Let me *flow*

A resilient flood strategy for Red Hook, Brooklyn

ARCHITECTURE MASTER THESIS
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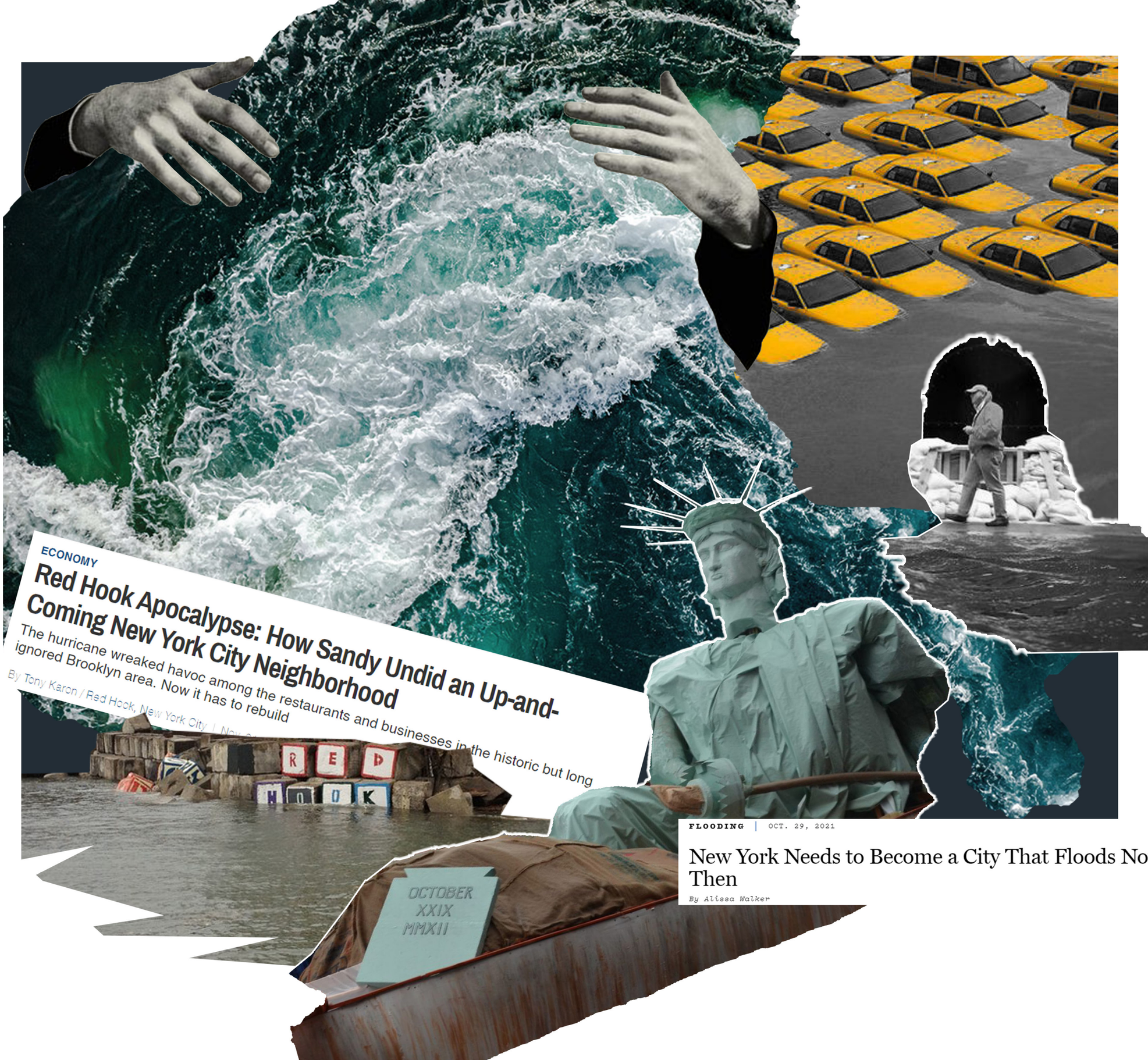
The contemporary city is facing changes and challenges in a **global context**.
The city is confronted with increasing **social inequity**, **rising population**, **transportation issues**, and the need for more **green areas**. The city must also inevitably deal with the increase in **climate change** disasters, which are changing and will change the geography and the idea we have of the city.

The climate is changing, we need to accept it and develop strategies to make the change live with the city.

The thesis begins by identifying the global problem of climate change regarding **flooding** and **sea-level rise**, investigating how contemporary cities address this problem. This is followed by a study of **New York City** from a geographical, social, economic, cultural, and environmental perspective, and then focuses on a more local view of **Red Hook**, a neighborhood located in northwest Brooklyn, characterized by being one of the most vulnerable areas to the effects of change in New York City. Most of its lower shoreline **is projected to be flooded** as early as 2100.

The research aims to act as an **urban acupuncture**, studying the most vulnerable areas of Red Hook to improve its ability to adapt to the water-related consequences of climate change.

The thesis is not intended to be a solution, but a **strategic analysis** of actions that can in turn generate reactions by developing a city's ability to be **resilient** to climate change.



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introduction

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“We are the first generation to feel the effect of climate change and the last generation who can do something about it.”

Barack Obama

photo by authors, 2022

01.1 context and motivation

why?

The contemporary city is confronted with changes.
To the demographic growth it has to deal with, to the increase in social inequality, to the problem of mobility and the need for greener cities, the city has to face the growing dramatic disaster related to climate change, whose irreversible dynamics are about to change the geography of the territory with considerable on artefacts urban.
The climate is changing.
It always did, but the past few years show how devastating the effects of our changing climate could be when we do not adapt to this changing circumstance.
Red Hook is a neighborhood situated in northwestern Brooklyn, and it is the most vulnerable area in New York City to flooding and coastal storms.
In October 2012, the community suffered extensive damage from Superstorm Sandy.
Red Hook was the most affected area in the city and after the storm most of the neighborhood remained underwater for days.
The future of Red Hook is uncertain as it is vulnerable to gentrification and climate change. Most of its low-lying coastal neighbourhood is predicted to be inundated by the ocean as soon as the year 2050.
Despite these challenges, strong local relationships and a network of community-based organizations form a strong foundation for resilience in the neighborhood.

01.2 research aim

what we want to achieve?

This thesis aims to understand, investigate, explore the existing solutions to the effects of climate change regarding the water, on the small scale of the neighborhood, using small-scale interventions to transform the larger urban context.

The research wants to investigate design methods to be more adaptive from the beginning, resilient strategies to be applied before a natural disaster, and not after.

The research wants to act as urban acupuncture, revealing the most vulnerable areas of Red Hook, and enhancing its potential. An adaptive strategy will be created involving three important topics: the role of the water in climate change, the importance of people, and finally how a city could be resilient after these challenges. The project does not want to upset the neighborhood, but to establish a system of adaptive and resilient actions that can reduce the risk of flooding, coastal storms, and socio-ecological transformations.

The design strategies will consider all the most relevant resources in the landscape, environment, culture, history, site-specificity, enhancing them. The goal of the research is to create a sort of toolkit, applicable when transforming an existing neighborhood to improve its capability to adapt to the consequences of climate change-related to water. The toolbox is developed from theoretical research and reference studies, analytical framework, and design conclusions.

01.3 research questions

The main research question is:

What kind of small scale spatial interventions in a neighborhood can facilitate adaptation to the effects of climate change related to the water?

A set of sub-questions were formulated to help answer the main research question:

THEORETICAL FRAMEWORK

. What are the future challenges and effects of climate change in the urban environment on a neighbourhood scale?

. How should architecture intervene to facilitate the conditions of adaptation to climate change?

. How are social inequalities connected with the causes and consequences of climate change?

. How can the citizen contribute and be involved in the different phases of urban development in order to adapt to the consequences of climate change?

EXPLORING RED HOOK

. How make people, both visitors and citizens, aware of the potential of Red Hook's waterfront?

. How can the architectural elements of Red Hook, now seen as nostalgic elements, be reintegrated into the city structure as a new and dynamic layer?

KIT WORDS

Community, Isolation, Defense, Gentrification, Plan, Buildings, Manhattanism, People, Disaster, Hazard, Vulnerability, Transportation, Industry, Flooding, Sandy, Resilience, Landscape, History, Water, Infrastructure, Strategies, Waterfront, Social activism, Climate change

WHAT

1 PROBLEM IDENTIFICATION

Motivation and Research Aims

WHAT'S THE PROBLEM?

Literature review
data collection

Research questions

What are the future challenges and effects of climate change in the urban environment on a neighbourhood scale?
How should architecture intervene to facilitate the conditions of adaptation to climate change?
Can a community be resilient to a flood disaster?
Can the people be involved in an urban planning of their own nighbourhood?

2 THEORETICAL FRAMEWORK

CLIMATE CHANGE AND **WATER**SCAPES

CLIMATE CHANGE AND **BUILT**SCAPES

CLIMATE CHANGE AND **HUMAN**SCAPES

WHY

WATER-RELATED DISASTERS

sea level rise

flooding (flash floods, urban flooding, river flooding, coastal flooding)

effects on cities: growth urban population, health vulnerability, high costs

effects on people: social inequality, illness and death, food safety, mental health

Today 56.2% of the global population lives in cities.

HOW CITIES RESPOND?

DIFFERENT COUNTRIES, DIFFERENT IMPACTS

	DEATHS	PAID ($ bn)	DISPLACED PEOPLE (mln)
Flood in Mozambique, 2019	603	0.001	1.8
Hurricane Sandy, New York, 2012	233	88.4	0.01
Cloudburst Copenhagen, 2011	2	1	?
Flood in Bangladesh, 2007	649	0.001	9.4

COPENHAGEN | *Climate Adaptation Plan*

2011

HAFEN CITY | *The Urban Plan*

100 RC initiative by Rockefeller Foundation

2013

ROTTERDAM | *Adaptation Strategy*

2014

BOSTON | *Living with Water*

NEW ORLEANS | *Greater New Orleans Water Plan*

2015

NEW YORK CITY | *Rebuild by Design*

BARCELONA | *Climate Plan*

HOW

3 NEW YORK CITY

LET'S UNDERSTAND THE CITY

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data collection

THE EVOLUTION
THE PEOPLE
THE ENVIRONMENT
THE MORPHOLOGY
THE WATER

MAIN TOPICS

4 RED HOOK

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On-site observation

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THE BUILDINGS
THE LANDMARKS
THE WATER
THE PEOPLE

MAIN TOPICS

PHOTOGRAPHIC IMPRESSIONS

RESIDENTS INTERVIEW

5 DESIGN PROPOSAL

WHAT IF

4 STRATEGIES

- **reclaim** the water
- **protect** the coast
- **connect** the neighborhood
- **slow down** the surface run-off

3 SYSTEMS

1. THE WATERFRONT
2. UNDER THE EXPRESSWAY
3. ELEVATED WALKWAY

climate challenge

02

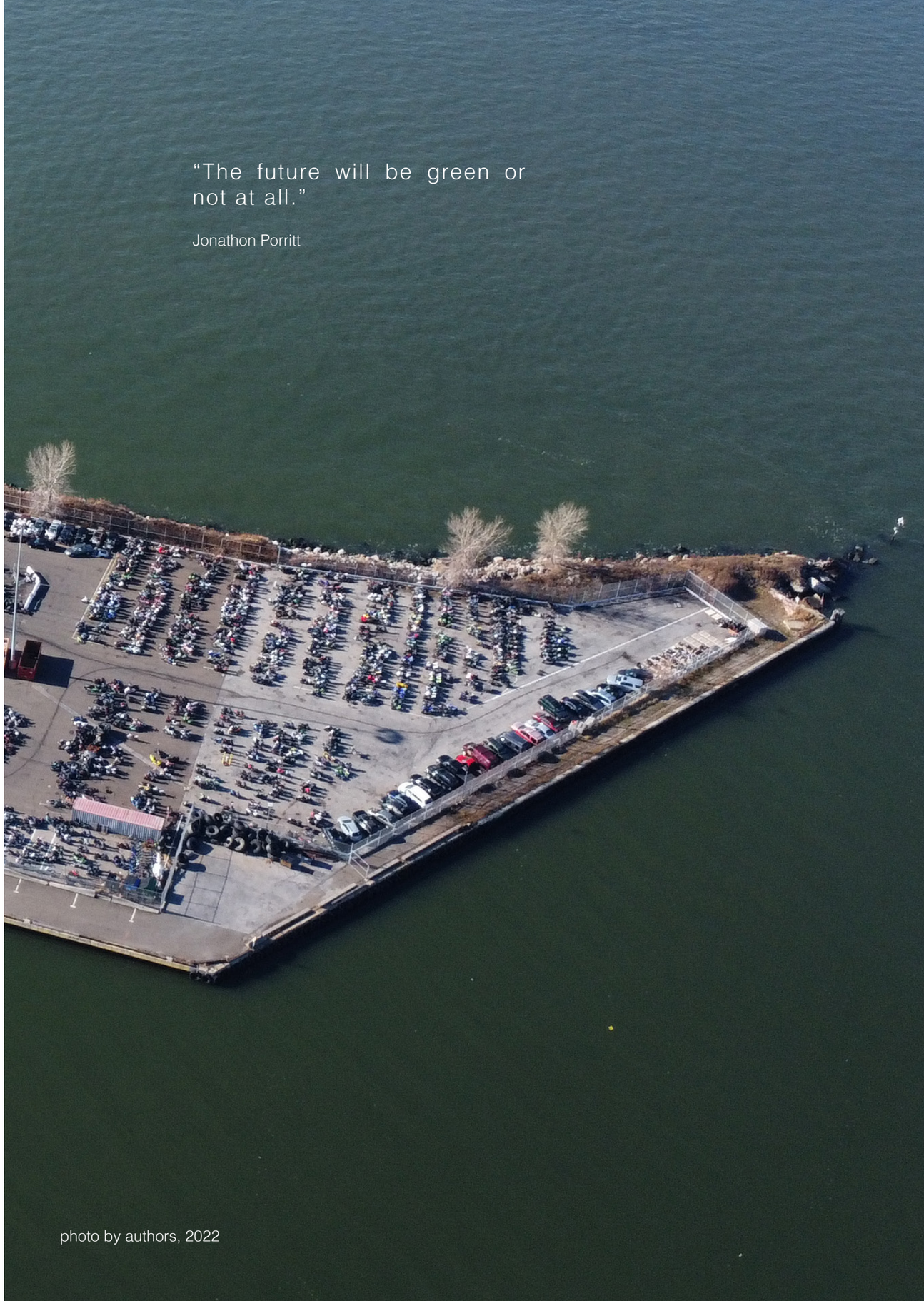


photo by authors, 2022

02.1 climate change

what is climate change?

