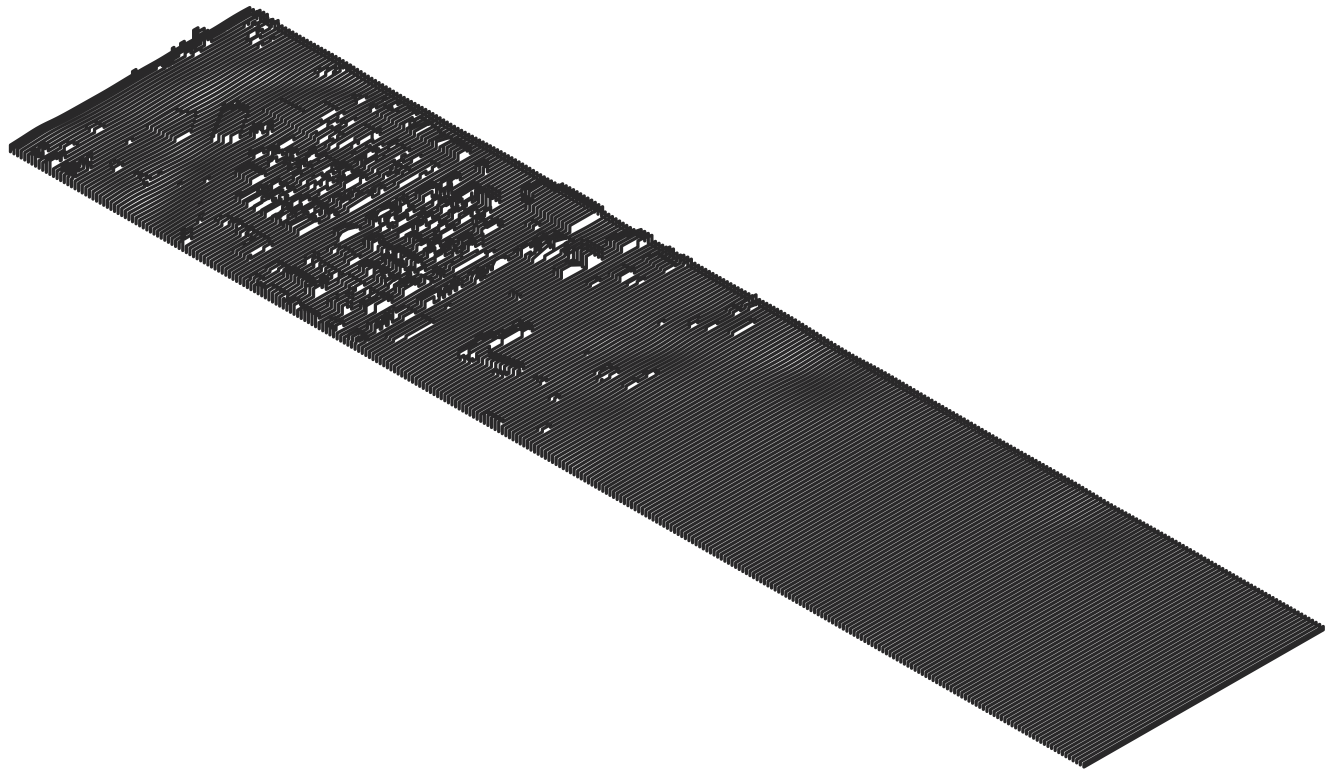
Super Natural

hybrid strategies for urban flood protection in Coney Island NY



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A thesis submitted in partial fulfillment of the requirements for the Master of Landscape Architecture Degree in the Department of Landscape Architecture of the Rhode Island School of Design, Providence, Rhode Island.

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Contents

Overview

How will inundation change the design of city coastlines? This thesis is an investigation into strategies to mitigate urban flooding from storm surge in Coney Island NY.

In Phase 1, dynamic phenomena are identified and deconstructed, the result are properties that can be assembled to make a machine that applies forces to wet plaster, which solidified to yield insights into the sectional forms of waves. This process was used to inform a conceptual model documenting the site's physical form, and the relative differences between land and water in terms of its density and porosity.

In Phase 2, a catalog of different coastal edges are pulled together from locally observable types of coastal edges, as well as more contemporary solutions. The outcome is an understanding of coastal engineering as ranging from hard seawalls to softer solutions involving lots of vegetation. The most contemporary solutions all begin to intentionally influence the deposition and erosion of coastal sediment in order to renourish the shoreline. These approaches are used to inform the direction of future research.

In Phase 3, this range of analyses are synthesized to form new hybridized coastal edges. This method has yielded new insights into coastal urban landscapes, specifically in order to address the crisis in New York City's waterfront.

Coney Island was selected because it is one of the most vulnerable parts of Brooklyn - following the wake of Hurricane Sandy this neighborhood has barely been rebuilt.

As it has turned out, retrofitting hundreds of thousands of old bungalows with modern HVAC units, insulation and sprinklers - and then lifting them 10-12 feet off their foundations onto stilts, while certainly technically feasible, is not possible by Mayor De Blasio's 2016 deadline for the rebuilding assistance program.

"In this sense, the very words
"Build It Back" miss the point —
unless by "back" you mean back,
way back, from the water's edge." [1]

While it is technically possible to rebuild thousands of residences here, it is not a sound idea for pragmatic reasons.

1 "After Sandy, Overpromising and Underdelivering." The New York Times. October 21, 2016. Accessed May 20, 2017. https://www.nytimes.com/2016/10/22/opinion/after-sandy-overpromising-and-underdelivering.html.

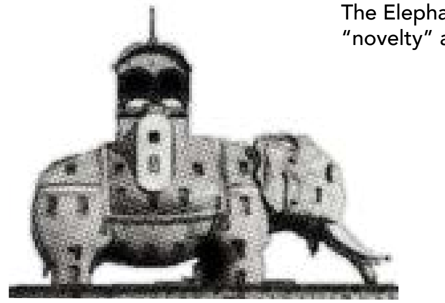
Site

Coney Island has been selected because the highest points are barely 10 feet above the high tide line. During Hurricane Sandy in 2012 the site was flooded by a nine foot storm surge, this inundated a great section of the island, from the boardwalk to the Stillwell Avenue Subway stop.

These types of landforms are always susceptible to the dynamics of the ocean. In its geological evolution this place sits at the tail end of the Wisconsin Glacial Episode. The coastal land here is very sandy, and the exposed bedrock is striated with the marks of the glaciers scraping by.

In 1609, Henry Hudson "discovered ™" Coney Island, and feasted on the gigantic oysters he and his men found growing there. The relatively pristine place they discovered was quickly turned into the dry grimy asphalt, concrete, and steel city it is today.

In its early days, Coney Island was a place of novelty where experimental architecture thrived. Those things that today are iconic parts of New York's identity were essentially tested at Coney Island. Before Mr. Eiffel installed Lady Liberty, the first thing people arriving at Ellis Island saw was the Elephantine Colossus, at the intersection of 22nd St and Surf Ave.



The Elephant Hotel, an example of "novelty" architecture.

At that time, Coney Island was a resort for the everyday person. While elites could afford transportation to upper Long-Island and the beaches of New Jersey, Coney Island has been accessible by subway from Manhattan since 1864.

Today, as part of the coastal floodplain, Coney Island is faced with the need to mutate.

"it has no choice but to counteract the
artificiality of the new metropolis with its own Super-Natural.
Instead of suspension of urban pressure. It offers ***intensification***"[1]

As a historical laboratory for new urban systems, Coney Island today has both the conceptual potential and the historic context needed to justify its redevelopment as a cultural and recreational amenity for the city.

As a physical structure, how must the urban fabric change with sea-level rise and the anticipated increase in storm events?

1 Koolhaas, Rem. Delirious New York. 1980.

Phase 1 Research

How can dynamic modeling inform design strategies for urban inundation?

Phase 1 Abstract

In Phase I dynamic ephemeral site phenomena were analyzed by diagrams and models. This analysis is used as a generative basis for a site design process that is more programmatically and ecologically resilient.

Design approaches to inundation have been simplified as "Sink, Float, or Swim". Floating and sinking are results of stratification of different densities, and a little of each is necessary to swim. Clouds float in the atmosphere and a ship floats at sea, but each is the result of different densities.[1]

What is the density of a landscape? How can this be modeled?

The main insight in Phase I is that physical characteristics of the site could be conceptualized as responding to the same principle rules that were discovered from studying wind and waves. This realization suggests a continuum, rather than a binary, between the fluid and solid materialities of the site.[2]

1 Stilgoe, John R. Lifeboat: a history of courage, cravenness, and survival at sea. Charlottesville, VA: University of Virginia Press, 2003.

2 "... shifting attention away from the object qualities of space (whether formal or scenic) to the systems that condition the distribution and density of urban form" (Corner, page 28)

Waldheim, Charles and James Corner. The landscape urbanism reader. *Terra Fluxus*. New York: Princeton Architectural Press, 2006.

Preliminary Land-Water Interface Model

Introduction

As an object of contemplation, the ocean is a source of mystery and power.[1]

In New York City, the proximity to the ocean has been of historic significance; Ishmael departs from the wharfs along Manhattan Island in chapter one of Moby-Dick, and the confluence of rivers with deep harbor were critical to the city's early roots as a Dutch trading post.

Today, this closeness is thought of as a liability, but the ocean provides many benefits to the city. One objective of this thesis is to further understand this relationship.

A part of Coney Island, from Stillwell Avenue subway station to the Atlantic Ocean, was selected for further research because of the site's proximity to the ocean. Vertically, parts of the site are within three feet of the high tide, and laterally the site is only 2,000 feet from the beach.

In order to learn about the implications of designing in inundation-prone areas, a study model of the land-ocean interface was created that enumerated what was known, what was assumed, and what was unknown.

1 Melville, Herman. Moby Dick; Norton Edition. New York: Norton Publishers, 2012.

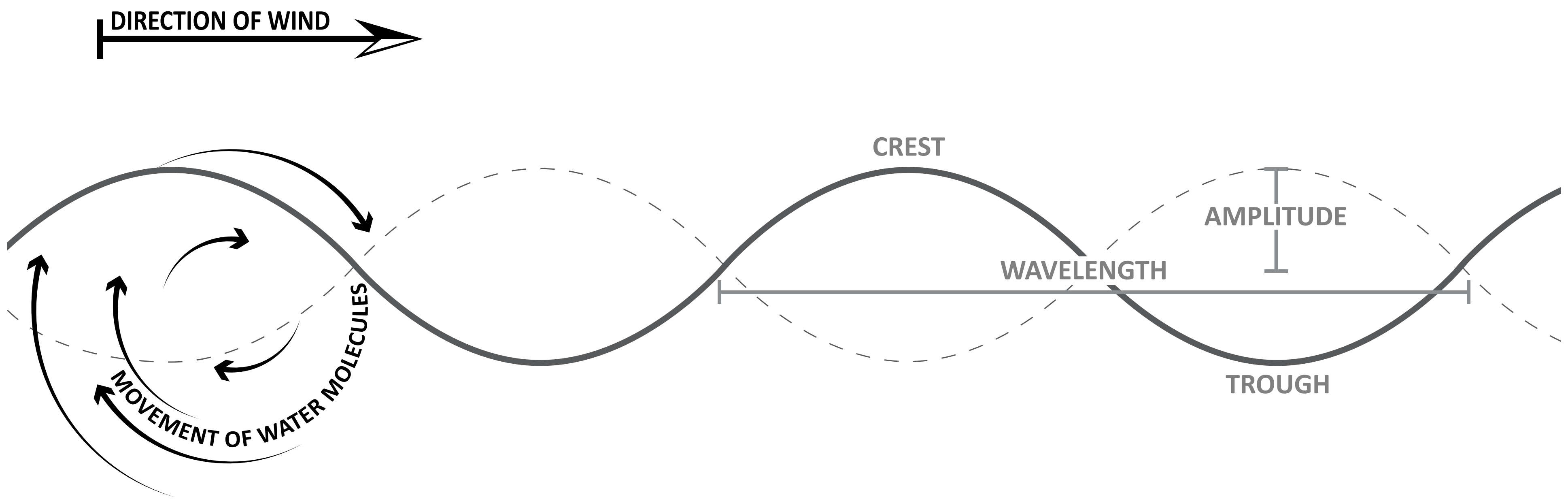
Methods

In early investigations, the primary method of cataloging information has been through diagraming, and then applying schematic design ideas through physical modeling.

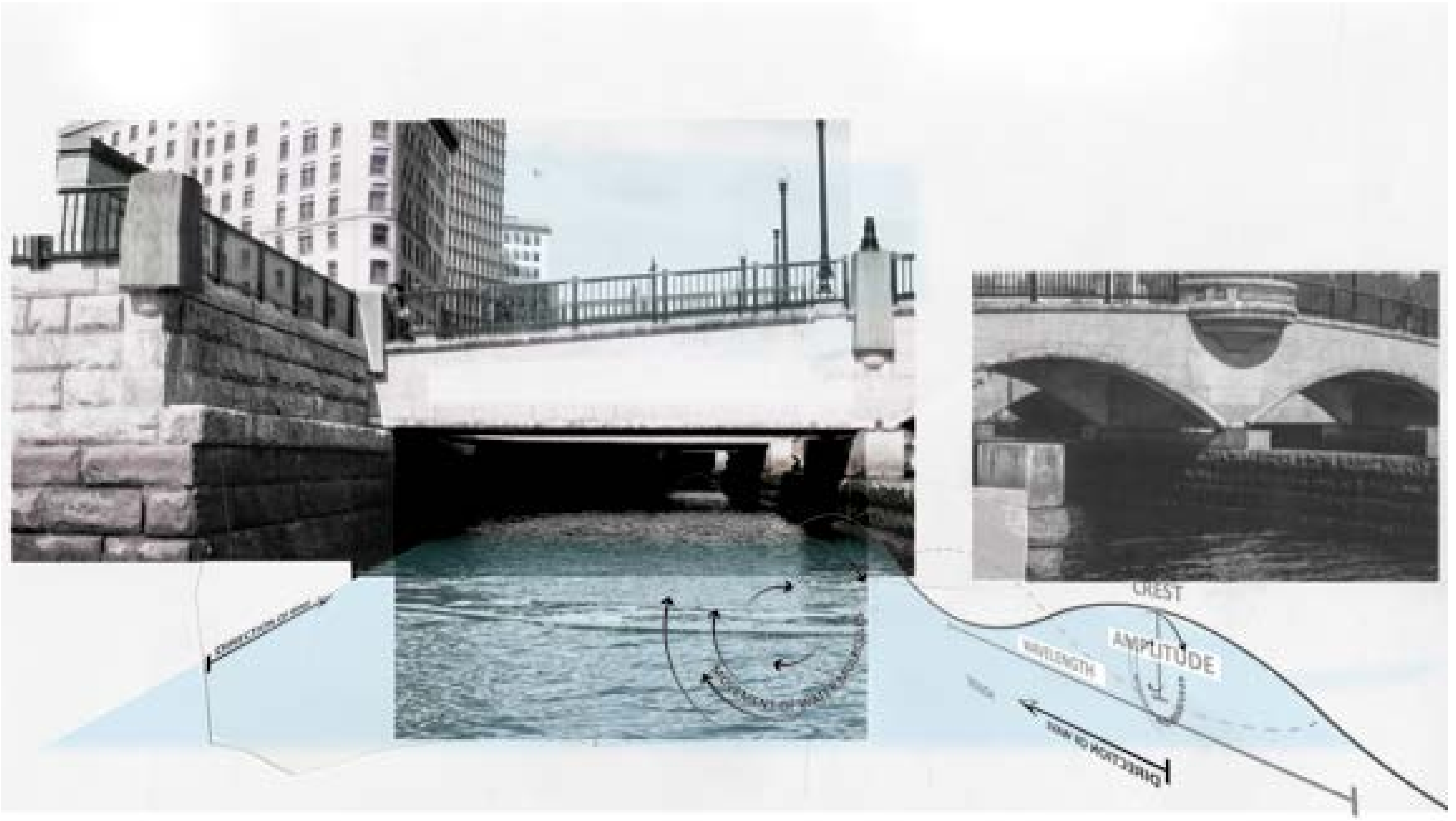
In order to understand wave action, a framework was constructed that could apply rotational energy to a medium that would transition from fluid to solid.

