 108-year-old system of varied construction can't be developed instantly, much less put into place in under a year."

"To prepare for weather events such as the one that devastated the region we had several emergency planning exercises in the months prior to the storm," said Steve Coleman, a spokesman for the Port Authority. "We also have been designing our new projects and facility replacements with climate change in mind such as the World Trade Center site, which, once completed, should be resilient against surges. We will assess and revisit all plans in the coming weeks and months."

Like the MTA, the private utility provider Con Ed was cognizant of the dangers of both climate change and storm surges in New York -- but not yet ready to spend large amounts of money to counteract them. Since 2007, the utility has spent \$24 million on precautions like submersible switches that can keep power flowing even when exposed to corrosive seawater.

But rolling out similar changes across the whole system would cost at least \$250 million -- a cost that would likely be passed along to ratepayers.

"Improvements to our systems are covered by rates," said Allan Drury, a spokesman for the utility. "We seek to balance our obligation to maintain the most reliable utility service in the United States with our obligation to keep costs low for ratepayers."

"Since 1990, utilities and utility regulators have done a fantastic job keeping down rates, cutting costs, outsourced stuff, and that's fantastic," said Steven Mitnick, an energy consultant who advised former Gov. Eliot Spitzer in New York. "We have very low rates. When we have new challenges, it means you can respond less quickly."

Instead of spending money to protect what we already have, experts also suggest there's another interim step just awaiting the political will to see it through: stop building more homes and businesses where they too will require protection. Nowhere in the region, perhaps, is this more contested than the Jersey Shore.

'UNTHINKABLE' DEVASTATION

When Sandy barreled ashore in New Jersey, storm surges of nearly 10 feet shredded boardwalks in Atlantic City and crippled an amusement park in Seaside Heights, **leaving a roller coaster in a shambles**, floating in the surf.

Three-story mansions were swamped by floodwaters and buried in sand, some torn from their foundations and lying on their sides. Boats were carried away and flung onto dry land like toys. Economic losses in the state are **estimated to be at least \$9 billion to \$15 billion**, according to Egecat, a disaster modeling firm.

After flying over the Jersey Shore in



a helicopter the day after Sandy's landfall, the state's governor, Chris Christie, **called the damage "unthinkable."** He vowed to bring back what was lost, saying there is "no question in my mind we'll rebuild it."
"I don't believe in a state like ours, where the Jersey Shore is such a part of life, that you just pick up and walk away," he told reporters.

But in the view of many land-use experts, the governor had it backwards: a lot of that development never should have been built there in the first place, given the mounting and increasingly well-understood dangers posed by coastal surges. For them, the catastrophe Christie was flying over was far from unthinkable.

Situated between two of the largest metropolitan areas in the nation, New York and Philadelphia, the Jersey Shore is a prime location for waterfront development. And over the past few decades, it has become one of the most densely developed coastlines in the country.

Population growth along the New Jersey coast has soared, nearly doubling over the past 40 years. More than 60 percent of the state's population now resides in coastal counties, and **the state ranks fourth in the nation** for the number of residential properties at risk from storm surge damage, behind only the Gulf coast states of Florida, Louisiana and Texas.

Ocean County is home to Long Beach Island, less than a third of a mile wide yet packed end to end with homes, restaurants and boat docks. The county has consistently been the fastest growing in the state since the 1950s, according to the U.S. Census Bureau, increasing tenfold from around 50,000 in 1950 to more than 576,000 in 2010.

Much of that growth has been aided by lenient land-use policies that have encouraged development in coastal areas known to be at monumental risk for damage, experts and critics argue. Real estate interests have historically been a powerful lobby in the state, ranking among the top donors **to Christie and former Gov. Jon Corzine.**

Representatives from the state's real estate and development trade groups declined to comment on their political activities, saying they were focusing on recovery efforts.

In towns such as Long Branch, N.J., local officials have turned around ailing downtowns and waterfronts by granting tax abatements for developers to relocate there. But longtime residents criticized an aggressive approach by the town and developers to buy older, single-family homes to promote condo and retail development near the ocean.