1. IPCC, Sixth Assessment Report, 2022

"Climate change means a change in climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable periods of time."
(UNFCCC, 1992)

Climate change is a phenomenon that has always occurred on our planet. For instance, in the last 650,000 years there have been seven cycles of glacier advance and retreat, with the end of the last ice age occurring between 10.000 and 15.000 years ago, which marked the beginning of the modern climatic era. From this scientific evidence, it is clear that **climate change is part of a natural cycle** that repeats itself over time linked to minimal internal and/or external variations of our planet (volcanic activity, solar activity, variations in the insolation, etc.) that modify the amount of solar energy our planet receives.

So, why has climate change been progressing so rapidly in recent years?

The UNFCCC makes an important distinction between "climate change" and "climate variability", referring in the first case to the natural and inevitable process to which the earth is subject (solar irradiance, volcanic eruptions, El Niño–Southern Oscillation, Milankovitch cycles) and in the second case to phenomena caused by processes attributable directly or indirectly to the activity Human.

The cause of this abrupt change is unequivocally the result of human activity since the mid-20th century. Since the **Industrial Revolution**, human activities have released large amounts of carbon dioxide and other greenhouse gases into the atmosphere, which has changed the earth's climate. Natural processes, such as changes in the sun's energy and volcanic eruptions, also affect the earth's climate. However, they do not explain the warming that we have observed over the last century.

Human activities have contributed substantially to climate change through deforestation, land use, aerosol production and above all greenhouse gas emissions.[1]

public debate

"I have learned you are never too small to make a difference."
(Greta Thunberg)

This issue is increasingly entering the public debate, through petitions, demonstrations and artistic exhibitions, with the aim of giving voice to a phenomenon that needs to be understood, addressed and resolved as soon as possible.

Fortunately, some activists are moving to give voice to this issue, **Greta Thunberg** being one of the main figures. Swedish activist Greta Thunberg, born in 2003, has been and still is a worldwide symbol of youth environmentalism. Her name is inextricably linked to that of the "Fridays For Future" movement, which is now present in over 7.000 cities and has over 14 million activists. Its Friday strikes have inspired thousands of people around the world to take to the streets to demand that their governments do more to combat climate change and save the planet.

A lesser known figure is Isaac Cordal, a Spanish artist from Galicia, whose installations often touch on climate change issues. In the image on the left we see one of his works, renamed by the public as "Politicians discussing global warming", which is meant to represent the stereotype of the world's political class discussing climate change not caring about its explicitly manifesting effects.

Photo from the exhibition "Follow the leaders" of Isaac Cordal, renamed by the public "Politicians discussing global warming"

greenhouse gas emission

An IPCC report stated that global **greenhouse gas emissions from human activities have grown 48%** since pre-industrial times. Concentrations of carbon dioxide, methane and nitrous oxide are now more abundant in the earth's atmosphere than any time in the last 800.000 years. These greenhouse gas emissions, mainly from the **combustion of fossil fuels**, have increased the greenhouse effect and caused climate changes more than any other human activity[2].

2. IPCC, Sixth Assessment Report, 2022

- **Carbon dioxide** (CO_2): Fossil fuel use is the primary source of CO_2. Carbon dioxide can also be emitted from direct human-induced impacts on forestry and other land use, such as through deforestation, land clearing for agriculture, and degradation of soils. Likewise, land can also remove CO_2 from the atmosphere through reforestation, improvement of soils, and other activities.

- **Methane** (CH_4): Agricultural activities, waste management, energy use, and biomass burning all contribute to CH_4 emissions.

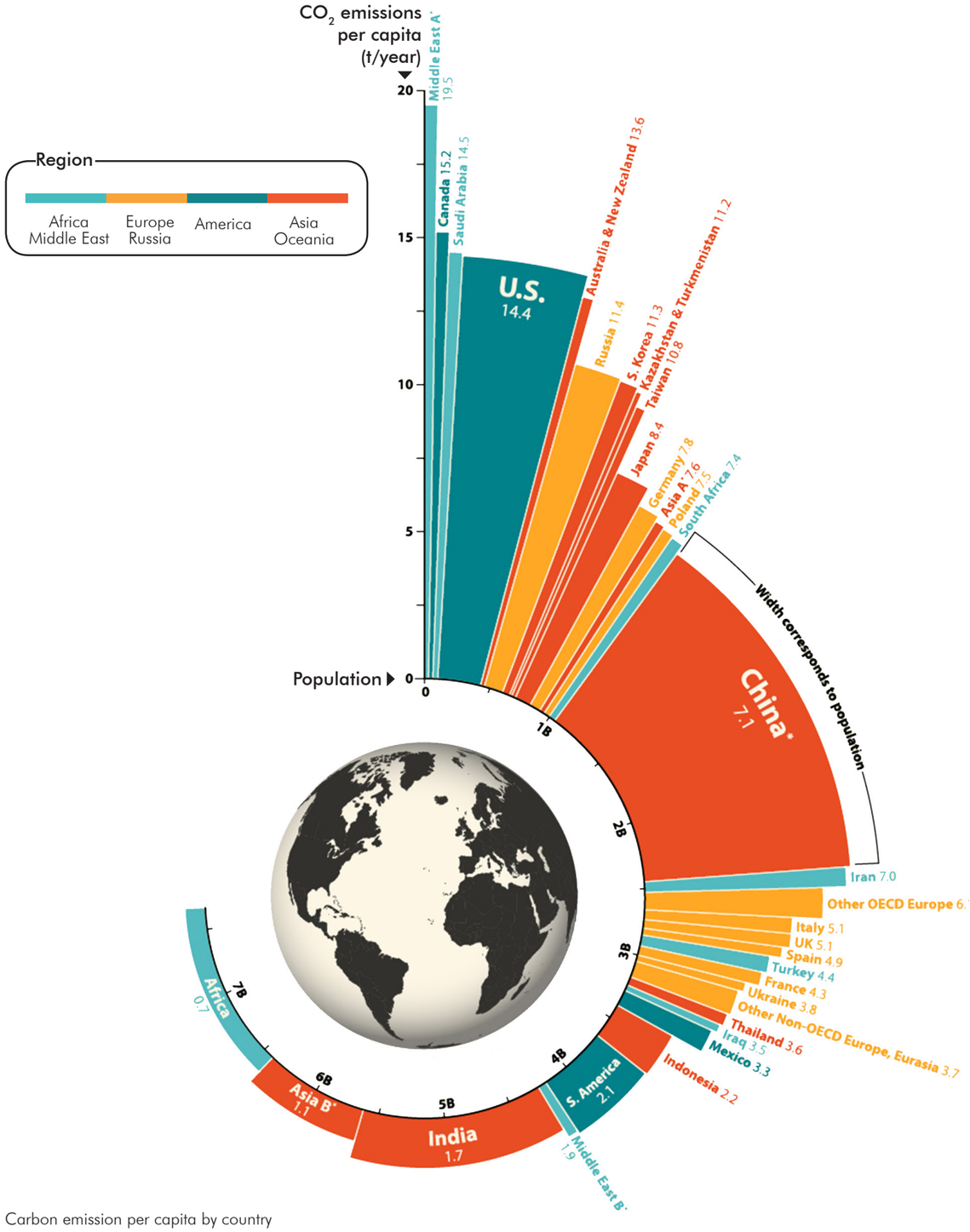
- **Nitrous oxide** (N_2O): Agricultural activities, such as fertilizer use, are the primary source of nitrous oxide emissions. Fossil fuel combustion also generates N_2O.

- **Fluorinated gases** (f-gases): Industrial processes, refrigeration, and the use of a variety of consumer products contribute to emissions of F-gases, which include hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6).

the graph

The graph reveals global **carbon emissions per capita by country**, using data from the International Energy Agency 2021.
A per capita perspective gives an objective idea of global emissions.
In fact, despite China being the highest emitter of CO_2, each American emits more than twice as much (14.4 tonnes) as each person in China (7.1 tonnes).
The **unequal global distribution of wealth** plays a role in carbon emissions. In fact, developed countries such as Qatar emit 31 tonnes of CO_2/year, while underdeveloped countries in Africa emit 0.7 tonnes of CO_2/year.
As well as wealth, the choice of energy sources plays a key role here. In the UK, Portugal and France, a much higher proportion of electricity is produced from nuclear and renewable sources.
For example, only 9.5% of France's electricity production comes from fossil fuels, compared to other developed countries such as the United States at 60.1% and Japan at 69.1%.
Massive CO_2 emissions, mainly through gas flaring, have meant that **major oil-producing** countries such as Bahrain, Oman, Kuwait, Qatar and the United Arab Emirates **have high CO_2 emissions per capita**, despite their small populations.[3]

3. IEA, Global Energy Review, 2021



Carbon emission per capita by country
Source: IEA and Aqal Group

02.2 climate change and **water**scapes

what is the role of water?

1. UN-Water, Climate Change Adaptation: The Pivotal Role of Water, 2010
2. IPCC, Climate change and water , 2008

"Climate change impacts are most felt through changing hydrological conditions including changes in snow and ice dynamics."
(United Nations, 2020)

Water plays a pivotal role in how the world reacts to the effects of climate change. Many experts have identified water as the environmental system on which climate change affects most destructively. The frequency of these climatic phenomena, which act both locally, in the form of floods, precipitation, coastal erosion, and globally, in the form of rising water levels, should question some structural limits of current urban forms and create new ideas for reflection for the configuration of these areas at risk, redefining water as a new generator of the shape of the city, in a dichotomous coexistence of risk and opportunity.
Therefore it becomes useful to deepen research that reflects on the changes in landscapes in close relationship with water, with the awareness of the intensity of the changes taking place.[1,2]

water-related disasters

3. UN World, Water Development Report: Water in a Changing World, 2009

The phenomenon of climate change is a general problem that is not limited to certain locations, in fact its consequences are expressed in different problems depending on the characteristics of a specific place, with consequences on the natural, social and urban environment.
In addition to the increase in the average temperature of the atmosphere of about 1.1°C (from 1850 to today), the climatic effects on water are evident in every region of the planet: **rising sea levels, melting glaciers, warming and acidification of the oceans, greater frequency, intensity and extent of so-called extreme climatic events**, such as prolonged droughts, torrential rains, hurricanes, cyclones and floods.[3]

sea level rise

4. UN-Water, Climate Change Adaptation: The Pivotal Role of Water, 2010
5. IPCC, Climate change and water , 2008

"As human beings, we are vulnerable to confusing the unprecedented with the improbable. In our everyday experience, if something has never happened before, we are generally safe in assuming it is not going to happen in the future, but the exceptions can kill you and climate change is one of those exceptions."

Al Gore

Sea level rise is a problem that has serious consequences in many parts of the world and is destined to have more and more. **More than half world's population lives within 60 kilometers of the coast**, and nearly half of the world's cities with more than one million people are located in the proximity of river estuaries.
Global sea level has risen by about 20 cm since reliable record began in 1880 and according the IPCC and other research by 2100 the sea level will be around 30 cm in the very high emission reduction scenario, and around 240 cm in the high emission scenario, compared to 1986-2005.
The C40 Cities Forum reports that by 2050, more than **570 coastal cities will face a sea level rise of at least half a meter.** This puts over 800 million people at risk due to the impact caused by the phenomenon. The global economic costs to cities due to rising seas and floods could amount to a billion dollars by mid-century.
The global sea level rise is due to **two main causes**: the **thermal expansion** caused by the warming of the ocean (the volume of water increases when it warms up) and the increase in the **melting of the ice**, both causes are produced by climate change.
Nickolay Lamm, an artist and researcher who graduated from the University of Pittsburgh in 2011, has created realistic images of what some US cities and landmarks would look like over the centuries if sea levels were to rise, as predicted by scientific studies. Some of these images have been featured on the following page.[4,5]

The hypothetical scenes created by artist Nickolay Lamm above show the Statue of Liberty, the Jefferson Memorial and Boston Harbour today and with a sea level rise of 2 metres (possible in 100 years according to Climate Central data)

flooding

6. UN-Water, Climate Change Adaptation: The Pivotal Role of Water, 2010
7. IPCC, Climate change and water , 2008

44% of all disaster events were floods, with an average of 163 floods per year.
Between 2000-2019, floods affected 1.6 billion people worldwide.

typologies:

1) Flash floods
2) Urban flooding
3) River flooding
4) Coastal flooding
(IPCC)

Flooding is one of the main hazards to which cities are exposed to. Floods are caused or amplified by both climate and human related factors. Major climate factors include heavy or prolonged precipitation, snowmelt, thunderstorms, storm surges from hurricanes and sea level rise. Human factors include structural collapsing of dams or barriers, altered drainage, and above all land cover alterations. In fact, deforestation, intensive monocultures and urbanization have considerably changed the landscapes around cities, leading to a considerable increase in waterproofed surfaces and to a decrease of the natural infiltration of pluvial water.