The visualization of the resulting form was then diagrammed and layered with further information.

Phase 1 Wave Diagrams



A wave is a periodic disturbance that transfers energy by the vibration of matter, and not the transfer of matter itself. Ocean waves travel as gravity pulls the crest of the wave downwards.

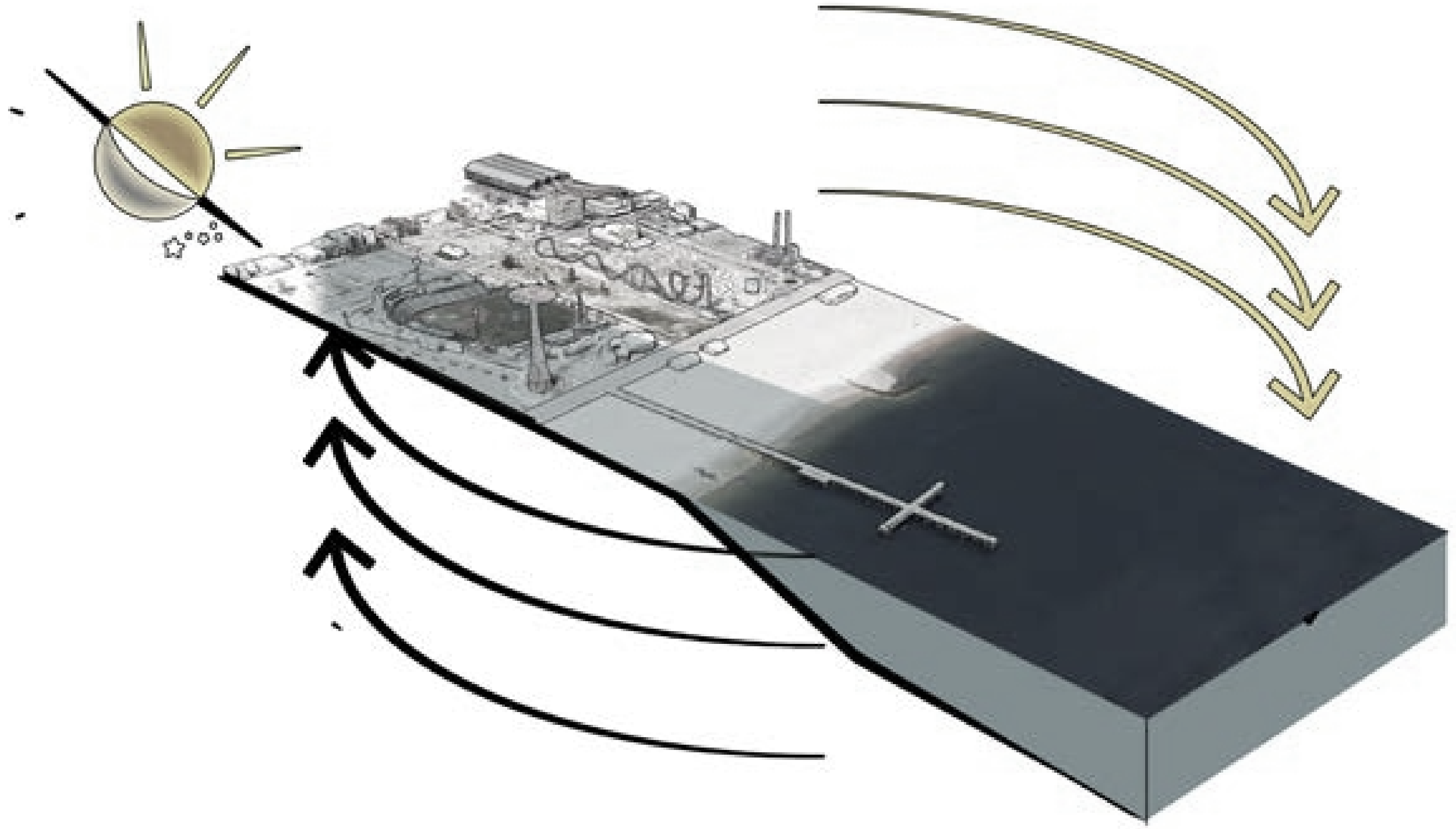


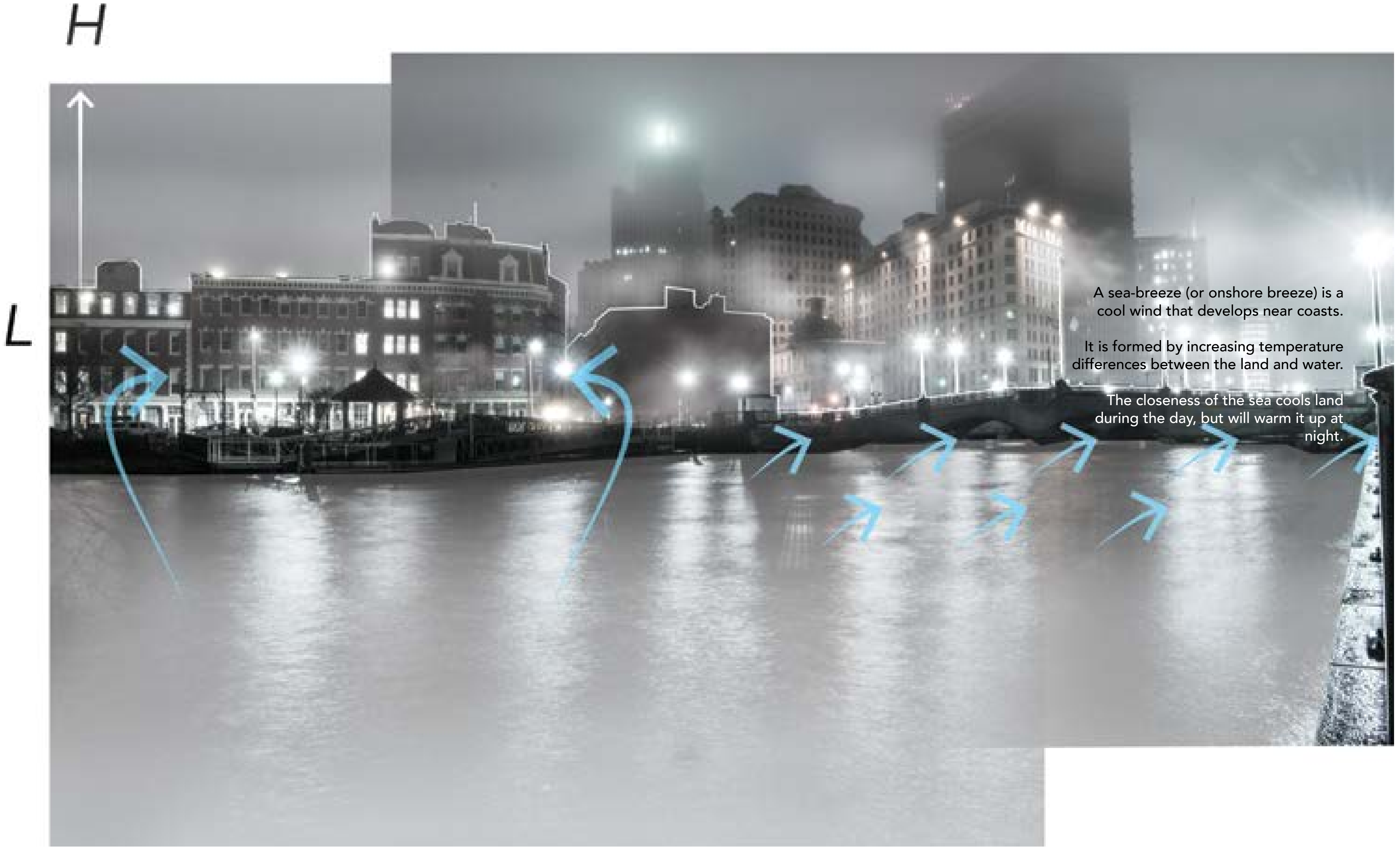
Waves can travel upstream because the movement of the energy is perpendicular to the vector of the current.

Depending on the size, this can happen with considerable force behind it -- 5 to 10 tons per square yard.

Even temporary inundation can cause permanent damage to structural foundations if they are not properly designed.

The sea has a greater heat capacity than the land, so the sea's surface warms up more slowly than the surface of the land (but it also retains heat better than the land).

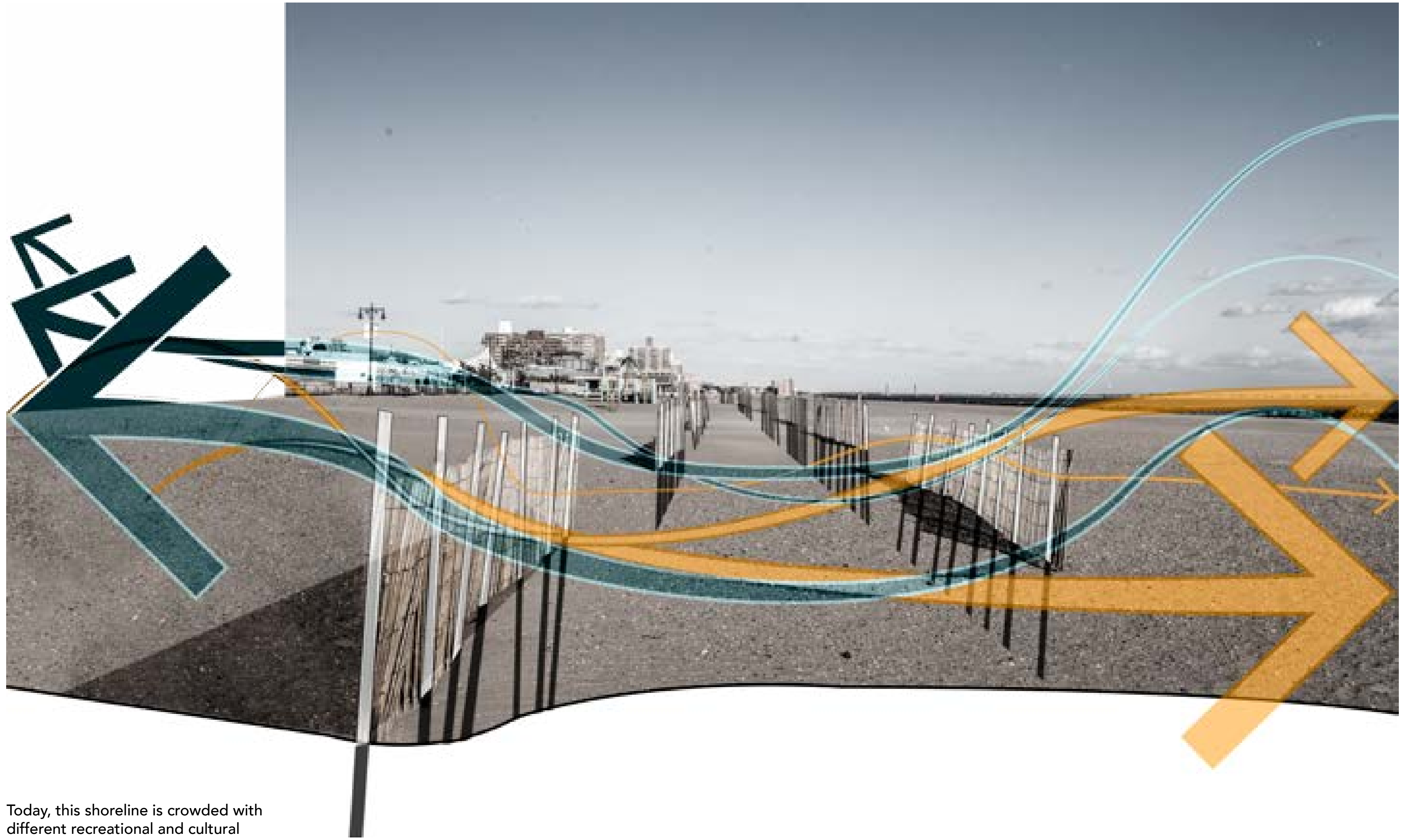




A sea-breeze (or onshore breeze) is a cool wind that develops near coasts.

It is formed by increasing temperature differences between the land and water.

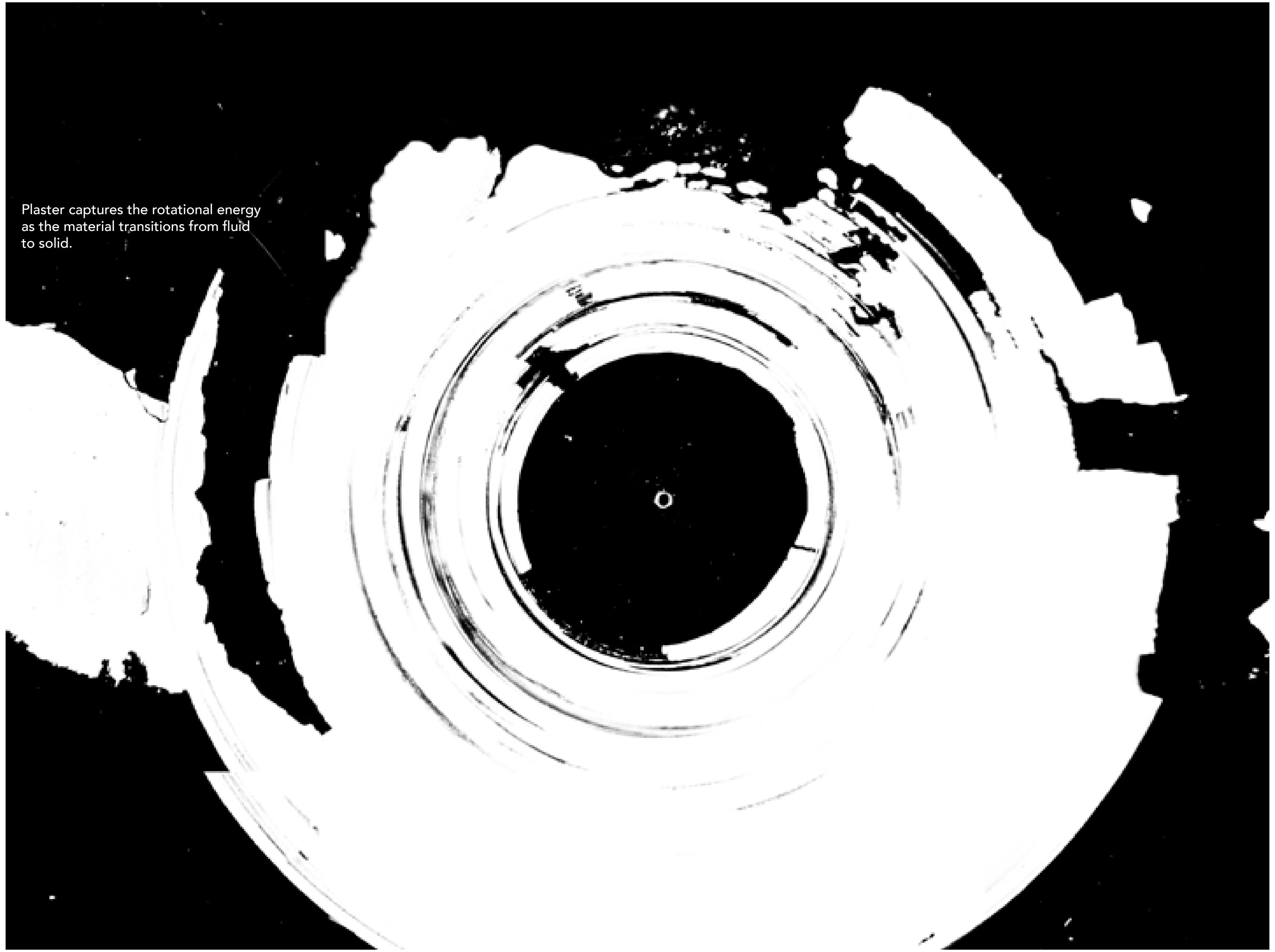
The closeness of the sea cools land during the day, but will warm it up at night.