Beginning in the late 1990s, the city partnered with a development company on two residential and retail projects in Long Branch, known as Pier Village and Beachfront North. The plan involved a massive redevelopment of the city's waterfront, which had burned down in the 1980s and never rebounded.

Eager for new development and tax benefits, the city began using a claim of eminent domain for homeowners and businesses that held out. Many of the property owners in the footprint of the first project, Pier Village, sold to the developer, The Applied Companies of Hoboken, in the early 2000s.

Watching the takeover unfold, property owners in the path of the next development refused to sell. The city **attempted to use eminent domain**, arguing the area was blighted, filing condemnation papers beginning in 2005. As the battle went on, a vice president for the development company said there were no plans to pull back on the project.

"We believe it is a good project for the city, and we intend to complete it," Applied's vice president, Gregory S. Russo, told the Asbury Park Press in 2006.

The city administrator, Howard Woolley Jr. **told the Newark Star-Ledger** that the decision was "for the greater good of the city."

The homeowners eventually prevailed in a state appeals court case in 2008, and the city settled the case. But development has cropped up all around the waterfront.

"The developers are getting their way here," Lori Ann Vendetti, a homeowner who was one of the key figures in the fight, told The Huffington Post. She remains critical of the town's eagerness to dole out tax abatements. "Why should the developer get that benefit?" she asked. "None of us got that benefit."

Officials with Applied Development could not be reached for comment. Mary Jane Celli, a councilwoman in Long Branch, wrote in an email that the tax abatements were part of an effort to attract developers after many years. "They were the first developers to come to the city after years of courting developers and offers to build," she wrote. "When folks are so negative about tax abatements they should look at the whole picture not the narrow view of one small segment."

New Jersey is one of the most susceptible states along the Atlantic Coast to the effects of sea level rise, **according to research from the University of Pennsylvania**. Oceans along the Jersey Shore are **predicted to rise nearly twice as fast** as bodies of water near coastal areas elsewhere in the country because the state has few rivers that deliver natural sediment to replenish coastal areas, and due to natural forces depleting the stock of offshore sand.

"We have this insane mentality, this boosterism along the coast," said Wolfe, the former state environmental official in New Jersey. "For years and years, people have been putting up warning flags. The state has known this, and instead of regulating more restrictively they've pushed right ahead."

Larry Ragonese, a spokesman for the state's Department of Environmental

Protection, argued that development along the Jersey Shore has been ongoing for decades, even before there was a coastal permitting program. He said it is not the state's role to dictate how redevelopment should occur.

"People who live along the shore always live with a risk, and they know that. That's understood," he said. "We at the state are not going to tell these towns you can or cannot rebuild, but we will work with them to make sure that whatever comes back will be done in as smart or protective a fashion as possible."

For nearly a century, local and state officials in New Jersey have contended with erosion along state shorelines, as the string of barrier islands lining the coast lost huge amounts of sand during major storms that have whipped through the region. State reports have documented how resort towns such as Long Branch, Atlantic City and Ocean City faced challenges from eroding beaches as far back as the turn of the 20th century.

To contend with disappearing shorelines and promote development along the coast, the state tried to delay natural forces by building bulkheads and seawalls meant to armor the coast against erosion.

Hard structures are now present along nearly 80 percent of the state's coastline, leading coastal researchers to coin the term "New Jerseyization" to describe short-term efforts to hold back rising seas.

A strong Nor'easter storm in 1962 killed 14 people and injured more than 1,300, opening everyone's eyes to the risks of living along the coast. But over the next two decades, development of the shore continued at a rapid clip.

A state Department of Environmental Protection **master plan from 1981** predicted growing dangers from continued development.

"Unfortunately, the devastation of the March 1962 storm was soon forgotten," the report said. "Since present population and development levels of the state's barrier islands exceed pre-1962 levels, future severe storms will undoubtedly result in far heavier tolls in lives, injuries and property damage."

In recent years, the effort to hold back the sea in New Jersey has shifted toward beach replenishment projects, where the local, state and federal governments all help pay to replace lost sand.

Still, the state has spent disproportionate amounts of money on short-term coastal protection projects rather than pursuing, as many researchers and analysts have recommended, buyout programs that discourage new development in the most hazardous areas.