According to the IPCC there are four main different types of flooding events:

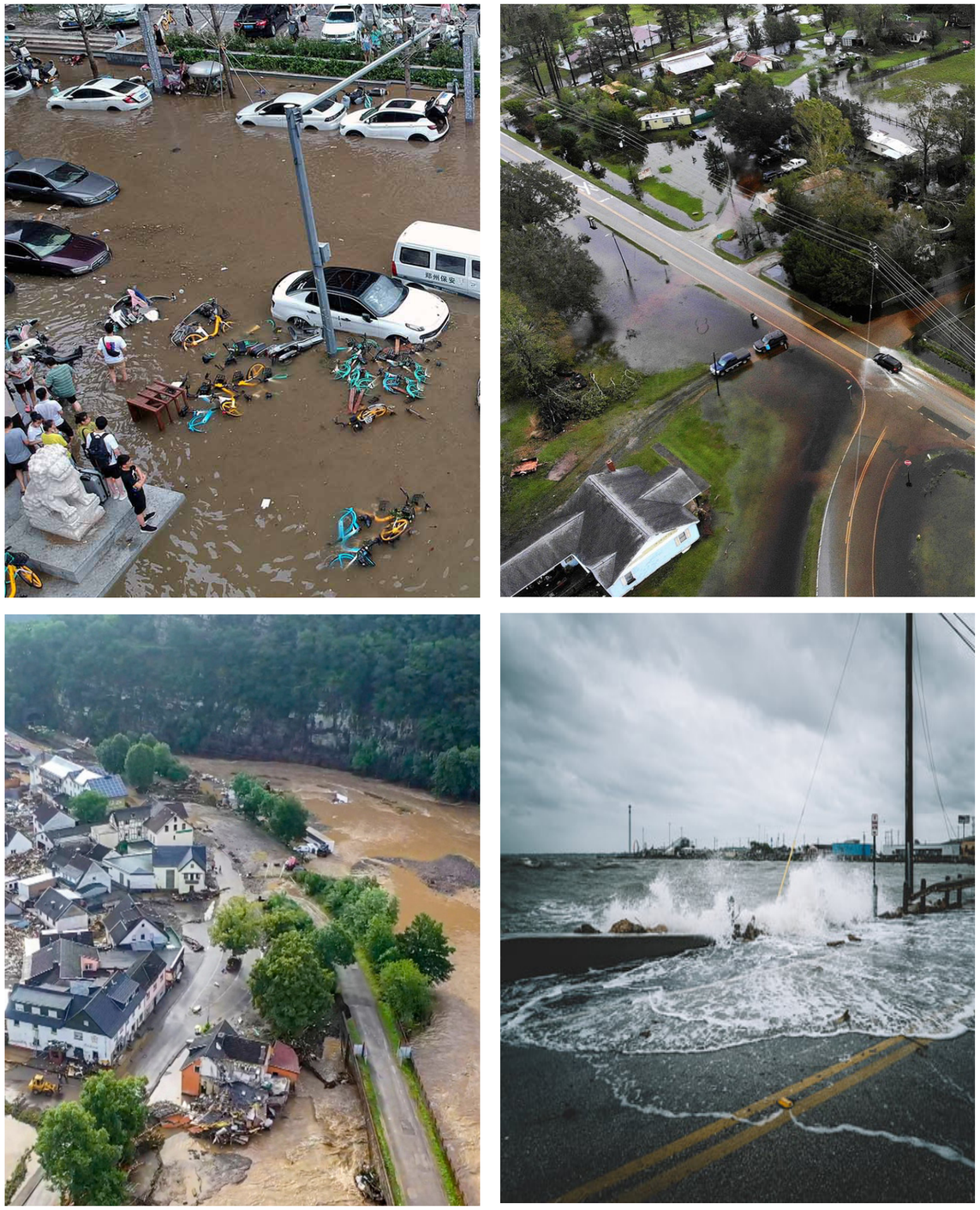
1) **Flash floods**: directly linked to heavy precipitation, occur in small and steep waterways and can be caused by short duration intense precipitation, dam or barrier collapsing, or collapse of debris and ice jams.

2) **Urban flooding**: directly linked to heavy precipitation, can be caused by short duration very heavy precipitation. Urbanization creates large areas of waterproof surfaces (such as roads, pavement and buildings) that slow down runoff and cause urban flooding.

3) **River flooding**: occurs when the water of a basin or a river overflows its banks and inundates adjacent low-lying areas, river flooding depends on precipitation as well as many other factors, such as existing soil moisture conditions and snowmelt.

4) **Coastal flooding**: mainly caused by rising sea levels, storm surges that accompany hurricanes and other storms that push large amounts of seawater towards the coast.

Floods do not occur only in cities but are in urban environment that they have more impacts, the unusual water quantities overcome the capacity of the drainage systems and they can carry around material of different nature - mud, rocks but also rubbles, cars and whatever they cross on the way - with devastating consequences on population, infrastructure and economy.[6,7]



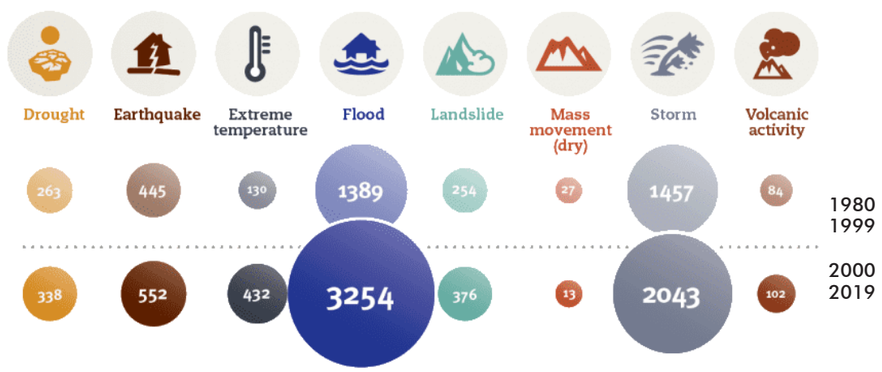
The four photos above represent examples of flash flooding, urban flooding, river flooding and coastal flooding
Source: Google images

8. Agire Onlus, report 2013
9. CRED, Annual Disaster Statistical Review 2014
10. UNDRR, Human cost of disasters: An ovwerview of the last 20 years, 2020

"We present probabilistic trends in continental flood risk and demonstrate that currently observed extreme flood losses could more than double in frequency by 2050 under future climate change and socioeconomic development.
Socioeconomic growth accounts for about two-thirds of the increased risk, as development leads to more buildings and infrastructure that could be damaged in a flood. The other third of the increase comes from climate change, which is projected to change rainfall patterns"
(JRC, 2014)

The 21st century has seen a dramatic increase in climate related disasters.
The percentage of climate related disasters doubled to 6.681 (compared to 3.656 in 1980-1999) and affected 3.9 bn people with 510.837 deaths (compared to 3.2 bn affected and 995.330 deaths in 1980-1999).
(UNDRR)

Over the next few decades, storm surges and high tides could combine with rising sea levels to further increase flooding in many regions, affecting human activities, coastal communities, infrastructure, and ecosystem. To the issue of water as a potential threat is added the issue of water as a resource and necessity, the supply of water resources that are not always easily available, and the pollution of water whose levels threaten the natural balance
Future scenarios indicate that as sea levels continue to rise and extreme events become more frequent, without the adoption of adaptation strategies, we will see an increase in flood risks for coastal communities.
To understand the extent of these disasters, it is useful to mention some data and projections developed by different research institutions.
In the period 2000-2010, floods and storms accounted for 81% of all disasters, generating 72% of overall economic damage and 23% of victims. On average, around 37 million people are affected each year by cyclones, hurricanes and typhoons; 366 thousand from landslides and 102 million from floods. More than 62% of the victims and nearly 90% of the affected populations live in Asia. Only 13% of disaster victims live in Europe. On the other hand, Europe and North America suffer to a greater extent from the economic damage caused by disasters. In 2007, for example, the 66 disasters that occurred in Europe generated almost 30% of the economic losses caused by natural disasters, but only 5% of the victims.
In 2012, the floods that hit the Republic of China were the most devastating catastrophe for the number of people affected, almost 35% of the victims of global disasters were Chinese.
In 2013, Typhoon Haiyan devastated the Philippines, killing around 8.000 people and causing damage equal to 5% of the national GDP.
In 2015, floods were confirmed as the most widespread catastrophe, accounting for 41% of total catastrophic events, responsible for 9% of deaths, and 39% of economic damage.[8]
The future scenarios, even if characterized by widespread uncertainty, report a situation in clear worsening, as emerges from the analyzes of the IPCC and confirmed by the study of the Joint Research Center of the European Union.



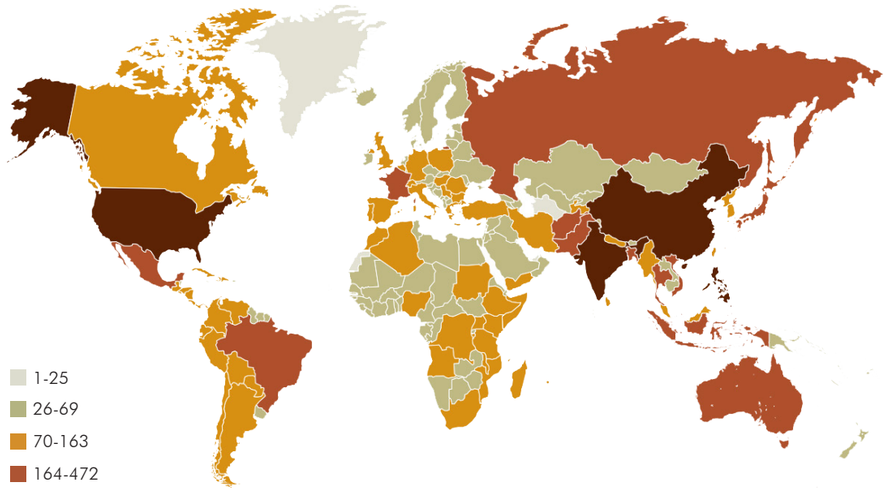
Total disaster by event: 1980-1999 vs 2000-2019
Source: United Nation Office for Disaster Risk Reduction data (UNDRR)

11. *The Costs of Climate Adaptation*, Lisa Dougherty-Choux, 2015;

Nothing has revealed more clearly the need for a society-wide focus on disaster risk reduction than the current COVID-19 pandemic, which has exposed many shortcomings in disaster risk management, especially in the decision making capacities of political leaders despite repeated warnings.

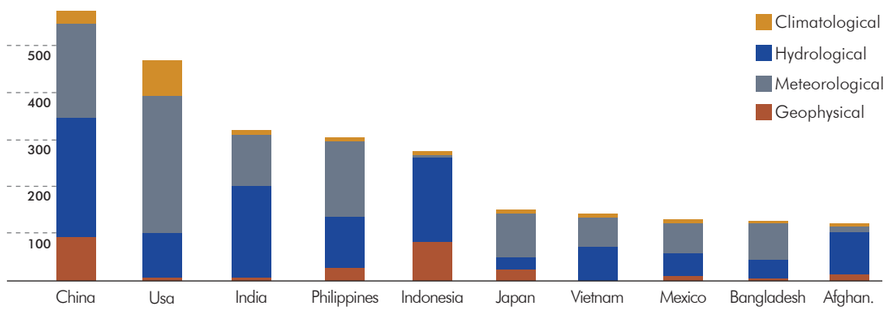
In terms of countries affected globally, China (577 events), the United States of America (467 events), followed by India (321 events), the Philippines (304 events) and Indonesia (278 events). These countries have large and heterogeneous continental masses and high population densities that are often concentrated in risk areas.

These risks are accompanied by a change in the geography of the territory not immediately visible, but affected by the changes in the past in any case for a short time. A geographical metamorphosis is taking place. The sea level rises faster and faster eroding the coast. Within a century, the geographical profiles will have to be redesigned and large cities such as Tokyo, Singapore, Bangkok, New York, Miami, Rotterdam, Copenhagen, Venice, could be submerged.
Let's imagine that the 7.5 cm increase in sea level in the past 30 years has caused an advance towards the hinterland of about 7.5 meters. Consequently, an increase consistent with future projections would result in the disappearance of entire communities, urban agglomerations, animal and plant species, crop loss and severe economic damage.
However, reporting in detail the situation of each city, region or country would be complex and redundant, it was therefore preferred to make a synthetic overview around the globe, describing the extent of these phenomena through some real disasters.[9,10,11]



Number of disaster per country (2000-2019)
Source: United Nation Office for Disaster Risk Reduction data (UNDRR)

China has experienced a wide variety of more than 500 catastrophic events.
Overall, eight of the top 10 countries for disaster events are in Asia, but with significant differences between event types.