Today, this shoreline is crowded with different recreational and cultural structures, while the interior of the site is almost entirely residential.

The result of these structures is that the shore is rapidly eroding. These dune fences are some of the existing strategies to retain sand.

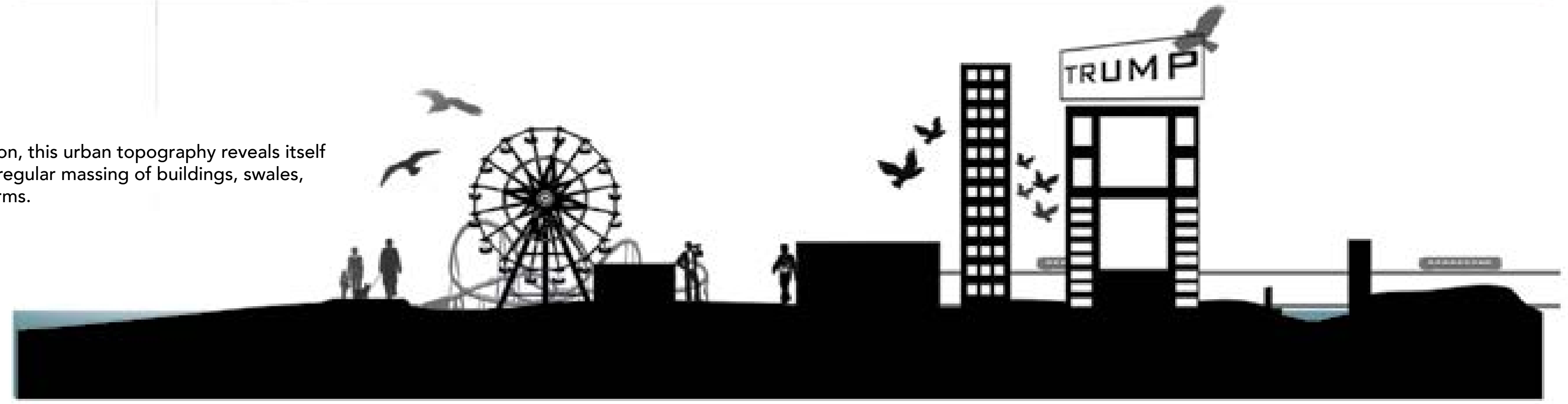
These forms are generated by creating a machine that applies rotational energy to wet plaster.


Plaster captures the rotational energy
as the material transitions from fluid
to solid.

The site was once a part of the barrier beach system along the Long Island and New Jersey coasts.

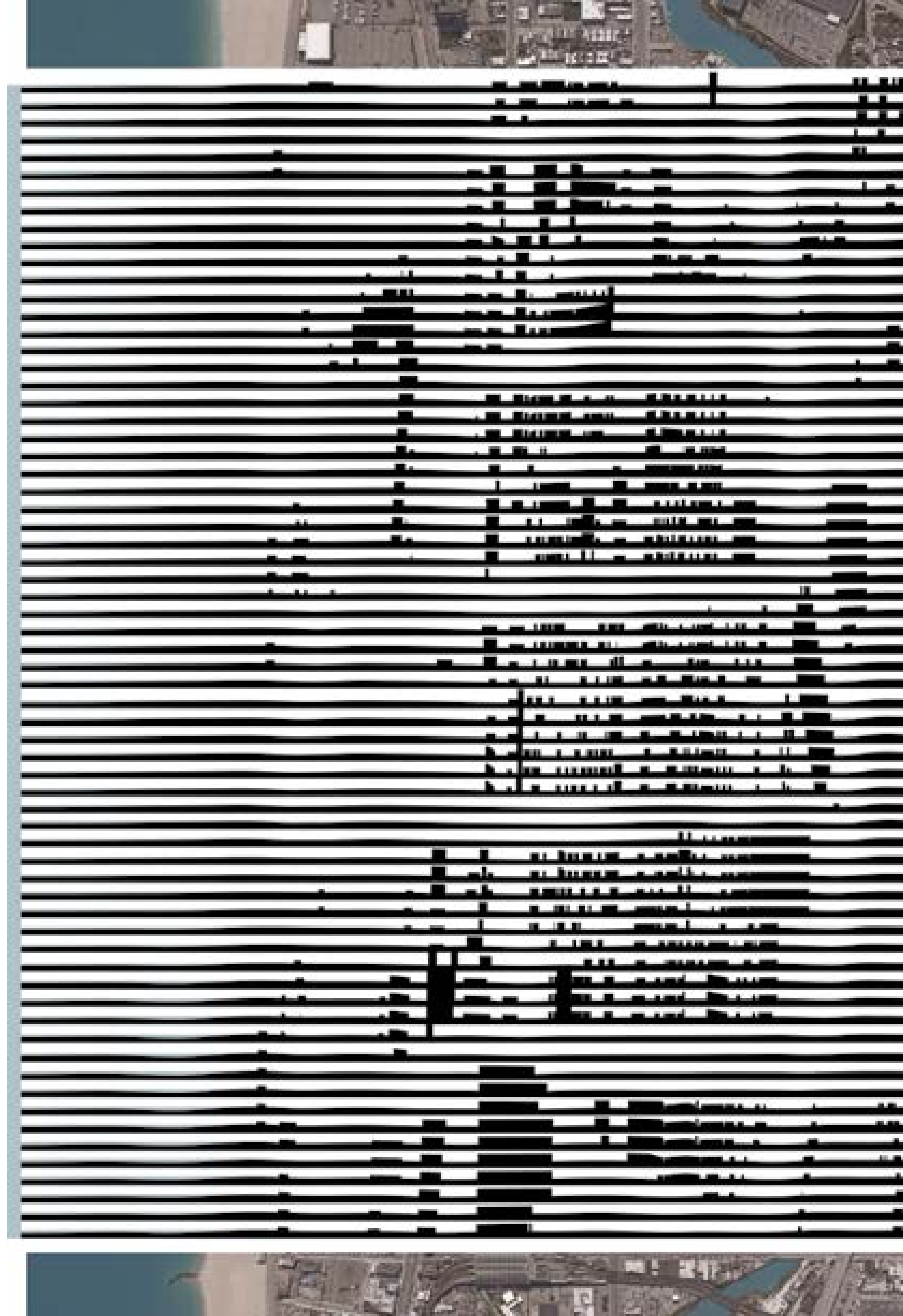
From 1864, with the arrival of the first train lines, the beach was immensely popular with people further inland. The site was an amusement park and resort for inlanders looking for fun.

In section, this urban topography reveals itself as an irregular massing of buildings, swales, and berms.



Through serial sectioning, the site's irregular history of development is revealed.

This also became an effective way to document the different density and porosity between land and water.



Findings + Conclusions

In Phase I, this research has uncovered methods in which quantifying phenomena can generate metrics that can inform the site design. More significantly, it has identified the shoreline as a specific site vulnerability.

In the first conclusion, wave action was analyzed to uncover the essential movement of particles as limited to a circular (or orbital pattern). Waves exist at every concievable scale. Ocean swells could have a wavelength that is hundreds of feet long, while a radio wave could be kilometers long.

Uniting all wave patterns is the fundamental characteristic of a cycle; essentially, a wave is a circular motion seen over time. Similar patterns exist at larger scales, like the daily cycles of wind, variations in temperature, and possibly the urban topography.

In Phase I, the realization has been that a set of definable principles govern the cylical forms of wind and waves, this insight suggests a continuum, rather than a binary, between the fluid and solid materialities of the site.

By clarifying the inbetweenness of the site as wave-like, Phase I suggests a set of metrics that could quantify the site phenomena.
In order to understand the site as existing in fluctuation, this assertion will be carried through by measuring characteristics like the wavelengths, amplitudes, crests, and troughs of each set of data.

This information will be used to uncover the hidden (or intuitive) logic behind the city's form, and will ultimately suggest places where this logic falls apart.

The broader significance of this research is a quantitative method of understanding the implications of urban inundation, but it is not clear how this can directly inform a site design.

Assessment

Since its inception about six months ago, this thesis has had to shift from a conceptual inquiry into urban form into a site-specific research question.

The original intention of this thesis was to understand how the current base of research in landscape scale change could inform coastal landscape architecture, in order to design more resilient coastal communities. However, there is truly a limited amount of research going into understanding how landscapes change at a regional scale.

Thus, the future direction of the thesis will need to address this gap in knowledge. With this understanding, the design proposal will be able to meet a local necessity with a more sustainable solution.

Phase 2 Investigation

Which types of infrastructures can mitigate flooding risks while creating cultural and recreational amenities?

Phase 2 Abstract

In Phase 2 the research question was “what kind of coastal edges are both recreational, culturally relevant, and protect cities from inundation?” The overall goal has been to analyze existing technologies, and to develop typologies which could be used to further analyze the site for opportunities and constraints.

Research began by looking at a wide range of existing technologies, first to avoid repeating research and second to expedite the design process. The first projects researched were based on what the critics recommended in the Phase 1 Review. These were international in scale, and represented a wide range of spaces, from architectural to landscape, recreational to programmed, and domestic to international. These projects were assembled into a catalog of coastal typologies, and then were remixed and refined to represent a wider range of “soft” to “hard” infrastructures.

The conclusion of this research can be framed within the range of “soft” to “hard” infrastructure. Hard structural solutions, like retaining walls, ocean groins, and riprap, all have effects on those patterns of sedimentation and deposition along the coastline that nourish shorelines and prevent damage further inland. Softer solutions, that incorporate vegetation and graded slopes into the sea.

Finally, the last conclusion of this research is that few hard infrastructures provide recreational or cultural amenities, and traditional soft infrastructural approaches are not stable enough for the erosive potential of the doubled heavy recreational use and large wave events.

When looking at the site in this context, the ocean groins, the boardwalk, the abandoned lots, and the theme park have taken on renewed appeal as a site that needs to be drastically reshaped in order to exist as a recreational and cultural amenity for New York City into the future.

In Phase 3, the research will focus on refining testing of typological models. Through iterative refinement, this process will suggest the specific hybridization of hard and soft infrastuctures to make Coney Island more resilient.

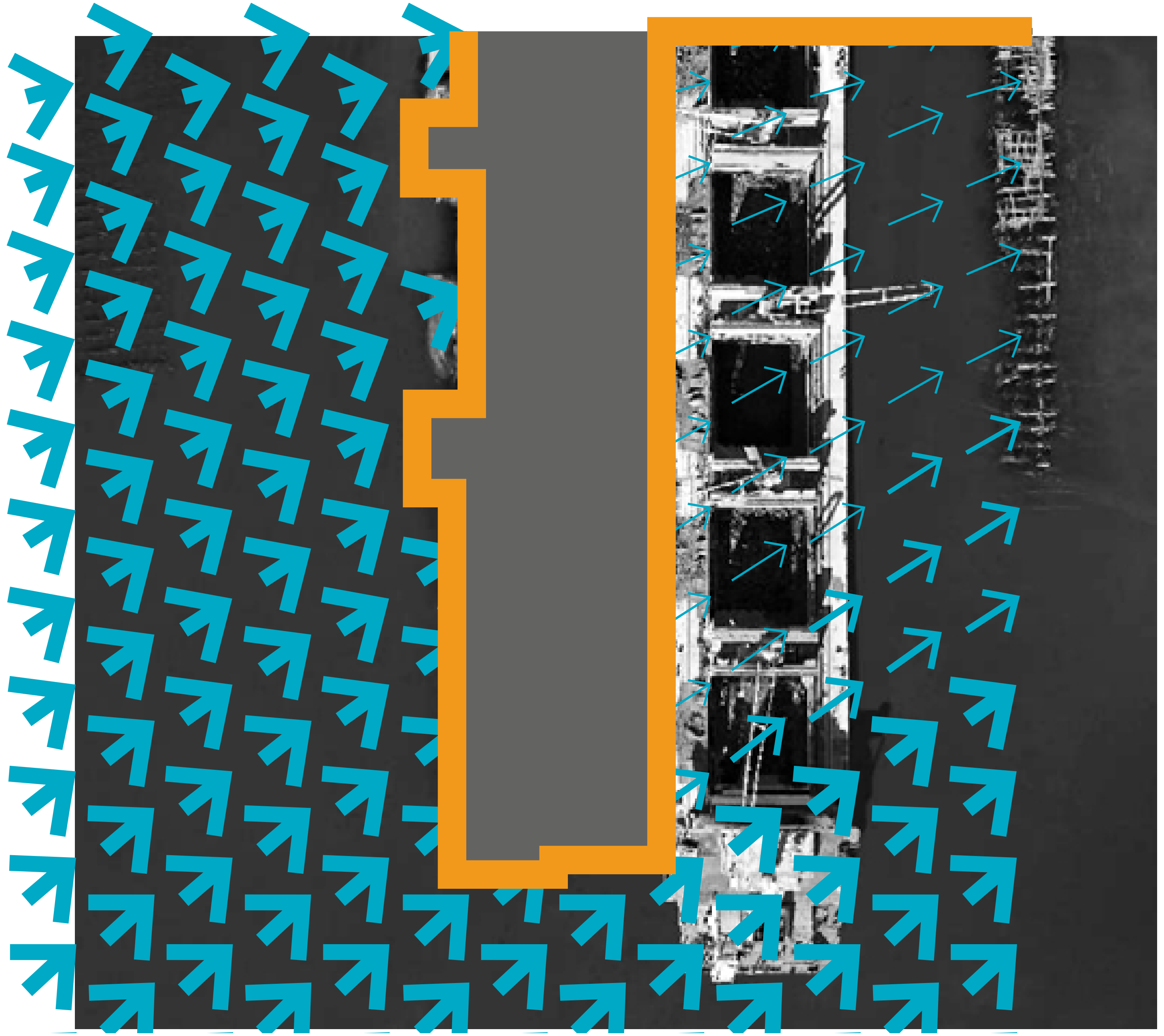
As the tip of Brooklyn, Coney Island is subject to powerful wave and wind that, overtime, have shaped its sandy soil.

The encroachment of urban sprawl and coincidental loss of shore vegetation have disrupted the accumulation of sand.

Engineered solutions like groins and dune stabilization fencing have failed to replace that previous natural accumulation =

The first case study is the industrial convention of retaining the shoreline through armorment like a seawall or riprap.

This seawall, in Providence RI, was likely built by the USACE in conjunction with the City of Providence.