Spokesmen for Christie did not respond to numerous requests for comment about New Jersey's approach to coastal development. A spokesman for Corzine could not be reached for comment.

New Jersey **allocates \$25 million every year** for shoreline protection projects, including beach replenishment, though in reality the cost is much higher because

the federal government has historically paid for more than two-thirds of the bill. These funds protect developed land as well as national parks along the New Jersey coast, although more than three-quarters of the state's shoreline is developed.

Past studies have shown that New Jersey's coastal protection efforts alone account for 14 percent of the total price tag of such projects nationwide. Research from Duke University showed that it would cost \$2.6 billion to maintain the state's beaches over the course of a decade, and other estimates have suggested a cost of more than \$4 billion over 10 years.

A **2010 report from the state's Department of Environmental Protection** warned that the cost of continued beach nourishment would "inevitably collide with resource and financial constraints."

"There is concern that less federal money will be available in the future for beach replenishment projects, just when need for the projects is increasing," the report concluded.

In contrast, the state reserves only \$15 million each year for a program that allows local governments to buy out property damaged by past floods or purchase undeveloped land in hazardous flood zones. That, of course, has encouraged continued coastal development and prompted researchers to warn of growing risks.

The state's own Department of Environmental Protection has **warned in a series of reports over the past decade** that officials needed to relocate private development away from hazardous areas. One DEP report from 2006 cited the challenges of such a policy, including "lobbying efforts of special interest groups, legal challenges to [state] permit decisions, provision of flood insurance through the National Flood Insurance Program, and public perception that large-scale beach nourishment projects eliminate vulnerability."

Over the years, critics have said the state has not been nearly aggressive enough in managing development in its coastal zone. Under long-standing state law, many smaller developments of less than 25 units in hazardous coastal flood regions don't require any state approval, leaving decision-making to smaller local governments.

John Weingart, associate director of the Eagleton Institute of Politics at Rutgers University, and a former official at the state Department of Environmental Protection in New Jersey, recalled that throughout much of the 1970s, 80s and 90s, nearly half the development on the Jersey Shore was in projects involving fewer than 25 units.

"We all said that some day archaeologists will dig up the Jersey Shore and think the number '24' had religious implications," Weingart said.

Property owners are also allowed to rebuild and in some cases expand on developments that have been damaged, leading to much larger and more expensive homes being built in risky areas.

At the local level, New Jersey coastal communities have not pushed for major

structural upgrades that would allow homes to better withstand floods and storm surges.

The National Flood Insurance Program's Community Rating System allows residents to receive deductions on their flood insurance premiums if their town officials require certain structural upgrades to reduce flooding risk, or do specialized floodplain mapping to pinpoint problem areas.

Though nearly 60 New Jersey towns participated in the program, the vast majority received among the lowest ratings, according to federal data, meaning town officials had only done minimal preparations to prevent flooding risks.

Several towns damaged by Sandy's flooding, including Lacey Township in Ocean County, participated in the program years ago but withdrew because it was too expensive. John Curtin, Lacey's community development director, said the town had to spend tens of thousands of dollars to hire engineers to do floodplain studies, which became "economically infeasible."

"It was certainly more than the township could afford at the time, and there was no grant money available," Curtin said.

New Jersey is also using flood maps that are more than two decades old to guide its development priorities. Although FEMA has come out with maps showing greater risks in certain flood-prone areas, the state has not formally adopted those maps, sticking with flood maps dating back to 1980.

Legislators **introduced a bill in the General Assembly earlier this year** calling for the state Department of Environmental Protection to adopt more recent FEMA flood maps to better assess risks for new development.

Environmentalists have argued that the outdated maps underestimate the risk because they do not reflect rising sea levels and more up-to-date science on specific flood hazards, allowing some projects to get less scrutiny because they are not considered to be in flood zones. "There's a whole series of regulatory things you have to do in order to build in the flood hazard area," said Jeff Tittel, the director of the New Jersey chapter of the Sierra Club. "By not being in the flood hazard area, you get to build whatever you want."

Ragonese, the DEP spokesman, said the agency's experts on the matter were too busy responding to Hurricane Sandy to comment on development and regulatory questions affecting the shoreline.