Top 10 countries by disaster events (2000-2019)
Source: United Nation Office for Disaster Risk Reduction data (UNDRR)

EUROPE

1. Adaptation cost in the Netherlands: Climate Change and flood risk management, Aerts, J.C, 2009

"From 2000 to 2012, floods in European Union countries averaged €4.9 billion a year in losses. In the floods of June 2013, losses tipped €12 billion in nine countries of Central and Eastern Europe. The annual average losses could increase to €23.5 billion by 2050."
(B. Jongman, 2014)

Most European coastal regions experience absolute and relative sea level increases, although there are significant differences in the rates of sea level change in Europe.
The European Union is developing new strategies to ensure that all members consider the issues related to climate change within their development plans. First of all, the Netherlands, where, due to its geographical location, rising waters represent an extreme and imminent danger, in fact, about a third of the country is below sea level.
Despite being subjected to a high hydrogeological risk, Dutch cities have a low index of vulnerability to flooding thanks to the good management and regulation of infrastructures and the proven political-administrative and social preparation for a possible emergency, but, above all, thanks to the Zuiderzeewerken (1927-1960) and the Delta Plan (1954-1997), respectively consequences of the floods of 1916 and 1953, which prompted the country to build a complex network of defense and water management well before the threat was made manifest global climate change.[1]
In fact, most residents of the Netherlands are not worried about facing serious problems due to the increased risk of flooding that climate change brings. Eighty per cent are 'very' or 'fairly' confident that the government will take appropriate measures in time, according to a survey of nearly 1.100 people conducted by the Flood Protection Programme.
On 2 July 2011, in less than 3 hours, 15cm of rain fell on Copenhagen, flooding neighborhoods, homes and streets and causing damage for over a billion euros. An extreme event that, for a city that has always been at the forefront of sustainable development issues, represented a wake-up call not to be ignored. In fact, once the emergency was over, the Danish government admitted that it had not prepared an adaptation plan, a plan that was implemented in just 2 years from that episode.
The 2013 flood is the worst the Bavarian city of Passau has seen in 500 years. The rivers Inn, Danube and Ilz converge in the historic centre of Passau. Much of the city was inaccessible on foot and the electricity supply was cut off as a precaution; rescuers used boats to evacuate residents from flooded parts of the city.
In July 2021, heavy rainfall caused severe flooding in the German states of North Rhine-Westphalia and Rhineland-Palatinate, as well as in Luxembourg, along the River Meuse and some of its tributaries in Belgium and the Netherlands.
At the time of the rains, the soils were partly saturated, plus some stretches are very narrow with steep slopes leading to funnel-like effects in extreme flooding.
The floods claimed at least 184 lives in Germany and 38 in Belgium and caused considerable damage to infrastructure, including houses, motorways, railway lines and bridges. Road closures left some places inaccessible for days, isolating some villages from evacuation routes and emergency response.

Aerial view of the flooded village of Oude Tonge on Goeree-Overflakkee during the 1953 flood.

Photo taken from a US Army helicopter.

An aerial view of the flooding in Passau taken on 3 June 2013, showing how the flooding made it impossible to move on the road in some cases.

Photo by Wolfgang Rattay via Reuters

The photo summarises the image of a city where many buildings and services are located below street level and where rainwater and wastewater are in a combined piping system, contaminated water has penetrated buildings and city infrastructure.
Jørn Thomsen, DMI meteorologist, described the cloudburst as the strongest ever measured in Copenhagen.

2. UNDRR, Human cost of disasters: An ovwerview of the last 20 years, 2020
3. *Yangtze River floods* in Encyclopaedia Britannica, Kenneth Pletcher, 2011

Asia suffered the largest number of catastrophic events, between 2000 and 2019, there were 3.068 catastrophic events in Asia, followed by the 1.756 events in the Americas and 1.192 events in Africa.

In Asia, 15 million cities may be affected by sea level rise by 2030. The situation is particularly alarming for countries such as China, Japan, India, Indonesia and the Philippines. Bangladesh, Vietnam and Thailand will see territories currently inhabited by about 20% of their population disappear below the high tide level.[2]

Cities and villages in the Republic of China, a country where are concentrated more than 40% of the world's water resources, are being hit harder and harder by flooding. Historically, floods occur during the rainy season, and are concentrated mainly along the "seven great rivers", where lives 70% of the population and is produced 70% of the country's GDP.
The Yangtze River, for example, has killed hundreds of thousands of lives on multiple occasions. The floods of 1911 and 1954 killed 100.000 and 30.000 people respectively. However, the most disastrous occurred in 1931, after a period of drought, heavy snow and rain fell on the territory, followed by at least 9 cyclones, which led to the overflowing of the Yangtze and Huai rivers, causing between 2 and 4 million deaths and affecting more than 50 million people. The Yellow River and the Grand Canal also faced serious flooding, while the flooding of other rivers was minor.
Excessive deforestation, reclamation of wetlands and the extension of river dam networks transformed the regular flood pulses, which were an integral characteristic of the river ecosystem, into destructive floods that devastated human communities.[3]

Emergency staff members check a logistics market flooded by the Yangtze River in southwest China's Chongqing Municipality in August 2020.

Photo by Huang Wei via Xinhua

4. AIDMI, Understanding the 2007 floods in South Asia
5. IFRC, Bangladesh: Monsoon Floods - Final Report, 2007
6. AMDA, Flood Disaster in Japan, 2021

Bangladesh, crossed by more than 700 rivers and with a coastline of 750 km, is completely surrounded by water. More than 5 million of its inhabitants live in areas affected by cyclones and hurricanes and more than half of the population lives within a radius of 100 km from the coast. According to a 2012 Asian Development Bank (ADB) report, Bangladesh is the country in the world most vulnerable to the risks associated with climate change. In fact, the floods from monsoon rains occur on a regular basis, every year around 18% of the country is flooded, killing hundreds of people and destroying millions of homes, with consequent migrations of about 500.000 people a year to makeshift camps in the suburbs of Dhaka.[4]
An example is the recent floods caused by Cyclone Amphan in 2020, which, according to the report of the International Federation of Red Cross and Red Crescent Societies, affected more than 10 million inhabitants, causing record damage for nearly 14 billion dollars, but causing the deaths of only 26 people, which when compared with the 3.363 victims of Cyclone Sidr in 2007, demonstrates how the long-term resilience strategy can reduce the country's vulnerability.[5]

Even Japan, whose cities are the result of a constant process of technological modernization, does not escape these contemporary tragedies.
One of the latest alert dates to August 2021, when the authorities issued an evacuation order for over 2 million people due to the torrential rains that have been running for days in the western area of the country.[6]

A village surrounded by flood waters as seen from a Pakistan Army helicopter during relief operations on 13 September 2010 near the village of Goza in Dadu district in Sindh province, Pakistan.

Photo by Daniel Berehulak

AFRICA

7. World Bank Group, Annual report, 2021

The 2021 report of the World Bank Group states: "Relative to 1970-79, the frequency of droughts in sub-Saharan Africa nearly tripled by 2010-19, it has more than quadrupled for storms, and it has increased more than tenfold in the case of floods."

In Africa, regions affected by drought border areas plagued by floods which increase the risk of epidemics.
The year 2020 was the fourth-warmest year for the African continent since the year 1910. The rises in temperature and changes in rainfall patterns have led to the increase in frequency and intensity of natural disaster across the continent. According to United Nations data, the number of people affected by seasonal flooding in East Africa has quintupled in four years, from 1.1 million in 2016 to nearly 6 million in 2020, although the 75% of Sub-Saharan Africa's floods and storms are concentrated in Kenya, South Africa, and Mozambique.
Indeed, in 2019, Cyclone Idai (second-deadliest tropical cyclone recorded in the Southern Hemisphere) has seriously affected Mozambique, flooding an estimated 3.000 km^2 of land, affecting nearly 1 million people, killing more than 1 thousand people and causing more than 2 billion of dollars in damage and in 2020, almost a full year after Cyclone Idai, more thaqn 100.000 people was still living in shelter with only basic services.[7]

The continuous increase in population density that is taking place in Dakar and its surroundings has led to the erection of spontaneous, anarchic and irregular neighborhoods, making them areas extremely vulnerable to disasters.
In the photo a hyperdensified district of Dakar after a flood.

Photo by Joe Penney via Reuters

Torrential rains displace hundreds of thousands of people across Africa each year.
In the photo the villagers go about their business in a flooded market center in Kisumu, about 400 kilometers west of the capital Nairobi, Kenya.

Residents cross a flooded street after heavy rains in early September 2020 in Keur Massar

"I have to go to university - either I take a boat or I walk on the water," Abdou said, before settling into a traditional wooden pirogue to go up the flooded highway.

OCEANIA

"Water literally seeps up through the ground below. This could happen in minutes, and I witnessed many communities being suddenly flooded. Even the airport runway was underwater at times." (Sean Gallagher)

The sinking islands of Oceania have become a symbol for the severe and unprecedented consequences of man-made global warming. As states in the Toda Peace Institute policy brief, many of the islands face extreme exposure and rather limited options for adaptation. Notable examples include some outer islands of Malaita, a province of the independent state of the Solomon Islands. People have started to relocate to mainland Malaita as islands become uninhabitable due to sea-level rise and its effects. Low-lying atoll countries, such as Tuvalu, Kiribati, or the Marshall Islands, are particularly vulnerable to vanishing. Between January and March, its seasonal "king tides" cause severe flooding .
Three Pacific islands, territories for which climate change is a real threat because the sea is already rising, have asked the governments of the world to draw up an agreement that will bring the emissions of the naval sector to zero by 2050.[8]

8. ADB, Climate Risk Country Profile - Tuvalu and Kiribati, 2021

Each year, the sea level rises by about 2cm. While this may not seem like much, it's a big deal considering the islands are less than a meter above sea level, which puts them at risk of flooding and storm surges. It is curious that the people of Kiribati account for little or nothing in terms of greenhouse gas emissions, but are forced to face the direct consequences of global warming.

Photo by Sean Gallagher

Much of the village of Eita has drowned due to the flooding of the sea. The people of Kiribati are under pressure to re-locate due to rising sea levels.

Photo by Jonas Gratzer via Getty Images

The Republic of Kiribati is experiencing an effect that the locals call "baki aba" which is grim with "hunger for land"; this is due to the fact that the population increases as the atolls shrink.

Photo by Diego Battistessa

Main square of Nui Island under water. Tropical Cyclone Pam caused diffused damage and marine flooding.

Photo by Silke Von Brockhausen via UNDP

According to the Office for the Coordination of Humanitarian Affairs, floods are the most common disaster also in Latin America and the Caribbean, with 548 floods occurring since 2000. Despite the relatively low death toll directly associated with floods, they have affected almost 41 million people and caused almost $26 billion in total damages.

In the United States, nearly 40% of the population lives in relatively densely populated coastal areas, where sea level plays a role in floods, coastal erosion and storm hazards.

Rising sea levels and coastal flooding will present growing challenges, especially for some cities on the east coast of the United States, such as New York, Miami and New Orleans. These cities have a long history of flooding caused by violent and disastrous hurricanes, including Hurricane Katrina (2005), Hurricane Sandy (2012), Hurricane Harvey (2017) and Hurricane Irma (2017).

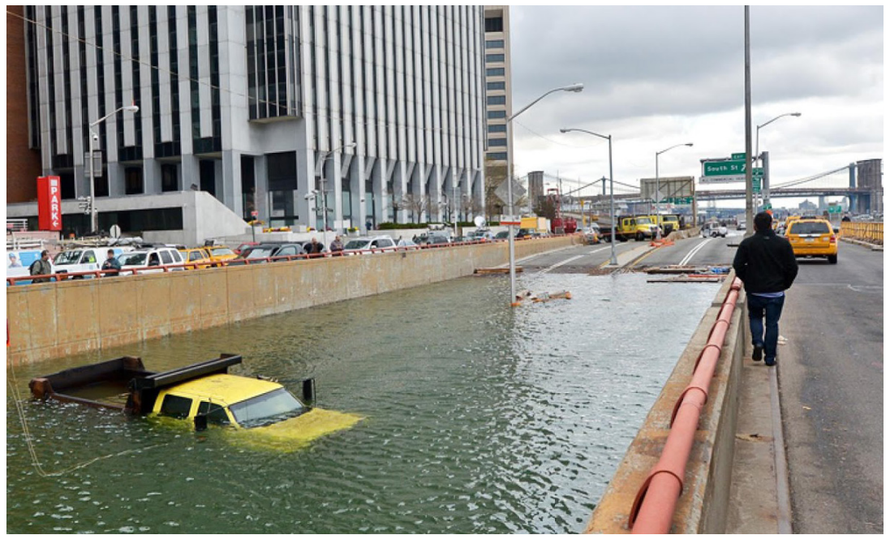
Let's talk for example of Hurricane Katrina in 2005, part of the tragedy of Katrina is related to the way humans have altered the landscape around New Orleans. New Orleans was once above sea level when French settlers first arrived there 300 years ago, but marsh drainage caused the city to sink. Areas below sea level, those most at risk of flooding, generally housed the city's poorest residents. In addition, New Orleans relied on a system of levees and dams built by the Army Corps of Engineers to keep the city from flooding. But when Katrina hit on August 2005, the levees failed. As a result, 80 percent of the city flooded, causing more than 100 billion in damage and killing 1.577 people, in Louisiana.

Seven years later, Hurricane Sandy brings New York City to its knees, flooding streets, tunnels and subway lines and cutting power in and around the city. The United States reported 157 deaths and $ 65 billion in damage.

Those severe storms that once occurred about every 500 years now occur more frequently.[9,10]

9. NCA, Fourth national climate assessment, 2018
10. U.S. EPA, Impacts of climate change, 2017

The 2021 report of the World Bank Group states: "Relative to 1970-79, the frequency of droughts in sub-Saharan Africa nearly tripled by 2010-19, it has more than quadrupled for storms, and it has increased more than tenfold in the case of floods."



A truck is submerged in lower Manhattan following Hurricane Sandy in 2012.

Photo by Justin Lane via Epa/Corbis

The photo shows the devastation from Hurricane Harvey, which caused widespread devastation in the greater Houston area. Most of the rain fell in Nederland, Texas, which received more than 150 cm of rain in 7 days. Flooding in the region displaced 30.000 people and damaged or destroyed more than 200.000 buildings.