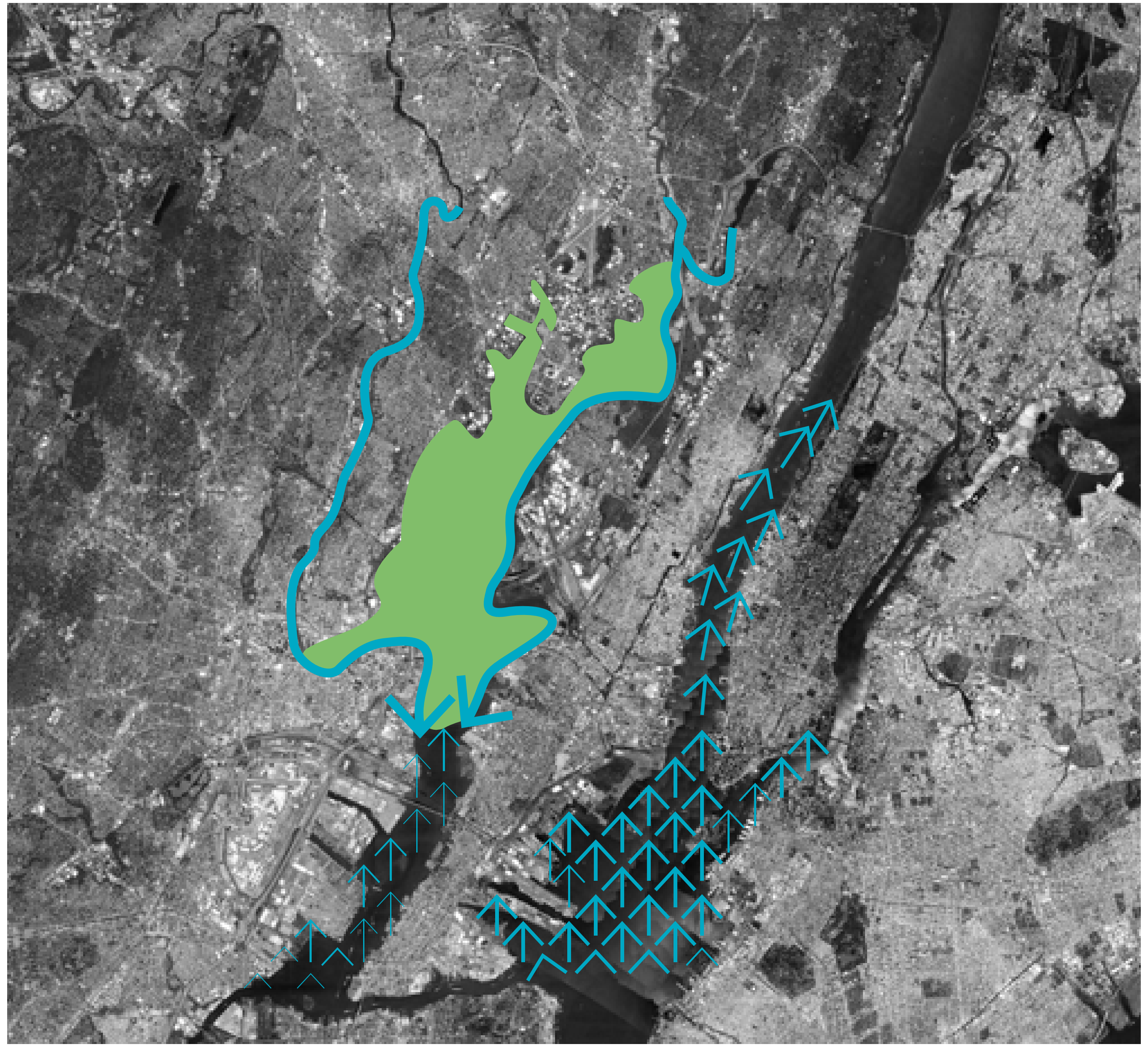


The objectives of this strategy is partially to keep water off the site and partially to prevent the shoreline from eroding.

In some instances, these are built so that ships can have access to the shore.

This second project is titled “the New Meadowlands”, and it was one of the finalists from the Rebuild by Design competition in NYC.

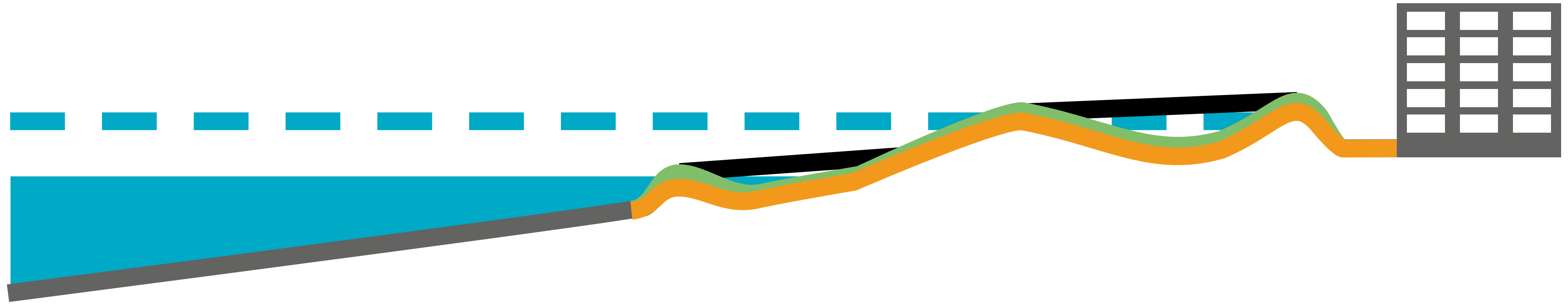
It was designed by the MIT Center for Advanced Urbanism in conjunction with the Dutch firms ZUS, Urbanisten, and Deltares.



In this strategy, the core objective of the project is still to keep water away from the city and to prevent the shroeline from eroding.

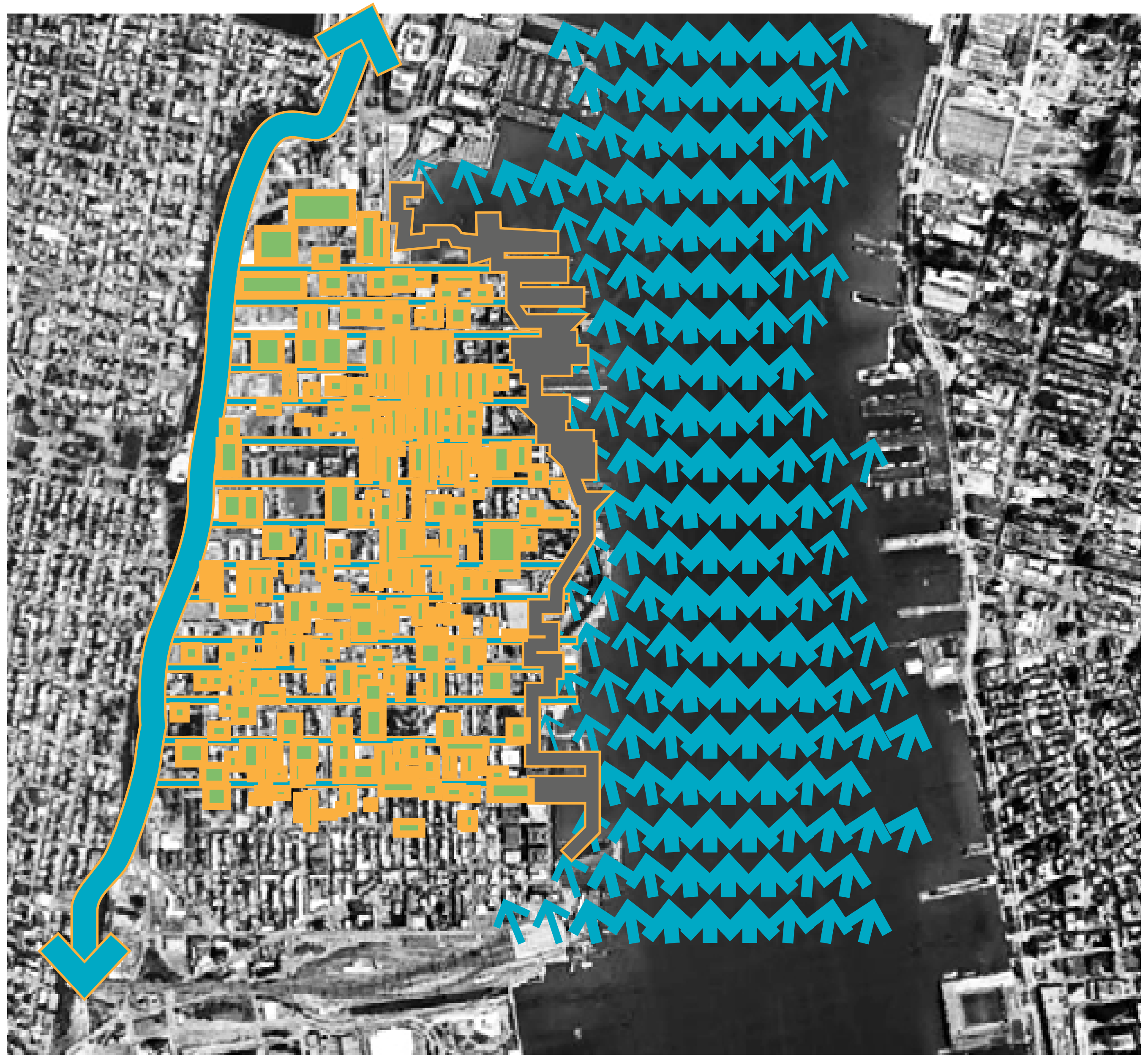
Hard structures have been replaced with densely vegetated slopes.

Ships can no longer access the shore.

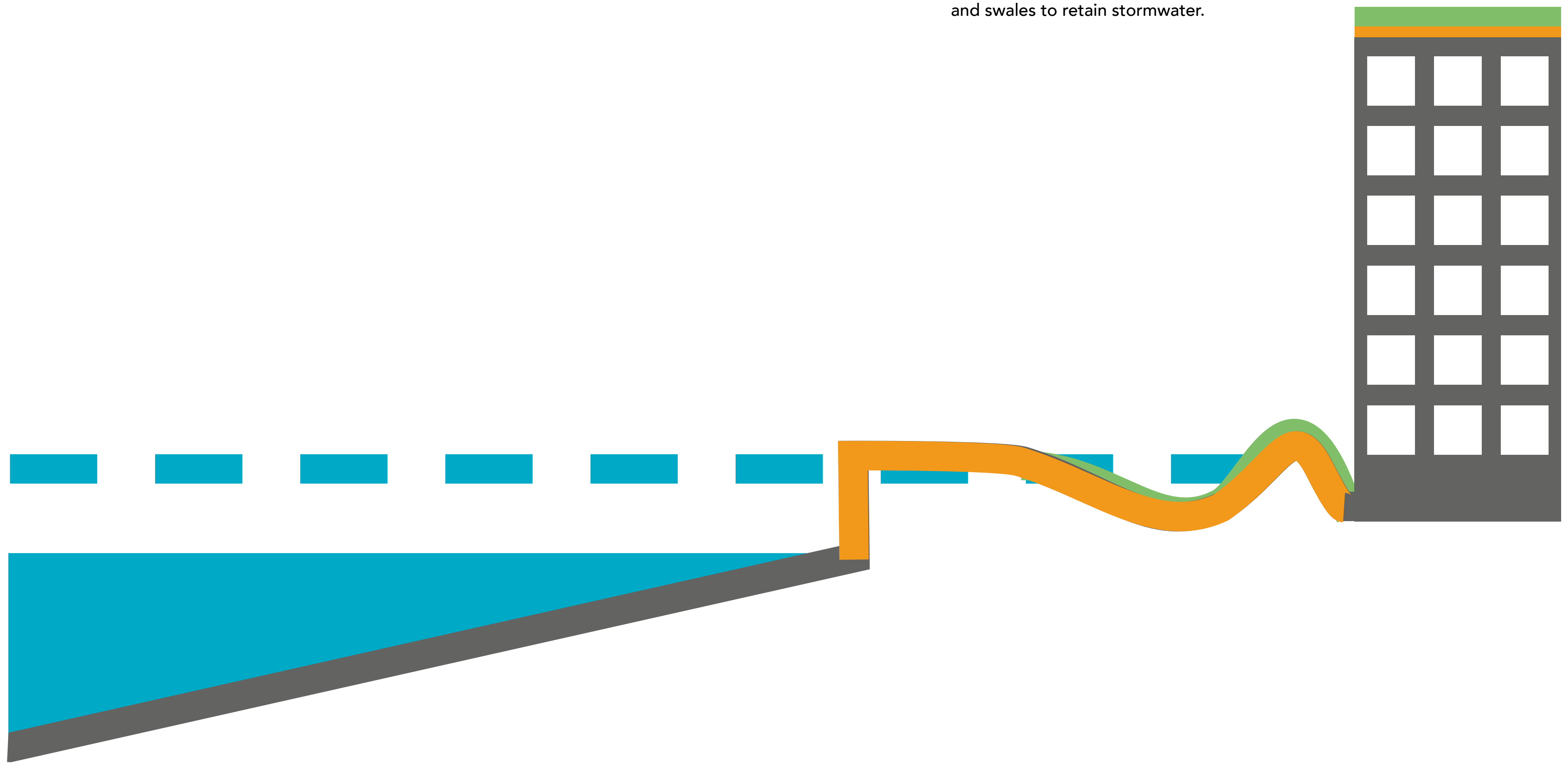


In these next projects, the strategy is to begin to strategize how water can be moved across the site in order to keep important areas dry.

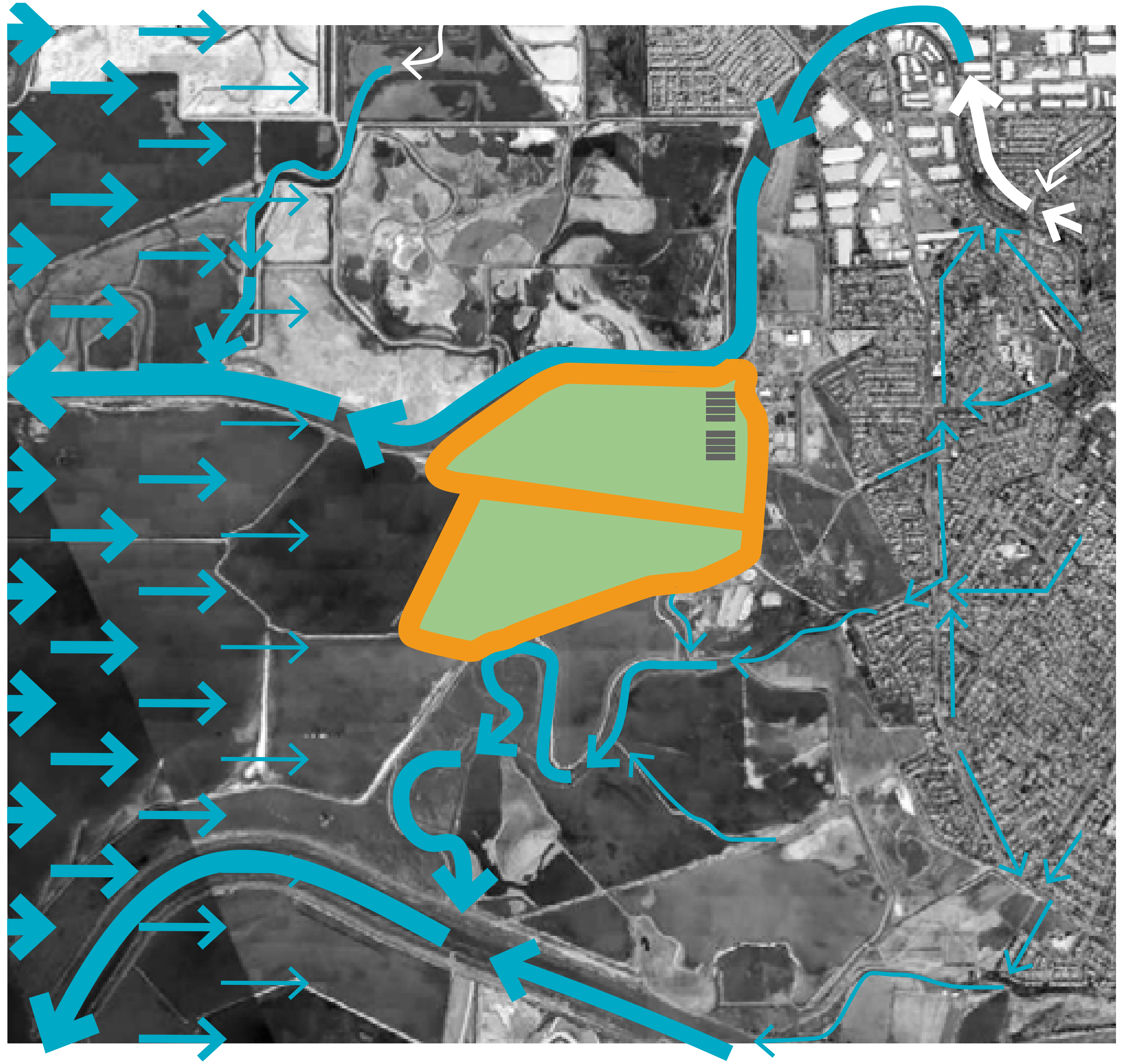
In RESIST, DELAY, STORE, DISCHARGE, designed by Office of Metropolotian Architecture and Balmori Associates, the strategy to control inundation is