Real estate interests are a **powerful lobby** in New Jersey, particularly along the coast, according to a review of state campaign finance and lobbying data.

Some of the largest developers include national giants such as Pulte Homes and K. Hovnanian Homes, which is based in Red Bank, N.J. Officials from both companies did not respond to requests seeking comment. The New Jersey Association of Realtors also declined to comment, writing in a statement: "This is not the time to debate development that has occurred in the past."

Commercial and residential real estate interests donated more than \$250,000 to Christie's gubernatorial campaign in 2009, the third-largest interest group behind lawyers and securities and investment groups, according to campaign finance data analyzed by the Sunlight Foundation.

Corzine received more than \$230,000 in contributions from real estate interests, second only to the legal services industry, from 2005 through 2009.

The New Jersey Builders Association **often ranks among the top ten groups in lobbying spending** among special interests in the state. The Builders Association did not respond to questions about political spending.

The group's director of government affairs, Jeff Kolakowski, wrote in an email that members were "focused on supporting the recovery efforts." He characterized New Jersey as "one of the most highly regulated states when it comes to development activity," and said the group "supports adherence to these laws and regulations, which safeguard our environment and require that development occurs in the appropriate areas of our state."

A past environmental affairs official for the builders association, Nancy Wittenberg, was appointed as New Jersey's assistant commissioner of climate and environmental compliance during the Corzine administration, a move criticized by some environmental groups. Wittenberg, who is now executive director of the New Jersey Pinelands Commission, disagreed with those criticisms, saying her past experience as a regulator and industry consultant has given her a balanced perspective on how to properly manage growth while considering environmental impact.

She described the state's coastal regulations as "fairly liberal," and said officials need to be more proactive in mandating what makes sense for coastal development in the future.

"People do what they're allowed to do. You can't blame builders for building where they're allowed to build," Wittenberg said. "You have to have regulatory agencies that make these calls and don't waver on them. I'm hoping that some smart planning can come out of this and that we can come forward and rebuild the Shore in a way that can sustain itself."

Still, real estate development along the Jersey Shore played a central role in one of the state's largest corruption scandals in recent years, known as Operation Bid Rig. New Jersey Assemblyman Daniel Van Pelt **was sentenced to more than three years in prison in late 2010** after being convicted on federal corruption charges for taking a \$10,000 bribe in exchange for expediting environmental permits for a developer to build a project in Ocean County.

The developer who offered the bribe turned out to be an undercover FBI informant, Solomon Dwek, who last month was sentenced to six years in prison for bank fraud in connection with a real estate Ponzi scheme. In an earlier phase of the FBI investigation, in 2002, former Ocean Township mayor Terrance Weldon **pleaded guilty to taking more than \$60,000 in cash** from developers in exchange for zoning

approvals. Weldon, who has been released from prison, did not return calls seeking comment.

Christie and President Barack Obama have both committed to rebuilding the Jersey Shore, a show of bipartisan support that typically follows a wrenching disaster like Sandy. Researchers say such responses after a disaster are understandable, but many argue that it would be best to consider where to rebuild because a wholesale reconstruction of the New Jersey coast would simply invite future, costlier disasters.

"If you have a beautiful view, sooner or later Mother Nature is going to give you the bill," said Nicholas Coch, the coastal geology professor at Queens College who has performed numerous storm surge predictions in New York City and along the Jersey Shore. "You have to learn to live with nature. Nature will always win because she plays with a stacked deck. And unless we live with nature and accept the setbacks and all that we have to do, we're in trouble."

A FAMILY'S CHOICE

More than a week after the storm, Vinny Baccale and his family still hadn't learned the identity of the man who they believe they saw die outside their window on Staten Island. He was likely one of the 21 drowning victims discovered in the storm's wake there, a death toll more than half as high as the entire city's.

Baccale's family has weathered floods before, but as his wife repeated in the days after the storm, they never imagined that the neighborhood might prove to be a watery death trap. "Never in a million years," she said.

Baccale's wife, Tracey, traces her roots in the area back three generations. Her grandfather, a railroad worker from the tenements of Hell's Kitchen, spent summers there when it was still more a bungalow community than a neighborhood.