New Orleans freeway interchange nearly totally flooded during Hurricane Katrina in 2005.

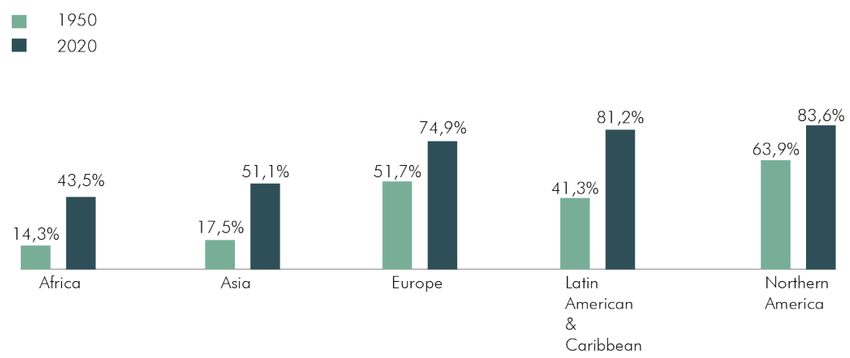
Photo by Jenn Bennet via Medium

02.3 climate change and **built**scapes

what is the impact on builtscapes?

Today most people in the world live in the city, so it is important to understand the effects of climate change on the built environment of the city. According to an analysis conducted by the U.N Population Division, it is possible to understand in which areas of the world the urban population grew the fastest from 1950 to 2020.

Today 56.2% of the global population lives in cities. The biggest change has been in Latin America and the Caribbean, with 81.2% of the population living in urban areas, up from 41.3% in 1950. Africa and Asia are urbanizing faster than any other regions in the world. **By 2050, 66% of the world's population is projected to be urban.** For example, Nigeria is projected to get an additional 212 million urban dwellers by 2050, China 292 million and India 404 million. It is important to think about the city, because our choices in urban infrastructure will significantly affect the way we manage climate change and our future life.



Comparison of world population in 1950 and 2020
Source: U.N Population Division

city: a cause of climate change

1. *Cities worldwide aren't adapting to climate change quickly enough*, John Rennie Short, 2021

The city's responses to climate change fall into two closely related categories: **mitigating (reducing) emissions** that drive climate change and **adapting to effects** that can't be expected.[1]
According to UN Habitat, cities consume 78% of the world's energy and produce more than 60% of greenhouse gas emissions, mainly from heating and cooling buildings and powering cars, trucks, and other vehicles. Urbanization also makes people more vulnerable to climate change impacts. For example, as cities expand, people clear vegetation, which can increase the risk of flooding and sea level rise. They also create impermeable surfaces that don't absorb water, such as roads and buildings. This contributes to flooding risks and produces urban heat islands.

the vulnerability of living in the city

2. *U.N Habitat Report*, 2018

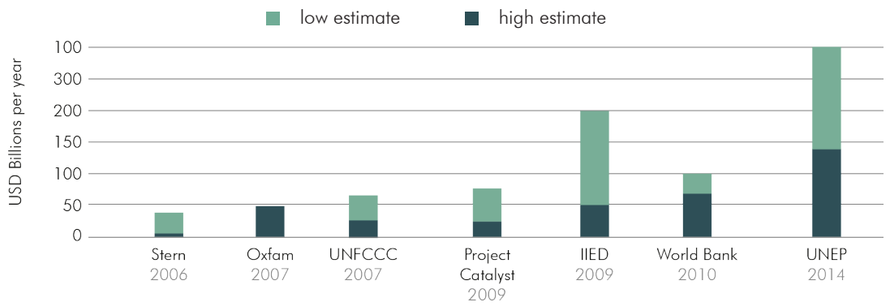
The city will face an increase in disastrous events related to climate change, such as floods, storms, and heat waves during this century. These disasters will affect the most vulnerable areas of the city, infrastructures, sewage networks, food distribution areas and more. Climate change impacts on urban infrastructure but also on the health system. This is especially noticeable when heat waves occur, because cities create "heat islands", much warmer than in rural areas. Older people are at particular risk of mortality in urban areas, creating a new kind of challenge for our health systems. In October 2018, the World Health Organization (WHO) said in a report that 93 per cent of the world's children breathe toxic air every day. According to the report, 1.8 billion children breathe air that is so polluted it puts their health and development at serious risk. WHO estimates that in 2016, 600,000 children died from acute lower respiratory infections caused by polluted air. The most affected populations are the urban poor who tend to live along river banks, on hillsides and slopes prone to landslides, near polluted grounds, on decertified land, in unstable structures vulnerable to earthquakes, and along waterfronts in coastal areas. The urban poor is indeed increasingly vulnerable: more than 1 billion people live in slums and informal settlements and are highly vulnerable to climate change (U.N Habitat)
Despite these risks, many cities have not yet addressed climate change. The reasons include a lack of relevant city policies and action plans; existence of regulations on urban planning and environment which have not been adjusted to manage climate change; slow response to climate disasters due to lack of capacity and resources; and lack of public awareness on climate variability and climate change-induced hazard mitigation.[2]

Photo of polluted New York, by Jeffrey Swanson, 2017

the cost of climate change

As climate change becomes more severe than initially projected, **the estimated need** for adaptation funding for developing countries **doubles or triples every few years**. Numerous reports have emerged over the past decade with estimates of adaptation needs based on current knowledge about climate change, with increasing estimates revealing uncertainty and evolving scientific knowledge.[3] The most recent estimates show that the developing world will require $140 to $300 billion a year by 2050 to adapt to climate change. Taking the most recent commitments for adaptation in 2013 and the lowest estimated needs by 2050, **adaptation finance will need to increase by 438% by 2050.**[4]

3. *The Costs of Climate Adaptation*, Lisa Dougherty-Choux, 2015;
4. *Adaptation Gap Report*, UNEP, 2014



Estimated adaptation finance needs from different reports (in different years)

Source: World Resources Institute

Case study: New Orleans

Sea levels in the New Orleans area are likely to increase by 1 to 4.6 feet (0.3 to 1.4 meters) by 2100. A study by the Pacific Institute has concluded that a rise in sea level of 1.4 meters could put 480,000 people at risk of a flood event along the west coast of North America.[5]

In response to levee failures that inundated New Orleans during Hurricane Katrina in 2005, the US government spent more than $14bn to build an improved flood control system for the city, which was completed in 2018.[6,7]

5. *Causes of accelerating sea level on the East Coast of North America, Davis J.L., Vinogradova N.T., 2017;*
6. *The economic risks of Climate Change in the United States, Risky Business, 2014*
7. *NOAA Office for Coastal Management , NoReport, NOAA, 2017*

$106 Billion

By 2050, up to $106 billion worth of coastal property will likely be below sea level (if we continue on the current path).

$12 Billion per year

Over the next five to 25 years, greenhouse gas-driven temperature rises will likely necessitate the construction of new power generation that would cost ratepayers up to $12 billion per year.

$12 Billion per year

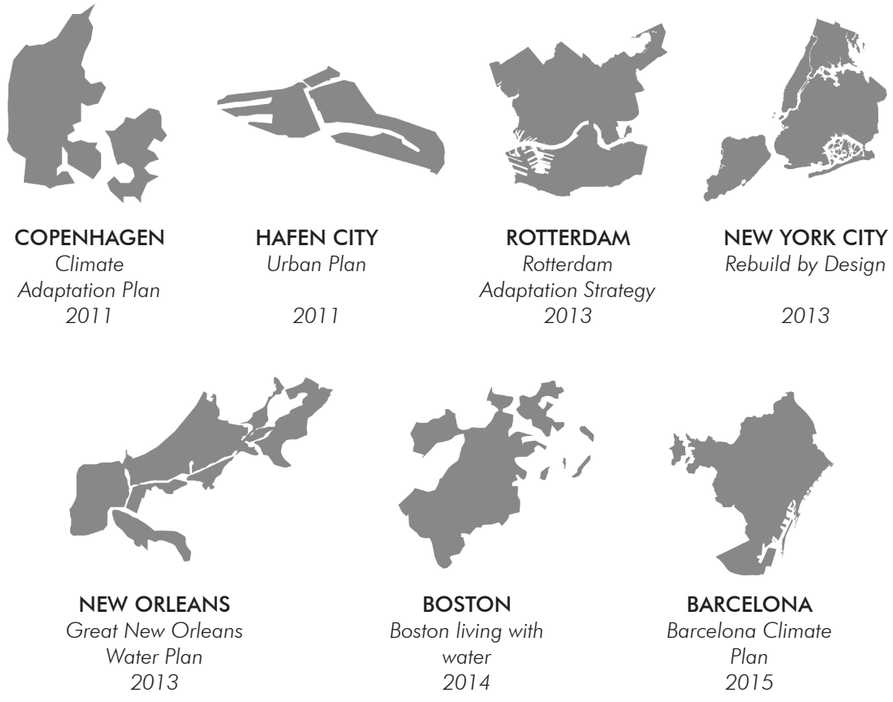
Without adapting to the changing climate, some places could see a decline in yields of more than 10% over the next five to 25 years, with a 1-in-20 chance of losses of crops by more than 20%.

Source: NOAA Office for Coastal Management

the strategies of the cities

"As New Yorkers, we cannot and will not abandon our waterfront. It's one of our greatest assets. We must protect it, not retreat from it"
Michael R. Bloomberg

National governments and local communities are working for the definition of policies and actions for mitigation and adaptation to climate changes. **Flood risk management has become one priority on the political agenda**. The issue of resilience, that is, the ability of a system to adapt to change, which in a transversal way is going through different cultural spheres, it entered in the urban and architectural debate. It is now a shared opinion that sudden climate change requires to cities **to plan interventions that allow them to adapt and mitigate the resulting risks**.
It is important to mention some city adaptation plans that give great importance to water management:
Climate Adaptation Plan of Copenhagen (2011);
Rotterdam Adaptation Strategy (2013);
the urban plan of Hafen City (2011);
Greater New Orleans Water Plan (2013);
Rebuild by Design project (2013);
Boston Living with Water (2014);
Barcellona Climate Plan (2015).
There are also **many projects** dedicated to helping cities around the world become more resilient to the physical, social and economic challenges. Among these, an example is certainly 100 Resilient Cities, financially headed by Rockefeller Foundation, which for some years has been helping cities around the world to become **resilient** from an economic, environmental, and social point of view.
In 2017, it had one hundred scattered municipalities around the globe.



coexistance with water: urban design principles

Adaptation plans are based on a set of **design principles** that are developed through intervention strategies aimed at **making cities resilient to climate change**. These strategies can be described as a toolbox that planners can refer to in different urban projects. The toolbox allows to work strategically in different small areas in order to benefit the whole neighborhood (or city) as an **urban acupuncture**.
The main concept is to design **with** water and **for** water.
This means to have different design strategies that allow water **to flow, to stop and to slow down**.
Today we can say that **we don't have to expel water from the city**, but to design spaces for it to coexist with water.

the toolbox

8. Climate adaptive solutions for the neighbourhood, J. E. van Lohuizen , 2014

The toolbox includes a series of **small-scale interventions** to facilitate adaptation to impact of climate change in the existing urban tissue. [8]
The design principles contained in the toolbox are categorized into **6, and some of them are interrelated**.
Their connection is due to the fact that the goal of this thesis is **not to work on a single problem**, but to try **to think in a "bigger" and global way** since the categories represented are part of a single system.
The new approach includes strategies such as the re-use of rainwater, the use of permeable pavements and materials that reduce the heat island effect, the creation of underground and in-building cisterns that collect water on rainy days and re-use it when needed (e.g. in summer), the planting of trees that provide cooling through both transpiration and shade.
The citizen is involved in the strategies thanks to the realization of areas for participation activities and awareness of climate change issues. It is important that citizens really know the effects, in a tangible way, so they can help in the project drafting.

The interconnected toolbox
Source: Retrieved from J. van Lohuizen, Climate adaptive solutions for the neighborhood, 2014.
Edited by the authors, 2022

02.4 climate change and **human**scapes

Why are people important in the context of climate effects?

1. *World Population Prospects: The 2017 Revision, United Nations, 2017;*
2. *UNESCO's Contribution to Face Global Water Challenges, B. Jiménez-Cisneros; A. K. Makarigakis, 2019;*

People play a key role in the impacts of climate change. Human activities are causing significant environmental problems, which are worsening faster every year. It is important to note that, although the situation is already very critical.[1] The upward trend in population size along with an improved quality of life are **expected to continue**, and with them the demand for water.[2]

As mentioned in the previous chapter, the climate change is responsible for more frequent and intense water related extreme events, such as floods and droughts, therefore the link between people, water and the effects of climate change is very important. Finally we can say that people have a main role because they are the **drivers** of climate change, but at the same time the **victims**.

climate change and social inequality

3. *Climate change, health, and equity: opportunities for action, L. Rudolph, S. Gould, J. Berko, 2015;*
4. *Climate Change: Addressing the Impact on Human Security, Barnett, O'Brien and Leichenko, 2008;*
5. *Fairness in Adaptation to Climate Change, W. Neil Adger, Jouni Paavola, Saleemul Huq, M. J. Mace, 2006;*

More attention has always been given to the effects of climate change on nature, and less to the effects on people. All countries are vulnerable to climate change, but poor countries are the most vulnerable, being the most exposed and having less means to adapt. We know that inequality is one of the main reasons why disasters such as drought, floods or tropical storms affect some people more than others.[3]
The effects of climate change impact more on people living in areas vulnerable to coastal storms, flooding, rising seas, or people living in very poor areas built with unsustainable practices. The effects impact on professions, tourism workers, agriculture, or coastal areas. Climate change creates insecurity through the "double vulnerability" that arises when poverty is compounded by climatic change.[4]
This is a justice issue because those that are least responsible for climate change are the most vulnerable to its effects.[5]

"Climate change globalizes and radicalizes social inequality; it exacerbates inequalities of rich and poor, core and periphery, and at the same time dissolves them in the face of a common threat to humanity. Climate change combines with the inequalities arising from globalization, decoupling the producers and subjects of risk."