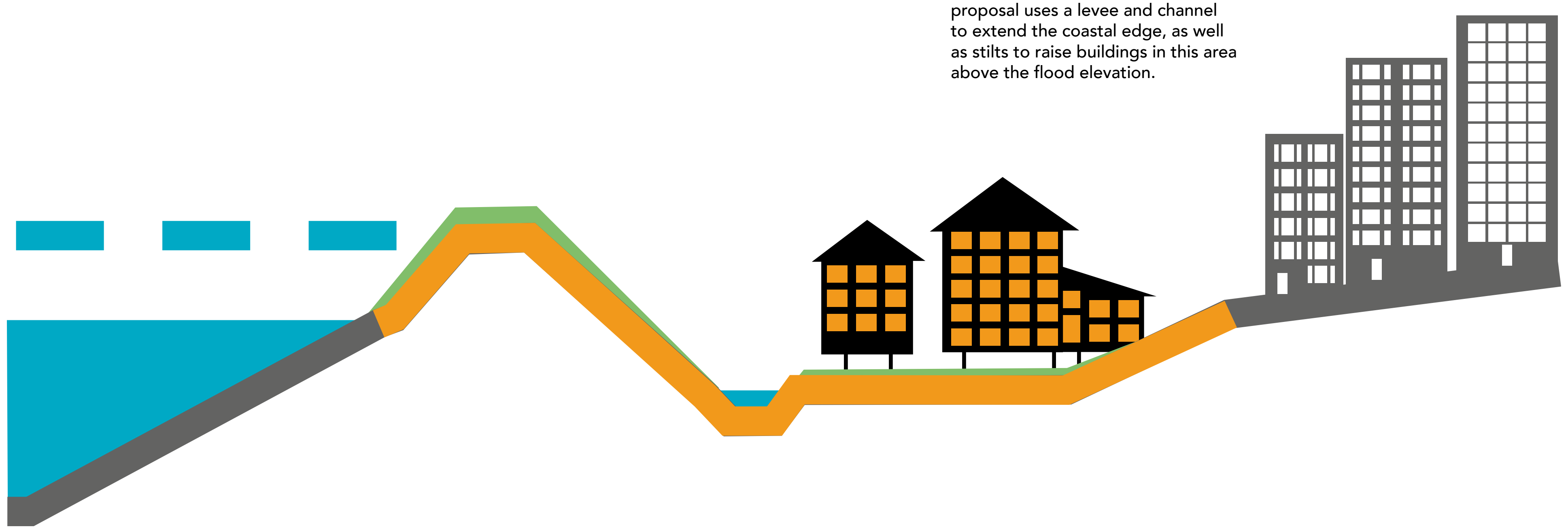
In this strategy, hard seawalls are hybrdized with vegetated rooftops and swales to retain stormwater.



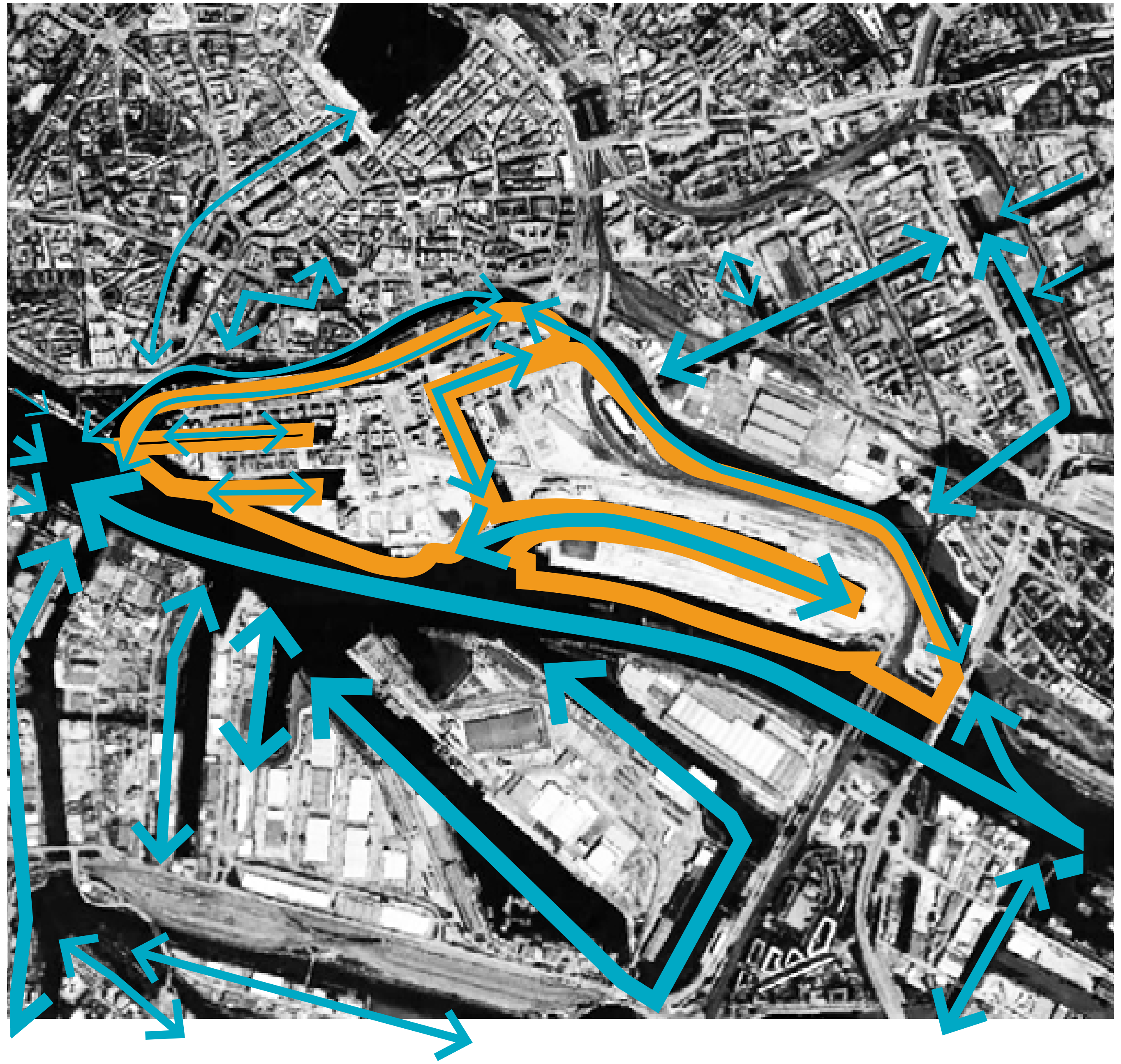
This conceptual proposal is "Adapating the EDGE", developed by a studio headed by Professor Kristina Hill, in SAN FRANCSICO,



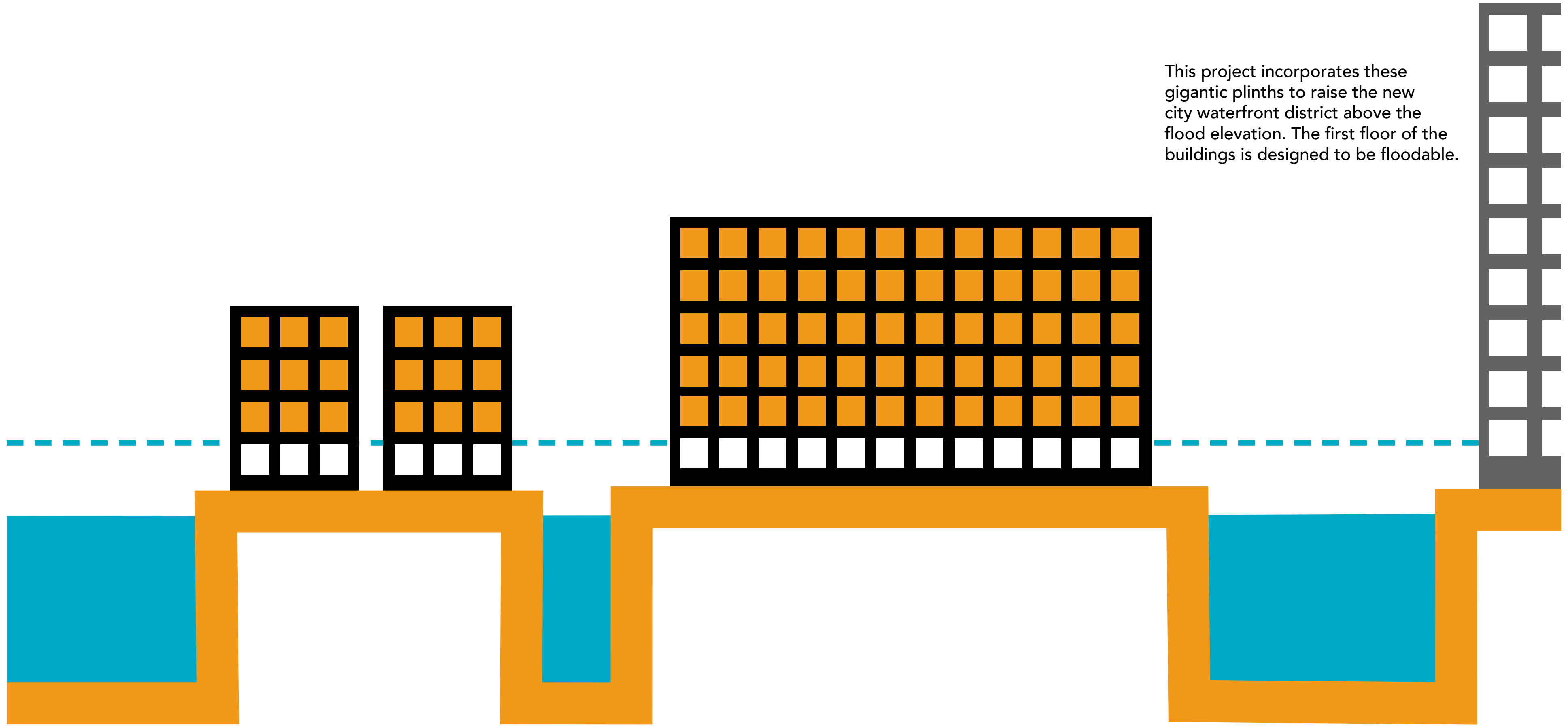
By adapting typologies from the Dutch model of land-building, this proposal uses a levee and channel to extend the coastal edge, as well as stilts to raise buildings in this area above the flood elevation.



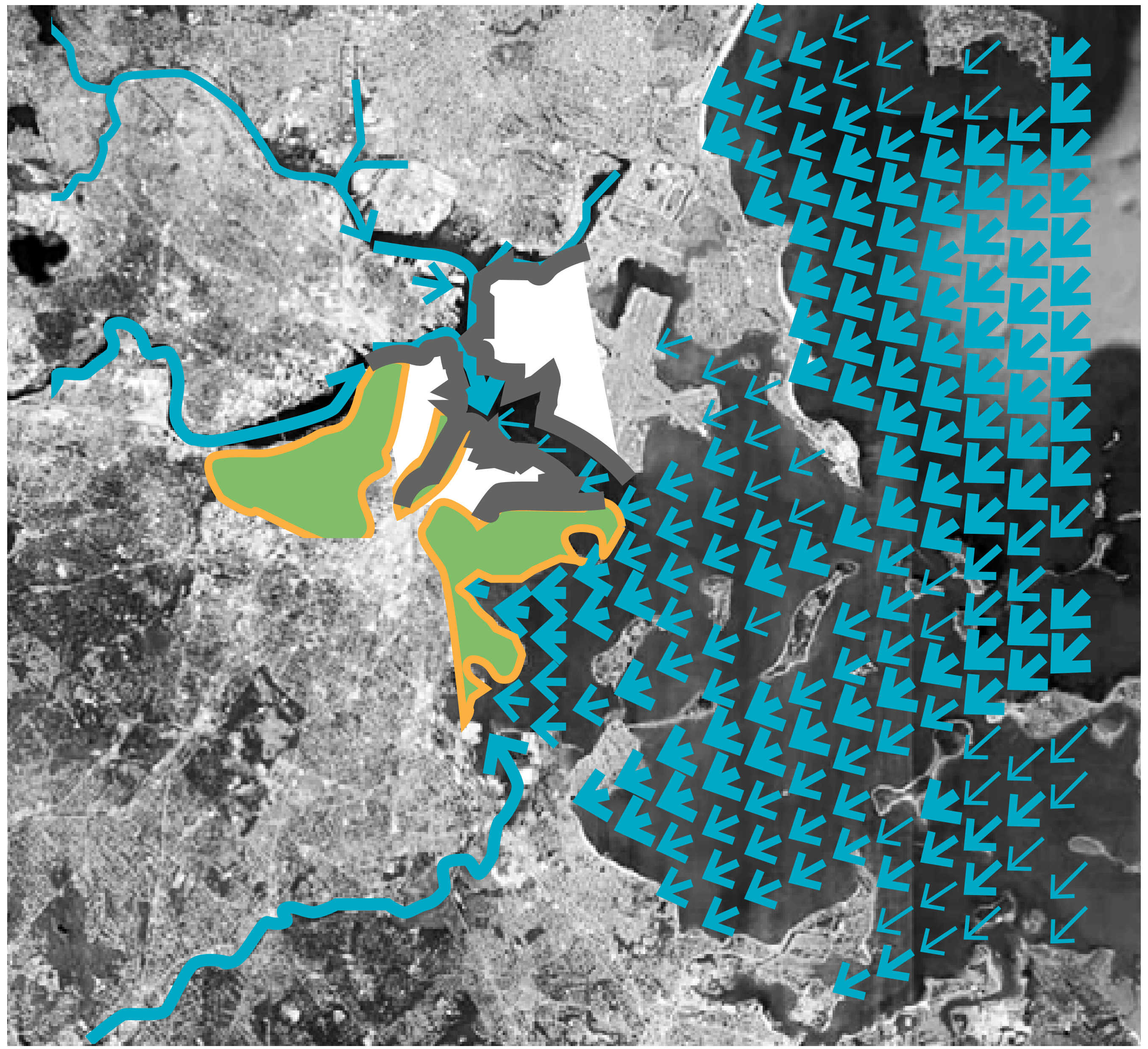
This is Vision HafenCity, designed by a studio headed by Professor Volkwin Marg and the city of Hamburg planning and business development.