Tracey's father grew up there year-round and eventually tore down their bungalow and replaced it with a pair of two-story homes. By the time Tracey came along, the neighborhood was so densely developed that the family would flee the city in the summer for the Jersey Shore.

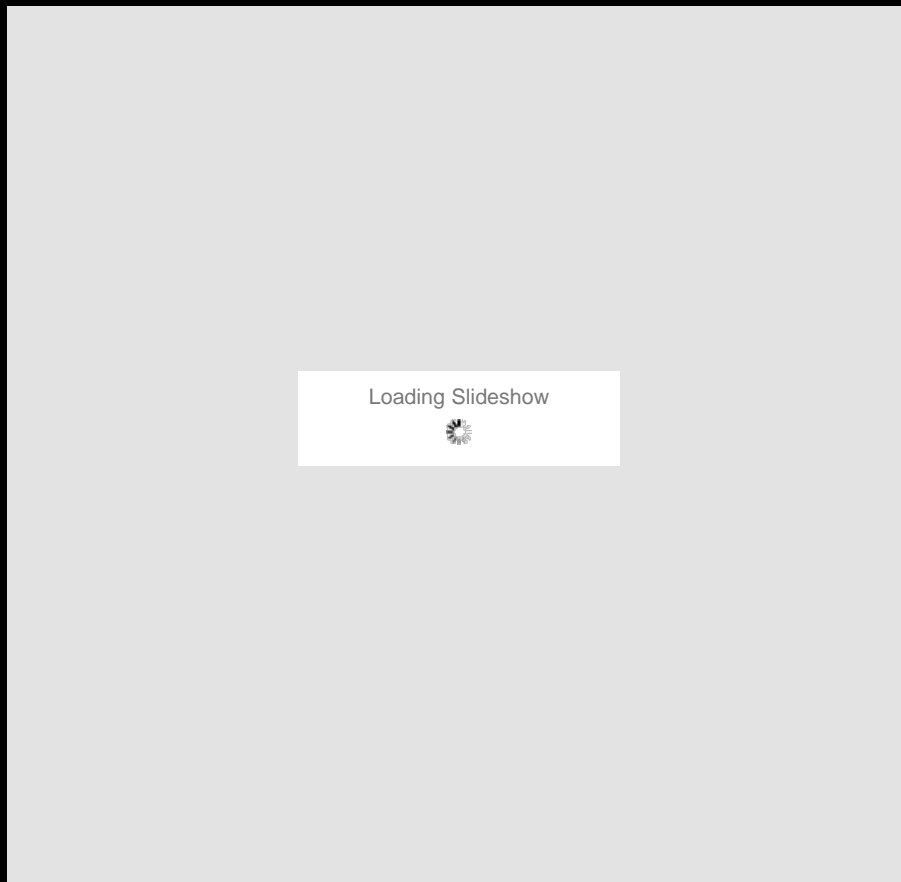
Nearly a century after her grandfather found a respite from the crowded West Side on that peaceful plot of seaside property, she's now questioning the wisdom of rebuilding. Unlike the bungalows that still dot the neighborhood, her two-story house is mostly salvageable -- a beacon of relative stability amid homes knocked off their foundations, cars awaiting the junkyard, and the gutted interiors of countless rec rooms and dens.

Yet she doubts that she'll ever again feel invulnerable to the ocean that lured her family there in the first place. As she and her husband and two kids bide their time in her mother's apartment on higher ground, she says she's been dwelling on the shift in the weather that brought chaos and terror to her neighborhood.

"I'm contemplating not even living there anymore," she said. "I kind of feel like this is the start of something new."

Joy Resmovits, Janell Ross, Lila Shapiro and Joe Van Brussel contributed reporting.

CORRECTION: *This article inaccurately characterized the views of Dr. William J. Fritz regarding Staten Island. Dr Fritz recommended zoning changes to protect the Staten Island shoreline. He did not, as the article noted, recommend condemning and demolishing existing properties. The article has been amended to address that mistake. It also misidentified Sims Municipal Recycling as "Sims Recycling Factor."*



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