Ulrich Beck

water-related ilness and death

6. *Climate impacts on water-related illness. The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment, U.S. Global Change Research Program, 2016;*
7. *Untangling the impacts of climate change on waterborne diseases: A systematic review of relationships between diarrheal diseases and temperature, rainfall, flooding, and drought, A. P. Woster, R. S. Goldstein, and E. J. Carlton, 2016;*

In most of the United States, climate change is expected to affect fresh and marine water resources in ways that **will increase people's exposure to disease-causing water-related contaminants.** Increased water temperatures associated with climate change are expected to alter the seasonality of growth and geographic range of harmful algae and coastal pathogens, and runoff from more frequent and abundant rainfall is expected to increasingly impair recreational waters and drinking water sources through increased introduction of pathogens and toxic algal blooms.[6]

Heavy rainfall, flooding, and high temperatures have been linked to increases in diarrheal disease and can **increase other bacterial and parasitic infections** such as leptospirosis and cryptosporidiosis.[7]

Photo of women walking on a flooded street in Bogura, Bangladesh, by SOPA, 2020

food safety

6. *Climate impacts on water-related illness. The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment, U.S. Global Change Research Program, 2016;*
9. *Climate Change, Global Food Security, and the U.S. Food System, U.S. Global Change Research Program, 2015;*

Climate change, including rising temperatures and changes in weather extremes, **is projected to adversely affect food security** by altering exposures to certain pathogens and toxins.[6] Climate change is very likely to affect global, regional, and local food security by **disrupting food availability, decreasing access to food, and making utilization more difficult**. Climate change is projected to result in more frequent disruption of food production in many regions and in increased overall food prices. **Food quality also is expected to be affected by rising CO_2 concentrations** that decrease dietary iron, zinc, protein, and other macro- and micronutrients in crops and seafood.[9]

mental health

Mental health consequences, ranging from minimal stress and distress symptoms to clinical disorders, such as anxiety, depression, post-traumatic stress, and suicidality, can result from short-term or prolonged exposure to weather or climate events and their consequences on health. These mental health impacts can interact with other health, social and environmental stressors to diminish an individual's well-being. Some groups are more vulnerable than others, including the elderly, pregnant women, people with pre-existing mental illness, economically disadvantaged communities, tribal and indigenous communities, and first responders.[10] Individuals whose families have experienced a flood or flood risk report higher levels of depression and anxiety, and these impacts may persist several years after the event. Disasters place a heavy burden on children's mental health when there is a forced displacement from their home or a loss of family and community stability. Increased consumption of alcohol and tobacco is common following disasters and droughts. Higher temperatures can lead to an increase in aggressive behavior, including murder. Social cohesion, good coping skills, and preventative disaster planning are examples of adaptive measures that can help reduce the risk of prolonged psychological impacts.[11]

10. Mental health and well-being. The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment, U.S. Global Change Research Program, 2016; 11. Psychological resilience after Hurricane Sandy: The influence of individual- and community-level factors on mental health after a large-scale natural disaster, L. Sampson, O. Gruebner, and S. Galea, 2016;

1 - 31

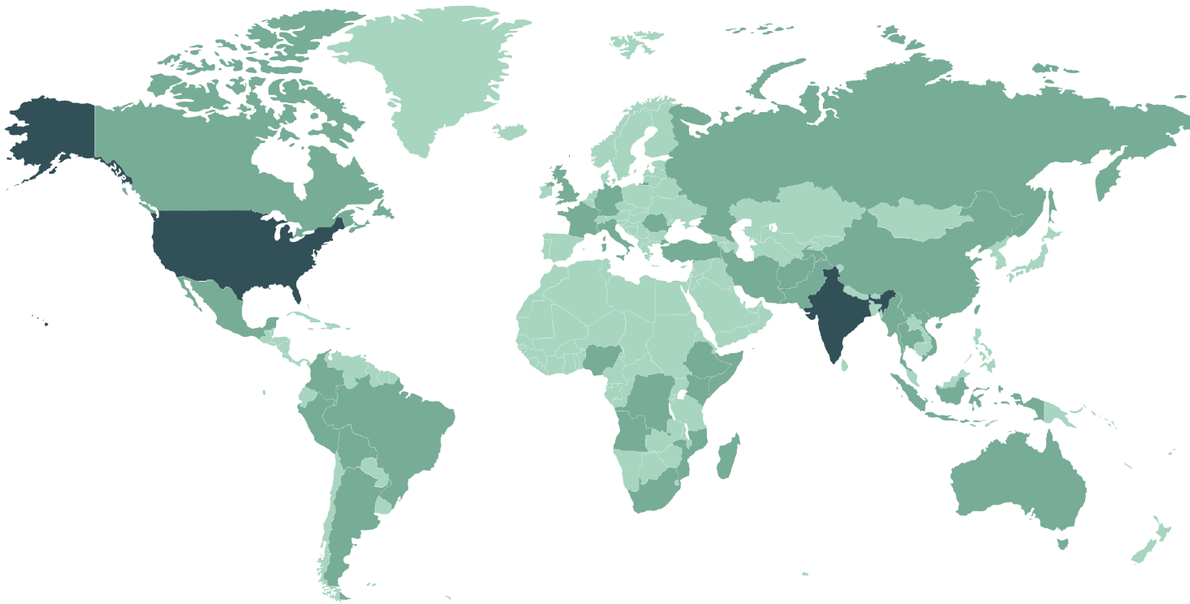
32 - 169

170 - 428

North America
occurrence: 938
total deaths: 20.222
the affected: 166.7 million
total damage (US$): 952 billion

Europe
occurrence: 655
total deaths: 2.910
the affected: 9.3 million
total damage (US$): 147.4 billion

Asia
occurrence: 2.206
total deaths: 255.438
the affected: 2.9 billion
total damage (US$): 557.5 billion



South America
occurrence: 384
total deaths: 8.325
the affected: 64.9 million
total damage (US$): 34.6 billion

Africa
occurrence: 990
total deaths: 38.880
the affected: 276.6 million
total damage (US$): 12.6 billion

Oceania
occurrence: 195
total deaths: 739
the affected: 5 million
total damage (US$): 35.2 billion

Spatial distribution of water related disasters occurrence based on EM-DAT data (2001–2018)
Source: EM-DAT - The international disasters database

exploring Red Hook

03

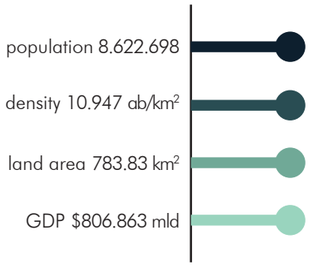
photo by authors, 2022

03.1 Introducing **NYC**

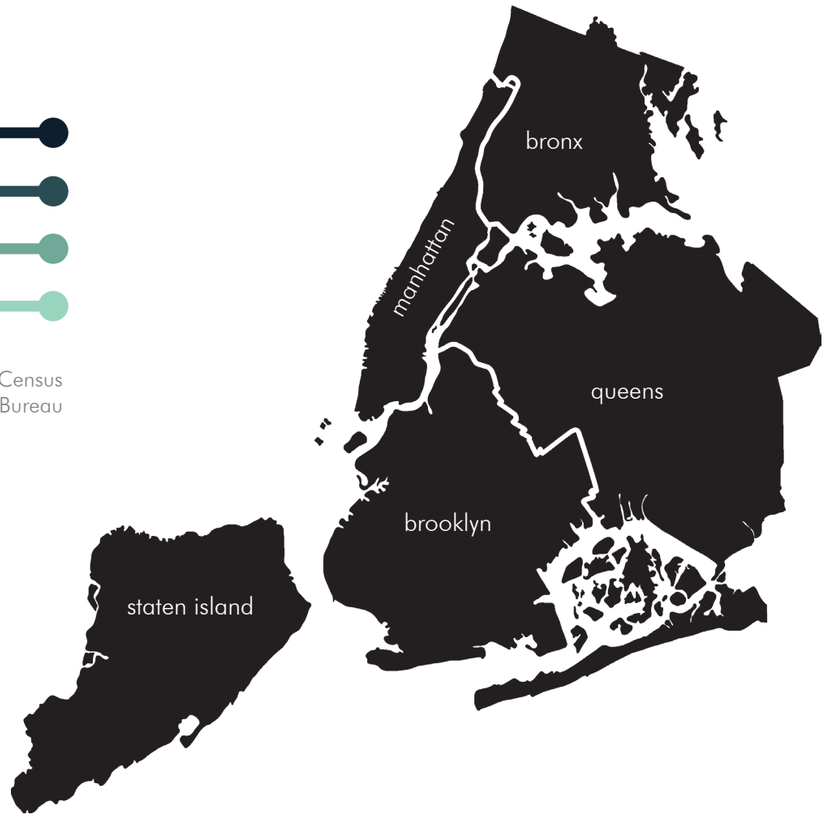
What makes New York New York?

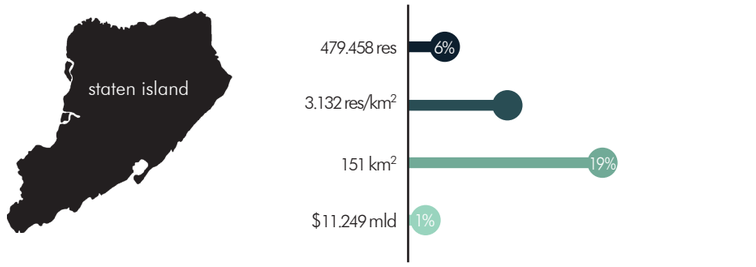
NYC and its 5 boroughs

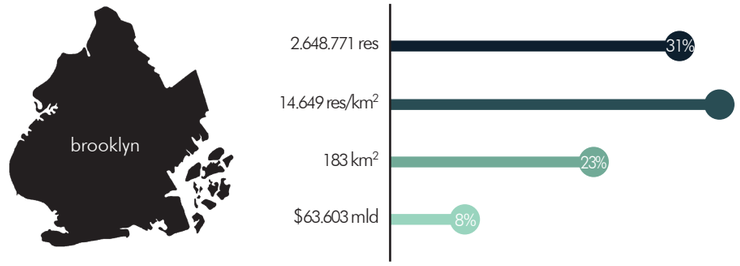
The five boroughs that make up New York City are Manhattan, Queens, Brooklyn, the Bronx and Staten Island. Some of them are better known, others less. Each neighborhood has its own character and characteristics, so we wanted to delve into what data regarding population, density, land area and gross domestic product.
The data that emerged described Queens as the most populous neighborhood with the most land area, Manhattan the one with the most density and GDP.