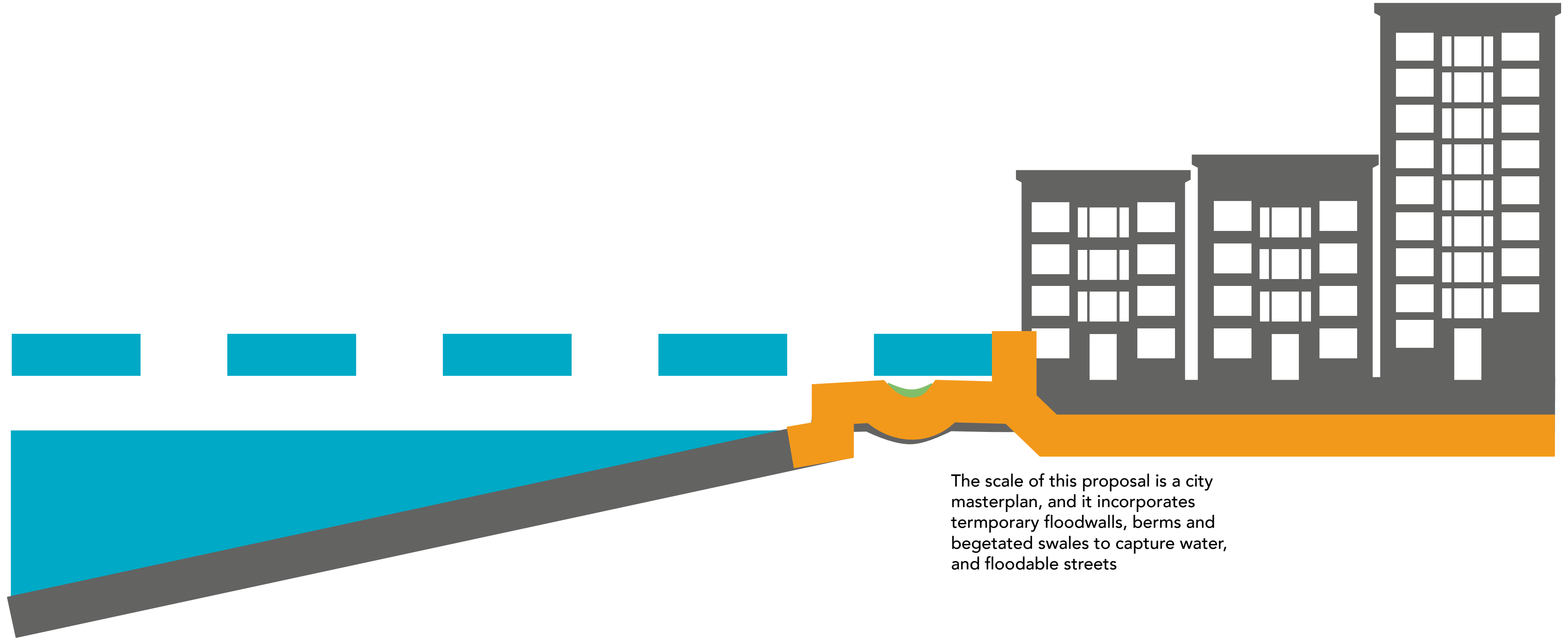


This project incorporates these gigantic plinths to raise the new city waterfront district above the flood elevation. The first floor of the buildings is designed to be floodable.



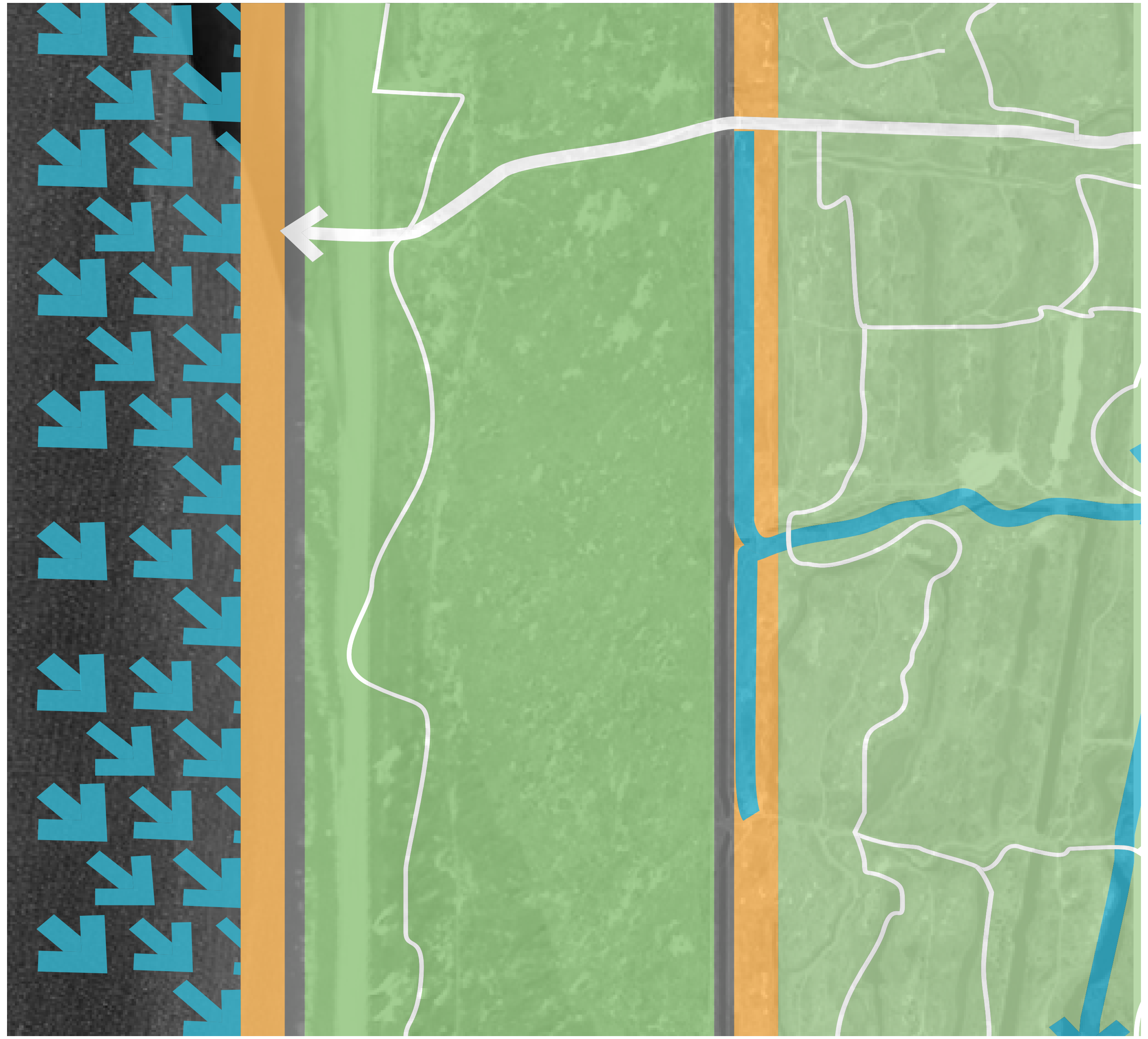
The fourth project is SeaChange (by SASAKI and associates), in BOSTON MA.



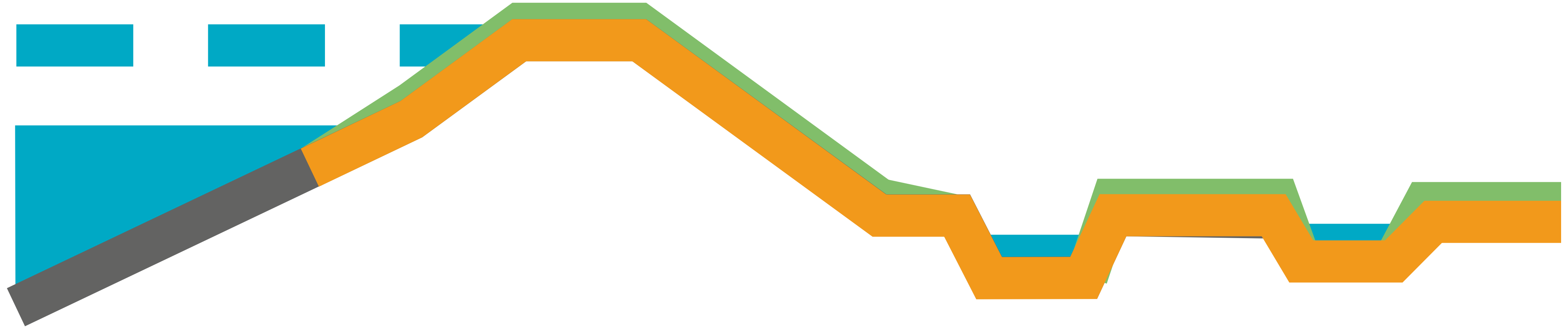


The scale of this proposal is a city masterplan, and it incorporates termporary floodwalls, berms and begetated swales to capture water, and floodable streets

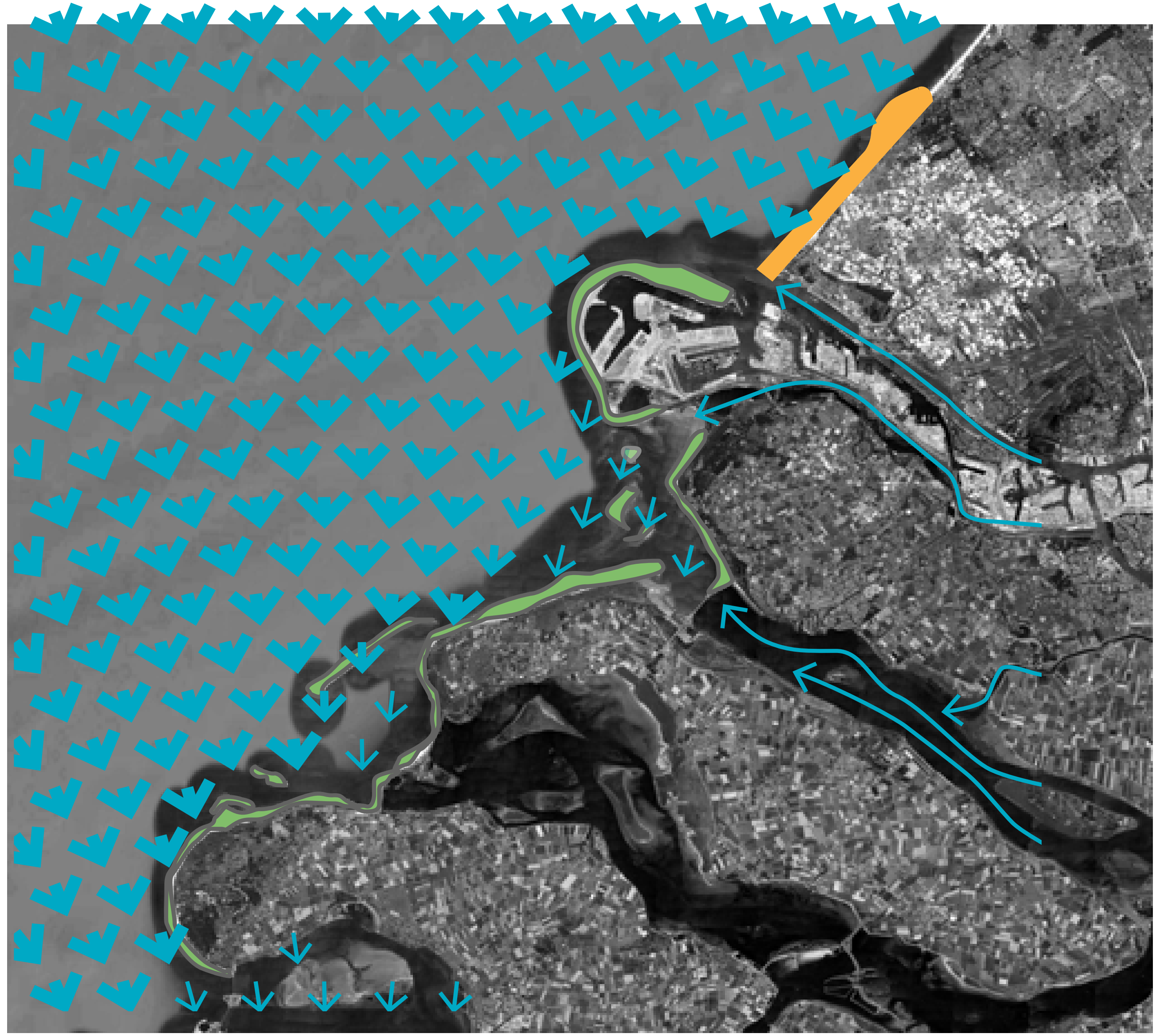
This fifth project is the Dijkring in Holland. It is maintained by the Rijkswaterstaat. The dijkring is designed to protect up to a 250 year storm, while behind it more levees and channels are designed to accomodate a 10,000 year storm.

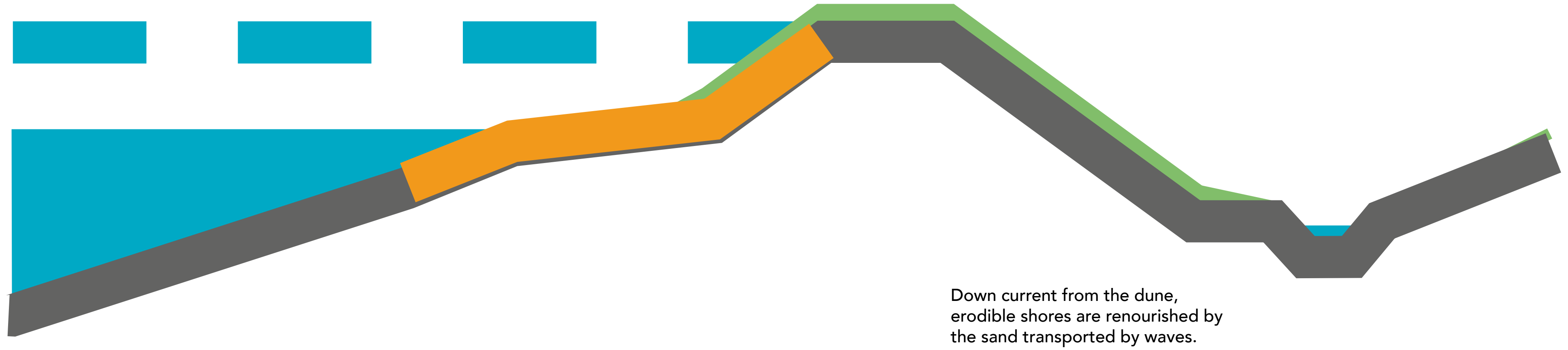


Behind each levee is a small channel, which continuously moves groundwater towards pumping stations where it is transportet into the sea.



The first project is the SAND ENGINE, in the NL. This project is a single massive sand dune maintained and monitored by the Delft University of Technology.

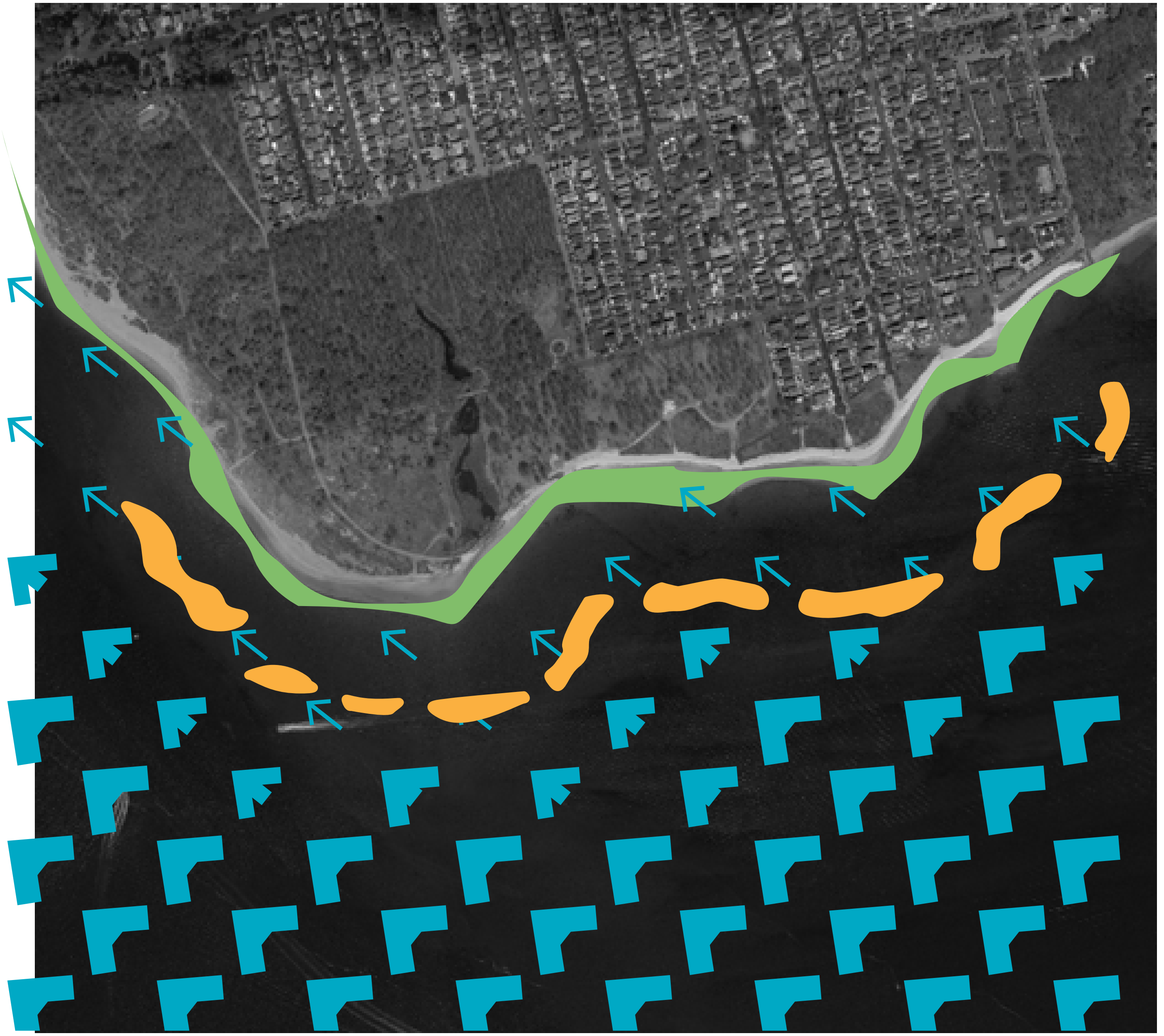


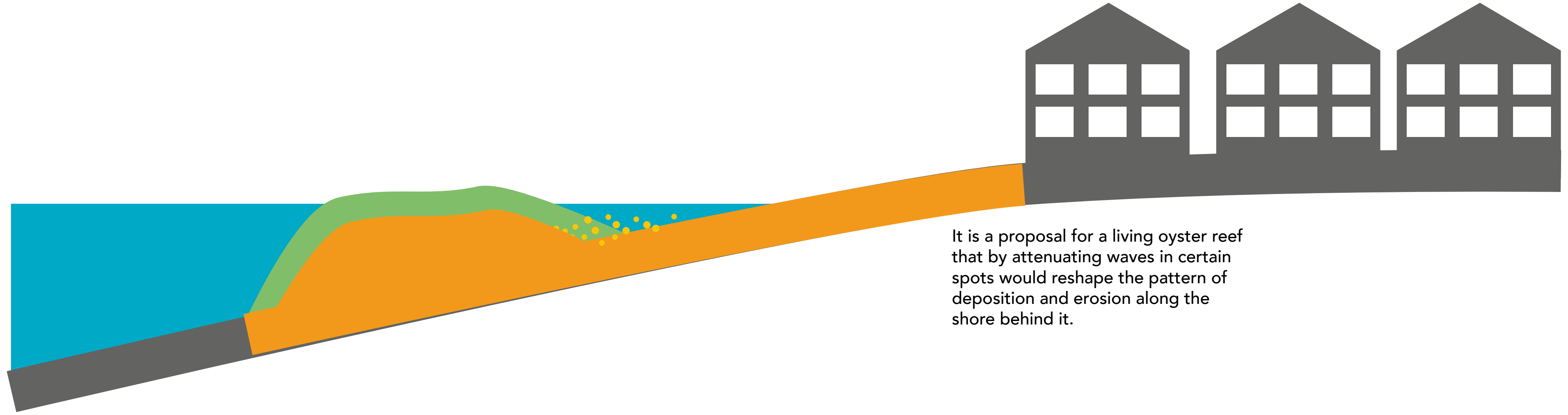


Down current from the dune, erodible shores are renourished by the sand transported by waves.

By renourishing this one section of the shore (instead of the entire coastline), the local government is able to save money.

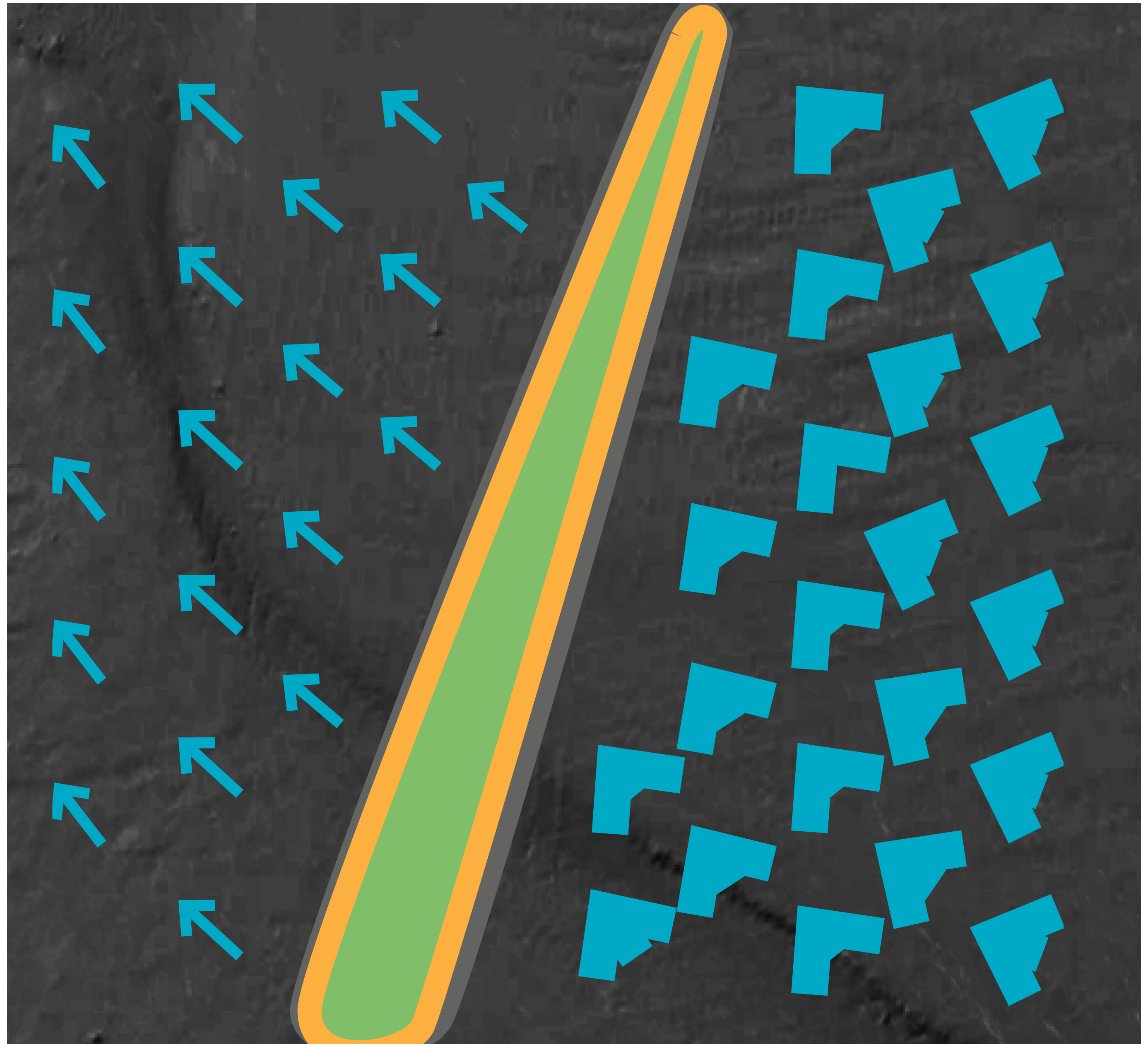
This project is LIVING BREAKWATERS, by SCAPE, and it is off the coast of Staten Island.



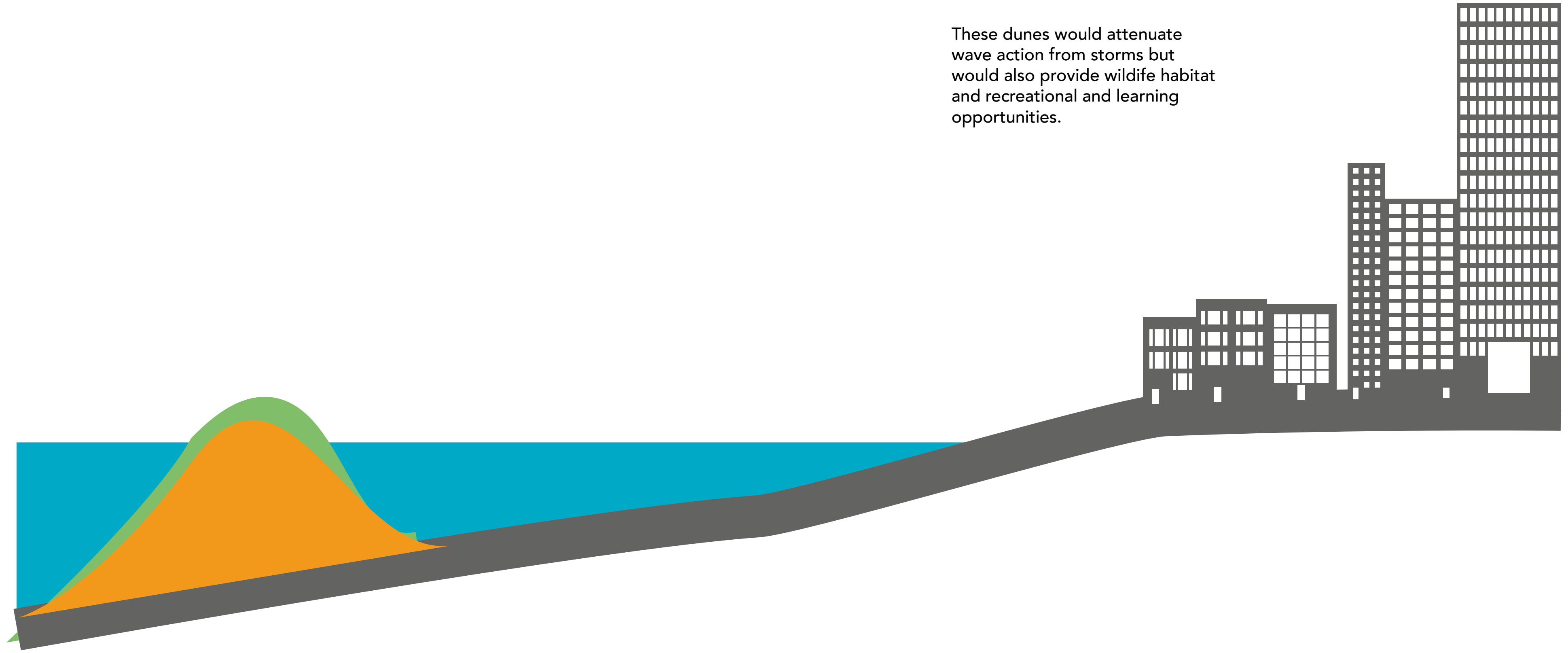


It is a proposal for a living oyster reef that by attenuating waves in certain spots would reshape the pattern of deposition and erosion along the shore behind it.

This proposal by WXY architecture and West 8 is to construct massive sand dunes off the coast of the Northeast.



These dunes would attenuate wave action from storms but would also provide wildife habitat and recreational and learning opportunities.







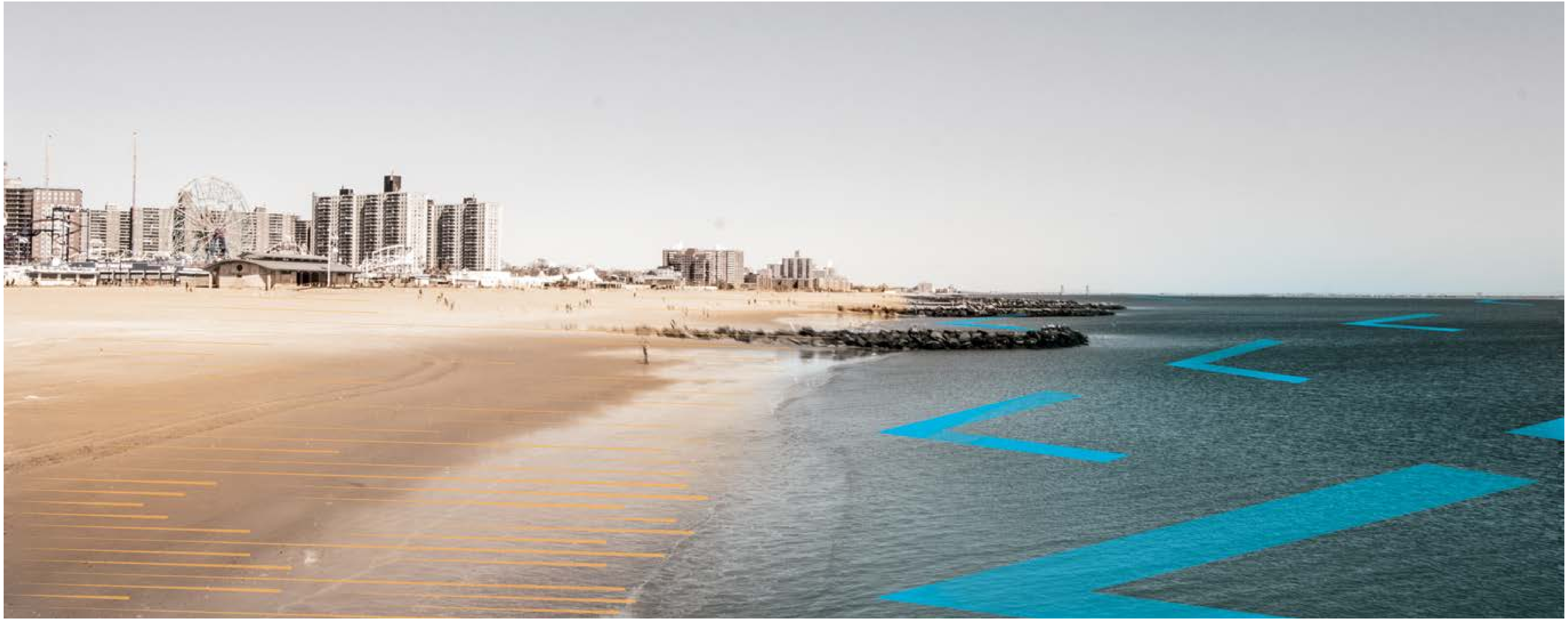
The conclusion of the typologies research are this series of models that diagramatically describe the range of coastal edges and describe relationships between these peripheral systems and the urban core they are meant to shelter.

In concluding this research, the next step in the design process is to identify site opportunities and constraints, to locate how Coney Island is being protected from inundation, and then to strategize how these edge typologies can be hybridized to fit the site's requirements.

As the tip of Brooklyn, Coney Island is subject to powerful wave and wind that, overtime, have shaped its sandy soil.