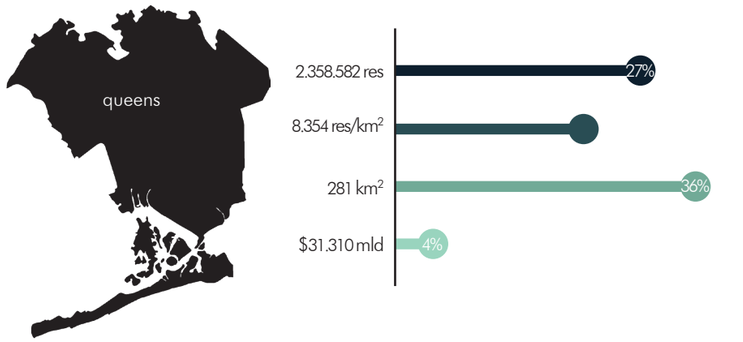


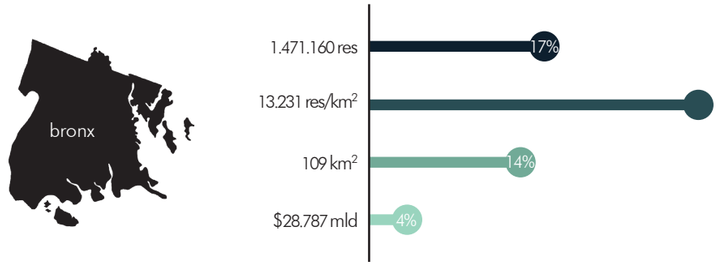
Source: United States Census Bureau

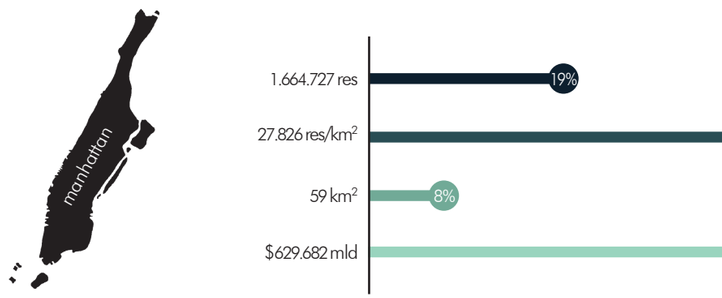










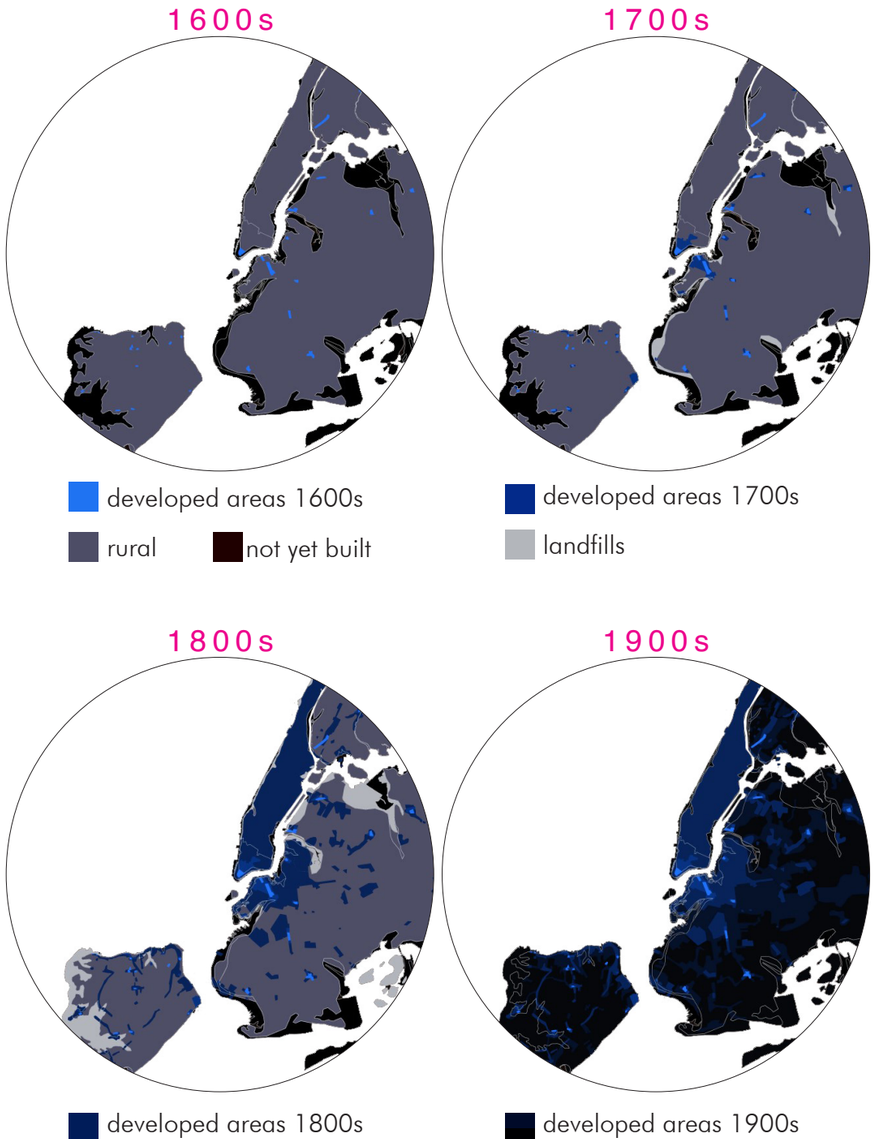


the evolution of the city

"Nothing is to be left unmolested which does not coincide with the street-commissioner's plummet and level. These are men who would have cut down the seven hills of Rome."
(Clement Clarke Moore, 1818)

New York has not been always a "concrete jungle", but in 1624 it was an unknown rural area.
The first residents were the workers of a Dutch company that decided to place a trading post on the southern shore of Manna-hata Island; by 1626 a settlement called New Amsterdam was established, today's Manhattan. The streets of lower Manhattan had, for the most part, developed organically as the colony of New Amsterdam, which became New York when the British took it over from the Dutch. Over the centuries the city expanded and became more and more populated, culminating in the Commissioners' Plan of 1811, the original design for the streets of Manhattan, the famous "grid". The increase in industry led to a staggering increase in population, and to response to this growth the grid has expanded.

urban growth



the evolution of the grid

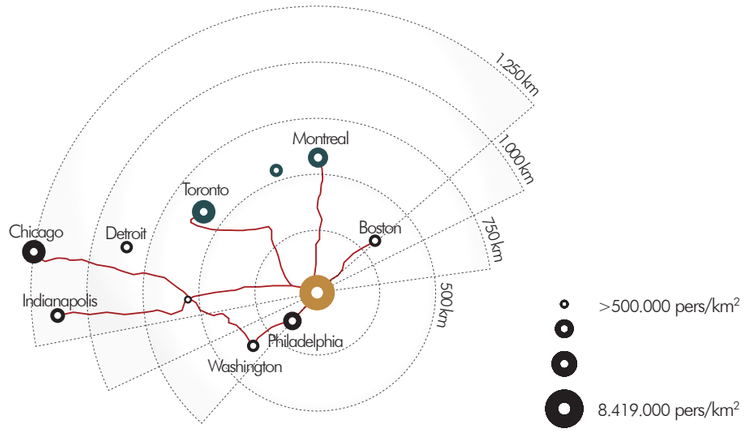
Evolution of the grid in NYC (elaborated by authors)
Source: Myles Zhang studies about New York City https://www.myleszhang.org/

distances

New York City is a very large and chaotic city that is located in an urban corridor of major American cities, such as Washington D.C, Boston and Philadelphia. Its location allows it to be just as close to other cities, such as Toronto and Chicago. Its size and public transportation offerings define different travel times compared to where you start from.

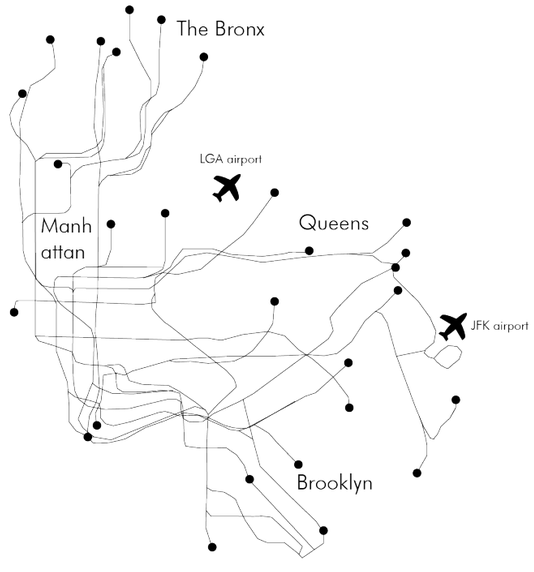
In this study we wanted to analyze the times commuters face being in Queens, Northwest Brooklyn and Manhattan respectively. It can be easily understood that starting from Manhattan the subway offer allows to arrive in 30 minutes even in more distant places. This is not the same if you live in Queens or even Northwest Brooklyn, where commute times are very long.

nyc distances



NYC Distances (elaborated by authors)
Source: Google maps

nyc subway map



NYC subway map (elaborated by authors)
Source: MTA

commute time map

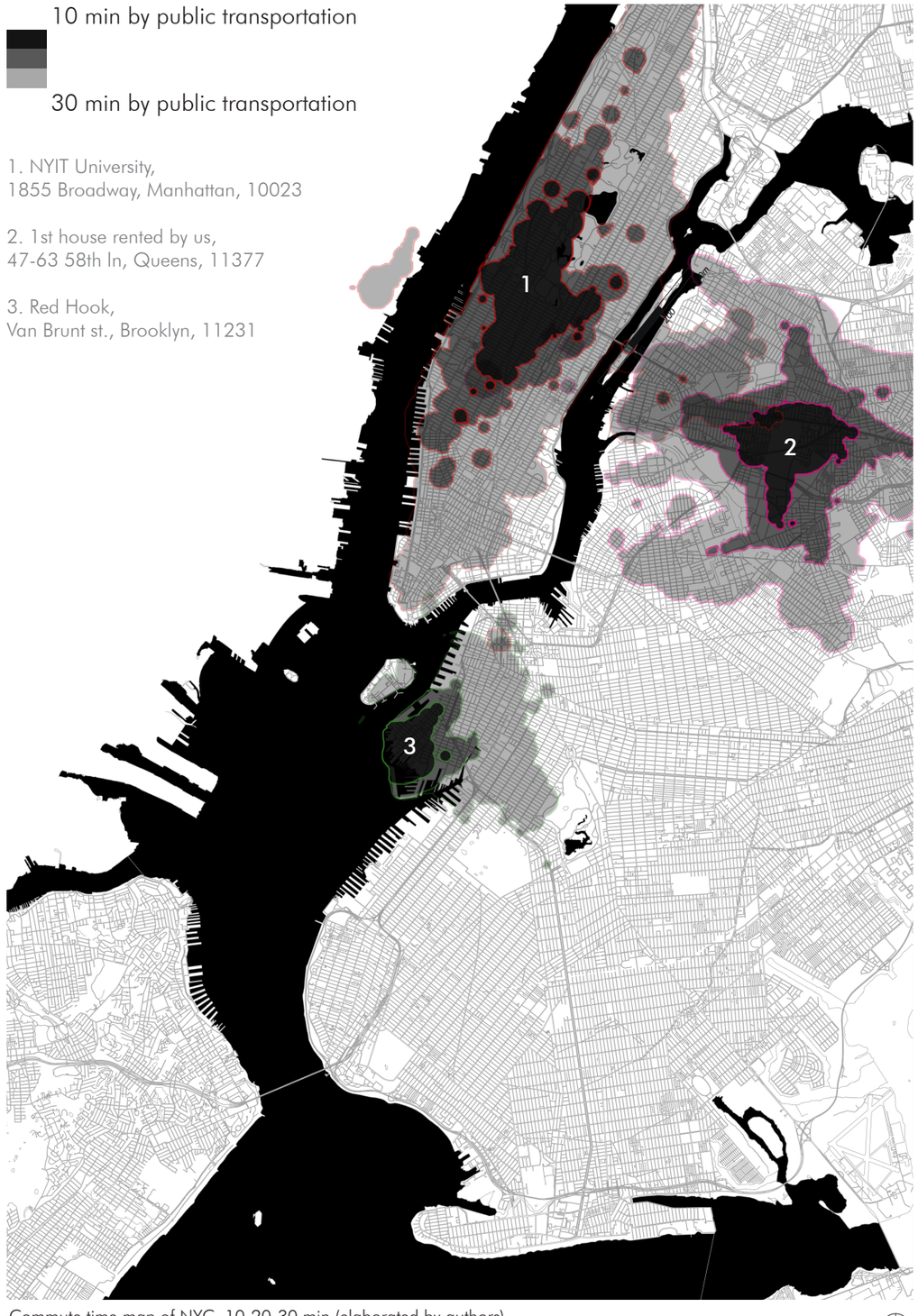
10 min by public transportation

30 min by public transportation

1. NYIT University,
1855 Broadway, Manhattan, 10023

2. 1st house rented by us,
47-63 58th ln, Queens, 11377

3. Red Hook,
Van Brunt st., Brooklyn, 11231



Commute time map of NYC, 10-20-30 min (elaborated by authors)
Source: www.commutetimemap.com

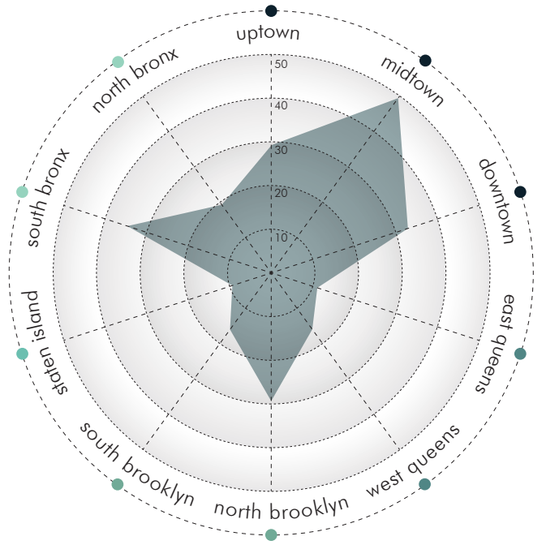
people in NYC

The city's population has increased by over 600,000 over the past decade. New York has more residents than any other major city in the country. The data provided equates to a 7.7% increase in the population

- Manhattan
- Queens
- Brooklyn
- Staten Island
- Bronx

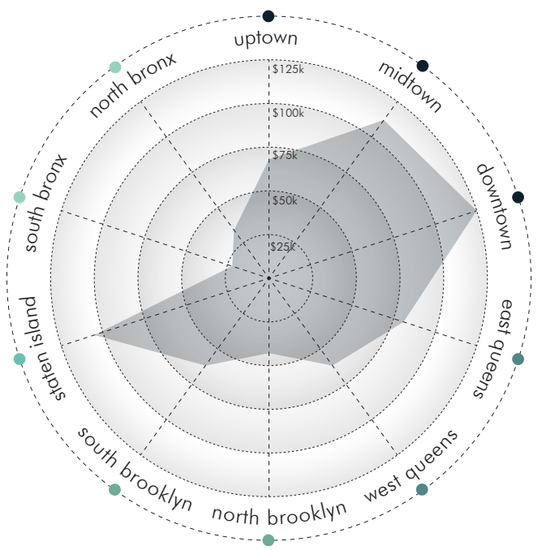
New York City's demographics show that it is a large and ethnically diverse metropolis. Throughout its history, New York City has been a major entry point for immigrants; the term "melting pot" was coined to describe densely populated immigrant neighborhoods on the Lower East Side.
As many as 800 languages are spoken in New York City, making it the most linguistically diverse city in the world.