The encroachment of urban sprawl and coincidental loss of shore vegetation have disrupted the accumulation of sand.

Meanwhile, small practices like dune fencing are meant to stabilize sand before it reaches the sand.



Along the shore, groins have been constructed to slow steady drift of sand down the coast.

Groins are a common technique to retain shore sand.

These will collect sand along the primarily up-current edge, but will also accelerate erosion further down-current.

In this small town in Rhode Island, the boardwalk and structures sit on top of stilts rather than a concrete foundation.

Findings + Conclusions

In Phase 2, the first conclusions are that there are a great deal of existing solutions to resolve the adjacency between city and water, and they stretch from hard to soft solutions. The range of solutions starts with hard engineered solutions, relying on armaments like concrete seawalls and riprap tidal wetlands to retain the shoreline. The problem with these solutions is that they accelerate erosion around their location.

More contemporary approaches to erosion use vegetative cover to reduce erosion and slow the movement of stormwater across the site. The outliers among these studies are strategies that incorporate the movement of sand and sediment within the system in order to renourish (rather than just retain) the shoreline.

The second conclusion is that the coastline is subject to extraordinarily intense phenomena, and that the dynamic coastline is a result of these forces. At Coney Island, the rapid urbanization of the last half-century has increased the edge's resistance to the effects of the ocean, and an unanticipated effect of this resistance is a slowing of the process of sand accumulation.

A hundred years ago, Coney Island was zoned commercial and the physical urban footprint of the city was smaller.

Urbanization has had a dramatic effect on the shape of the shoreline. Today, the site is highly urban, and is almost entirely made of impermeable surfaces. Along this edge of the city, the boardwalk (constructed 1923) has solidified the normally dynamic natural curvature of the shoreline, and coincidently is furthering the process of coastal erosion. Compared to less urban areas, the existing structures are not hybridized with natural systems.

While the beach can be nourished by trucking in more sand, the urbanization of the low-lying interior of Coney Island is problematic because it exposes the thousands of people that live here to the risks.

The outcome of these findings is the design attitude of deurbanization, replacing the existing residential built fabric with the original dune ecosystem, which could be hybridized with the historic amusement park to yield new and exciting coastlines.

In conclusion, Phase 2 has led to the following inquiry. What coastal structures could shift the littoral drift so as to deposit more sand? What is the relationship between urban development and coastal erosion?

Assessment

In Phase 2, the original intention was to develop an attitude towards the design outcomes and find a specific logic that will inform the site design. Developing a catalog of existing strategies emerged as a quick way of understanding existing the range of coastal design strategies. The conclusion of the process were physical models illustrating a kit of parts for designing coastal edges.

Since each technique is described as a solution to a particular problem, this also became a quick way to begin to understand new coastal issues. Thus, when these technologies are compared with the current technology on the site, it begins to suggest site opportunities and constraints. In terms of leading to clear logical outcomes, Phase 2 was successful. However, by becoming so technical, the research fell short in adequately arguing for the site, and it was unclear if the site should be saved.

Phase 3 Design

What are hybrid landscapes?

How can the processes of catalogs and site analyses inform a design response?

Phase 3 Abstract

In Phase 2 the research question was "what kind of coastal edges are both recreational, culturally relevant, and protect cities from inundation?" The overall goal has been to analyze existing technologies, and to develop typologies which could be used to further analyze the site for opportunities and constraints.

Research began by looking at a wide range of existing technologies, first to avoid repeating research and second to expedite the design process. The first projects researched were based on what the critics recommended in the Phase 1 Review. These were international in scale, and represented a wide range of spaces, from architectural to landscape, recreational to programmed, and domestic to international. These projects were assembled into a catalog of coastal typologies, and then were remixed and refined to represent a wider range of "soft" to "hard" infrastructures.

The conclusion of this research can be framed within the range of "soft" to "hard" infrastructure. Hard structural solutions, like retaining walls, ocean groins, and riprap, all have effects on those patterns of sedimentation and deposition along the coastline that nourish shorelines and prevent damage further inland. Softer solutions, that incorporate vegetation and graded slopes into the sea.

Finally, the last conclusion of this research is that few hard infrastructures provide recreational or cultural amenities, and traditional soft infrastructural approaches are not stable enough for the erosive potential of the doubled heavy recreational use and large wave events.

When looking at the site in this context, the ocean groins, the boardwalk, the abandoned lots, and the theme park have taken on renewed appeal as a site that needs to be drastically reshaped in order to exist as a recreational and cultural amenity for New York City into the future.

In Phase 3, the research will focus on refining testing of typological models. Through iterative refinement, this process will suggest the specific hybridization of hard and soft infrastuctures to make Coney Island more resilient.

A regional splash model was cast out of a vacuum-formed polystyrene mold.

This was used to understand regional storm surge patterns by spraying water across the surface.

In this image, a future scenario is envisioned where the bare minimum effort needed to rebuild Coney Island is undertaken, and the site otherwise remains unchanged.

In this absurd fiction, the road is destroyed twice a day during high tide.

Although most of the site infrastructure could be elevated, certain parts, like the sewer system and gas pipelines, could not be elevated.

The site will inevitably need to be abandoned.

The present boardwalk sits on top of a thick concrete foundation.

An initial testable solution that emerged was to hybridize the boardwalk with existing dune restorative strategies.

Today Coney Island is zoned residential. Massive housing projects were still being subsidized here through the 1970s.

By rezoning the site as a commercial "special district" - the site would begin to revert back to the prior amusement park land uses.

This is a necessary first step as the amusement park is more compatible with the above strategies for coastal flood protection.

This study model was assembled from actual site contours and larger scale materials were used to identify existing coastal edge strategies.

In order to understand the effect on littoral drift, the model was evaluated using spray paint.

Learning from these models, the proposal integrates dense grids of trees, pilings, and dune planting to retain the sand.

Through these initial site moves, the site will evolve to regain mass over time.

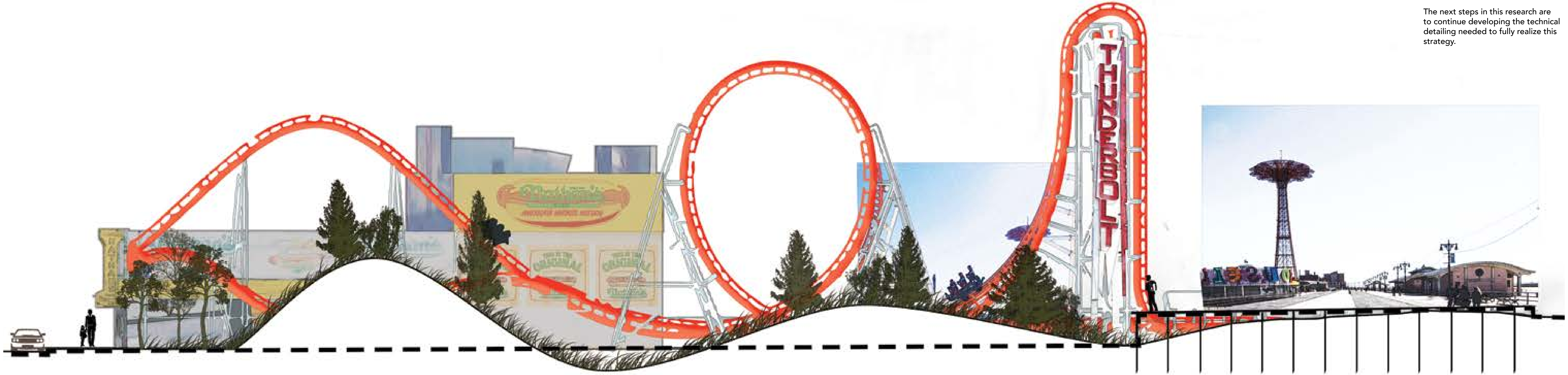
Accumulation of the littoral drift from upcurrent coastal erosion will be used to reduce damage from storm surge.

In this diagram, the piling system is overlayed across the site.

The boardwalk strategy is to restore the dune in critical patches near adjacent vacant lots.

As long as cultural and recreational amenities remain, the boardwalk maintains its original character.

Once those parcels become inundated, they become open to the possibility of being integrated into the dune.



The adjacency of the dune and the amusement park yields existing sectional hybrid landforms.

The next steps in this research are to continue developing the technical detailing needed to fully realize this strategy.

Findings + Conclusions

This thesis is an investigation into strategies to mitigate urban flooding from storm surge in Coney Island NY.

In the first phases, the objective was to discover dynamics between land and water, and then materially model this information, as a way of analyzing and applying it to the site.

This method has inserted itself into every step of the thesis process and has been reiterated in the final conclusions. This gives new direction for the thesis to grow in, but is also a typical working pattern; develop a model, test it, and then respond to it. The question that emerged from this process was, which types of edges have recreational and cultural value?

These same tools are applied to assess the site. What are the major site opportunities and constraints? How are rebuilding efforts at Coney Island compared to other sites affected by Hurricane Sandy, like Breezy Point in Queens, and the boardwalks in New Jersey.

The site is also examined through history, in order to develop a logical outcome for how the site should change in response to flooding. The main revelation was that the site was historically a great amenity for New Yorkers, but in the 1950s Robert Moses rezoned the Western portion of the island to be residential, and through the 1960s different developers, like Fred Trump, tried (but failed) to get the rest of the amusement park to be rezoned residential.

Today, this is a private gated community, which is not eligible for federal assistance to maintain and rebuild the shoreline. The historic amusement park is mostly-gone, occupying this tiny sliver of land between Surf Ave and the Riegelmann Boardwalk. Thus a critical question is, how has the history of urbanization contributed to the decline of Coney Island?

The overall principle of this design is that residents should not rebuild their homes on the island, and instead the vacant lots should be re-vegetated in order to allow a dune to grow back over them. Later, as the shoreline lots accumulate over time, special permitting will allow for them to be redeveloped back into an amusement park.

In order to protect the existing homes, an immediate strategy is to rebuild the boardwalk in such a way as to allow storm surge to affect certain parts of the site where extensive landforms and vegetated dunes could minimize damage while allowing the amusement park to re-expand over it. In parts of the boardwalk adjacent to high-density residential communities, a solid concrete foundation could minimize the amount of water let into the land and thus help protect those buildings.

In conjunction with this strategy this thesis also proposes an extensive system of wooden pilings, which in the water would shift the pattern of littoral drift so as to deposit sand along these critically eroded shorelines.

If there were a Phase IV, the thesis could go in a number of conceivable directions. The first are the testable aspects of the site design. One question I have is if the density of pilings is adequate to satisfactorily influence the littoral drift. Could such a system attenuate wave action? How can the case studies further inform coastal design strategies? Finally, how can the edge of Coney Island also make the interior more habitable?

Assessment

The first shortcomings of the thesis are the actual viability of the proposed system. More research is needed in order to answer the third outcome of the thesis; What is the final height of landforms needed to mitigate storm surge? What is the density of pilings needed to interfere with the littoral drift?

The next shortcoming is related to the over arching strategy of deurbanizing the site. In the historical research, the thesis process revealed the legacy of planners and developers and in identifying the shortcomings of these urbanists, this argument for redeveloping the site has contradicted itself by not directly addressing the necessity of moving thousands of people from their homes.

The reality is that people will not inhabit Coney Island in fifty years, because the impact of sea-level rise will be such that building foundations will crumble, infrastructure like sewer lines and gas pipelines will break, and one day far from now the entire site will be underwater. Without this initial acknowledgement, the thesis proposal remained in the possibilities of fantastic and does not enter the realm of necessity.

Future research will be targeted at further inland strategies for inundation.

Overall Assessment

Final Conclusions

This thesis is an investigation into strategies to mitigate urban flooding from storm surge in Coney Island NY.

In the first phases, the thesis investigated dynamics between land and water, and then materially modeled this information as a way of analyzing and then applying generalizable phenomena to the specifics of the site. This method has inserted itself into every step of the thesis. In Phase 2, a series of coastal edges were cataloged and documented in order to conceptualize a kit of parts that could then be applied to the site as typologies of design strategies.

The major revelation is that new technologies that are being developed can be thought of as a third kind of coastal edge. These incorporate dynamic interactions between land and water in order to protect coastal edges; in the Sand-Engine, through the littoral drift, harnessing wind and wave power to slowly and sustainably move sand to vulnerable beaches and shores along the coastline.

In Phase 3, the major revelation have been derived from the work in Phase 1 and 2. Site phenomena, like wave action and littoral drift, were re-framed in order to understand how they are problematic in a coastal site like Coney Island. Some of the coastal edges researched in Phase 2, like the Sand-engine in Holland, took on new significance as it represented a new third type of coastal edge, distinct from the conventional first engineered solutions and the second more contemporary vegetative solutions.
Thus, the ultimate outcome of the thesis is three-fold. First, by identifying this emergent trend in new coastal edge design, it suggests a material method of testing and designing coastal sites. The second outcome of the thesis is an overarching strategy of de-urbanization at these critical vulnerable coastal sites. The third and most visible outcome of the thesis process were testable models of the schematic design proposals for the site's land-water edge.

Final Assessment

Since its inception about six months ago, the core ideas behind the thesis have solidified around some specific frameworks. The difficulty in this process became ever more present at the detail of the site scale, where the multiplicity of different site phenomena require more precise technical possibilities. This is where categorization has been a vital component of the design methodology.

The original intention of this thesis was to understand how the current base of research in landscape scale change could inform coastal landscape architecture, in order to design more resilient coastal communities. The final outcome has been a very specific method of generating forms from the interaction between solid and fluid materials.

While the original research topic was not quite specific enough, an additional problem was that design research is inherently biased to produce tangible site proposals. The thesis has changed because the current base of landscape scale change is not enough to satisfactorily inform how design should respond to inundation.

While the final proposal is lacking in specificity, this is still a successful method of developing novel strategies and architectural forms.

Bibliography

Saunders, William S., Patrick M. Condon, Gary R. Hilderbrand, and Elizabeth K. Meyer. Richard Haag: Bloedel Reserve and Gas Works Park. New York: Princeton Architectural Press, 1998.

Bois, Yve-Alain, and John Shepley. "A Picturesque Stroll around "Clara-Clara"." October 29 (1984): 32. doi:10.2307/778306.

Calvino, Italo. Invisible cities. London: Vintage, 2009.

Corner, James. Recovering landscape: essays in contemporary landscape architecture. New York: Princeton Architectural Press, 1999.

Corner, James, and Alex S. MacLean. Taking measures across the American landscape. New Haven: Yale University Press, 1996.

Cosgrove, Denis E. Mappings. London: Reaktion, 2002.

Foster, Hal. The anti-aesthetic: essays on postmodern culture. New York: New Press, 2002.

Koolhaas, Rem. Delirious New York. 1980.

Niarchos, Nicolas. "Richard Serra in the Qatari Desert." The New Yorker. May 03, 2017. Accessed May 21, 2017. http://www.newyorker.com/culture/culture-desk/richard-serra-in-the-qatari-desert.

Nordenson, Guy, Catherine Seavitt Nordenson, and Adam Yarinsky. On the Water: Palisade Bay. Ostifidern: Hatje Cantz, 2010.

Simpson, Deane. Third age urbanism: retirement utopias of the young-old. Zürich: ETH, 2010.

Smithson, Robert, and Jack Flam. Robert Smithson, the collected writings. Berkeley: University of California Press, 2000.

Stilgoe, John R. Lifeboat: a history of courage, cravenness, and survival at sea. Charlottesville, VA: University of Virginia Press, 2003.

Tilder, Lisa, Beth Blostein, and Jane Amidon. Design ecologies: essays on the nature of design. New York: Princeton Architectural Press, 2010.

Tuan, Yifu. Surface phenomena and aesthetic experience.

Wood, Denis, John Fels, and John Krygier. Rethinking the power of maps. New York: Guilford Press, 2010.