major crimes



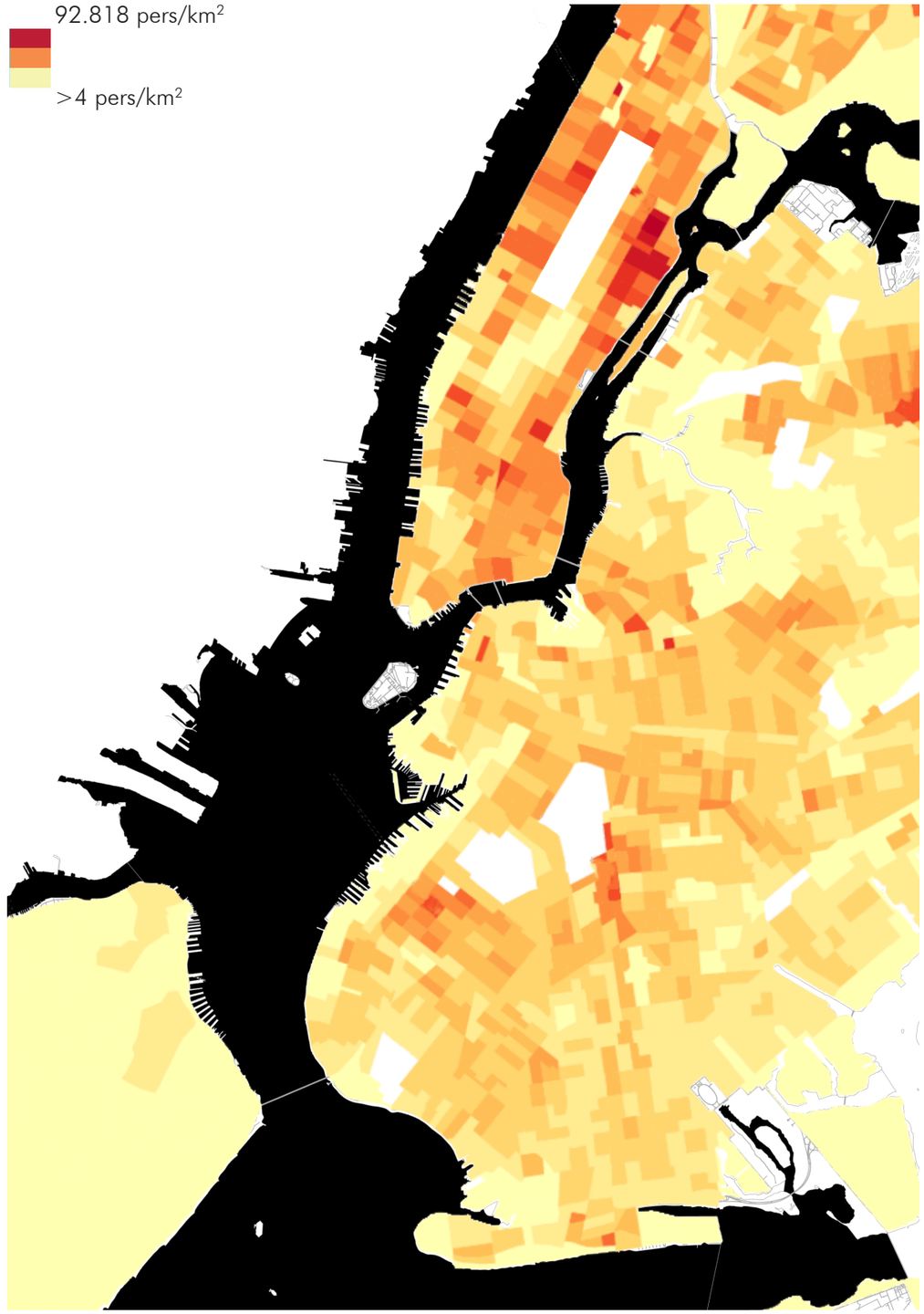
Major crimes/1.000 residents, 2020-2021 (elaborated by authors)
Source: NYC police department

household income



Household income 2019 (elaborated by authors)
Source: Census USA

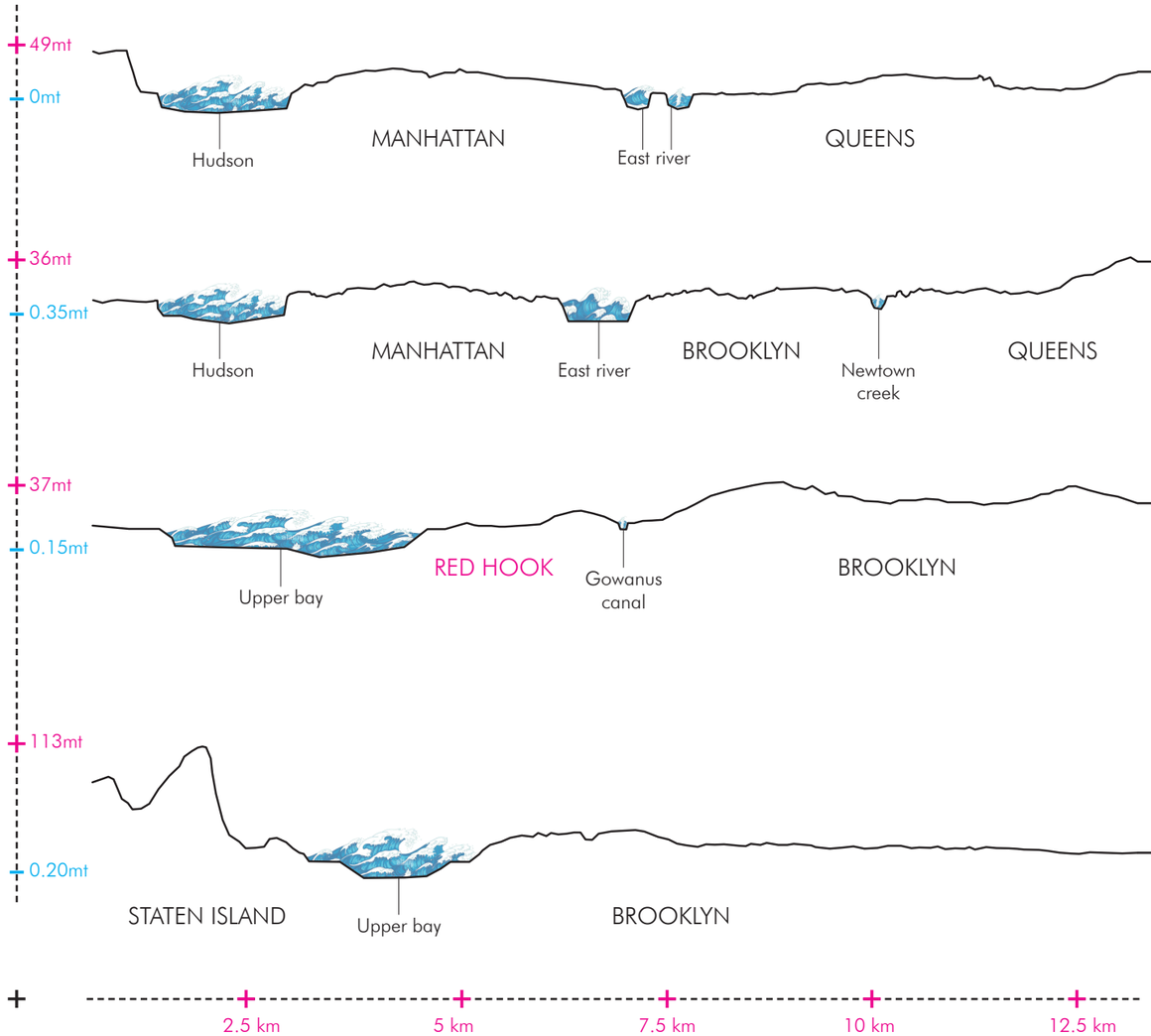
nyc population density



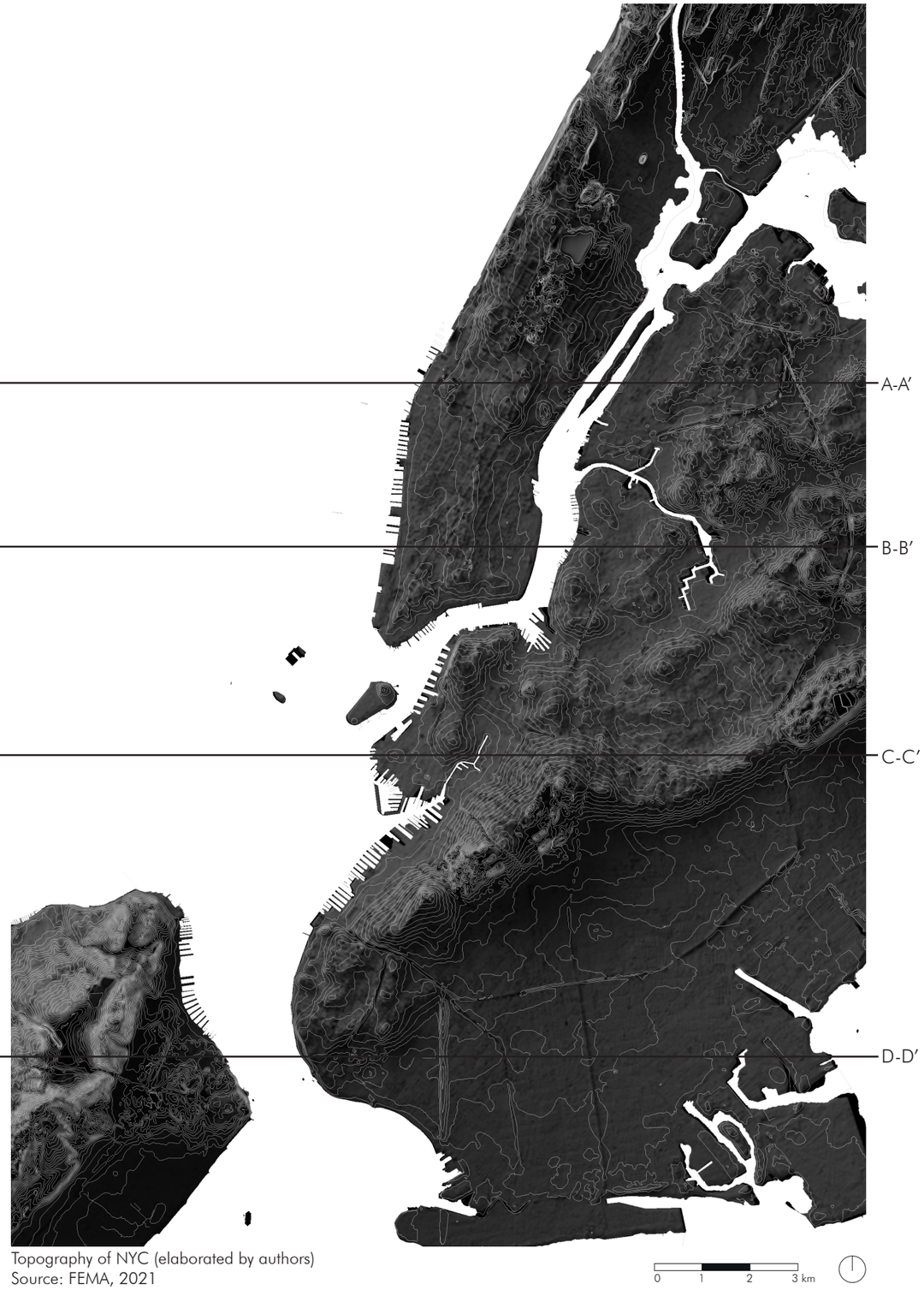
New York City population density in 2015 (elaborated by authors)
Source: Census USA

topography

A first look at the topographic map of the New York region shows that the landforms are very diverse and complex. but at the same time the victims.
The city's land has been altered considerably by human intervention, with substantial land reclamation along the waterfronts since Dutch colonial times.



Territorial sections (elaborated by authors)
Source: Google Earth Pro



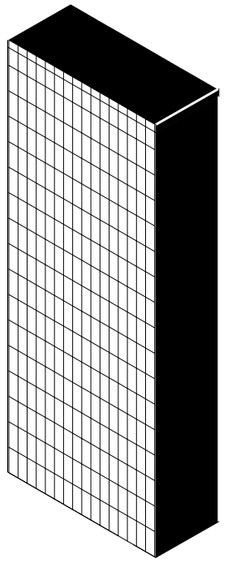
Topography of NYC (elaborated by authors)
Source: FEMA, 2021

urban morphology

When you think of New York, the first building that comes to mind is definitely the skyscraper, the symbol of the city's skyline.
New York, however, is not only made of skyscrapers, but also other types of buildings that are located in the 5 boroughs. Walking around the city it is easy to come across different types of housing that define a varied pattern of buildings.

The area of Northern Manhattan is characterized by social housing buildings inhabited by a population with low income.
Areas that are close to the waterfront are characterized by the presence of large industrial warehouses due to the industrial nature of the New York coast.
A population with a medium income lives in houses called "row houses" with apartments for several families.

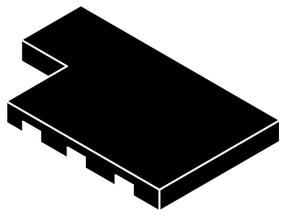
MOST COMMON BUILDINGS TYPOLOGIES IN NYC



skyscraper

row house

NYCHA house



warehouse

figure ground map

Buildings in NYC (elaborated by authors)
Source: Morphocode explorer

flooding scenarios

The Earth's average temperature has warmed by more than one degree Fahrenheit over the last century, and scientists overwhelmingly agree that most or all of this warming comes from human influence (IPCC 2013). It is very *likely* that the rate of global mean sea level rise during the 21st century will exceed the rate observed during 1971–2010 for all Representative Concentration Pathway (RCP) scenarios due to increases in ocean warming and loss of mass from glaciers and ice sheets (IPCC, Sea level change).

The sea level of New York's coast is up to 9 inches higher than it was in 1950. With nearly half of the state's residents living in marine counties, sea level rise puts New York's people, resources, and economy at risk.

There are already over 30,000 properties at risk from frequent tidal flooding in New York.

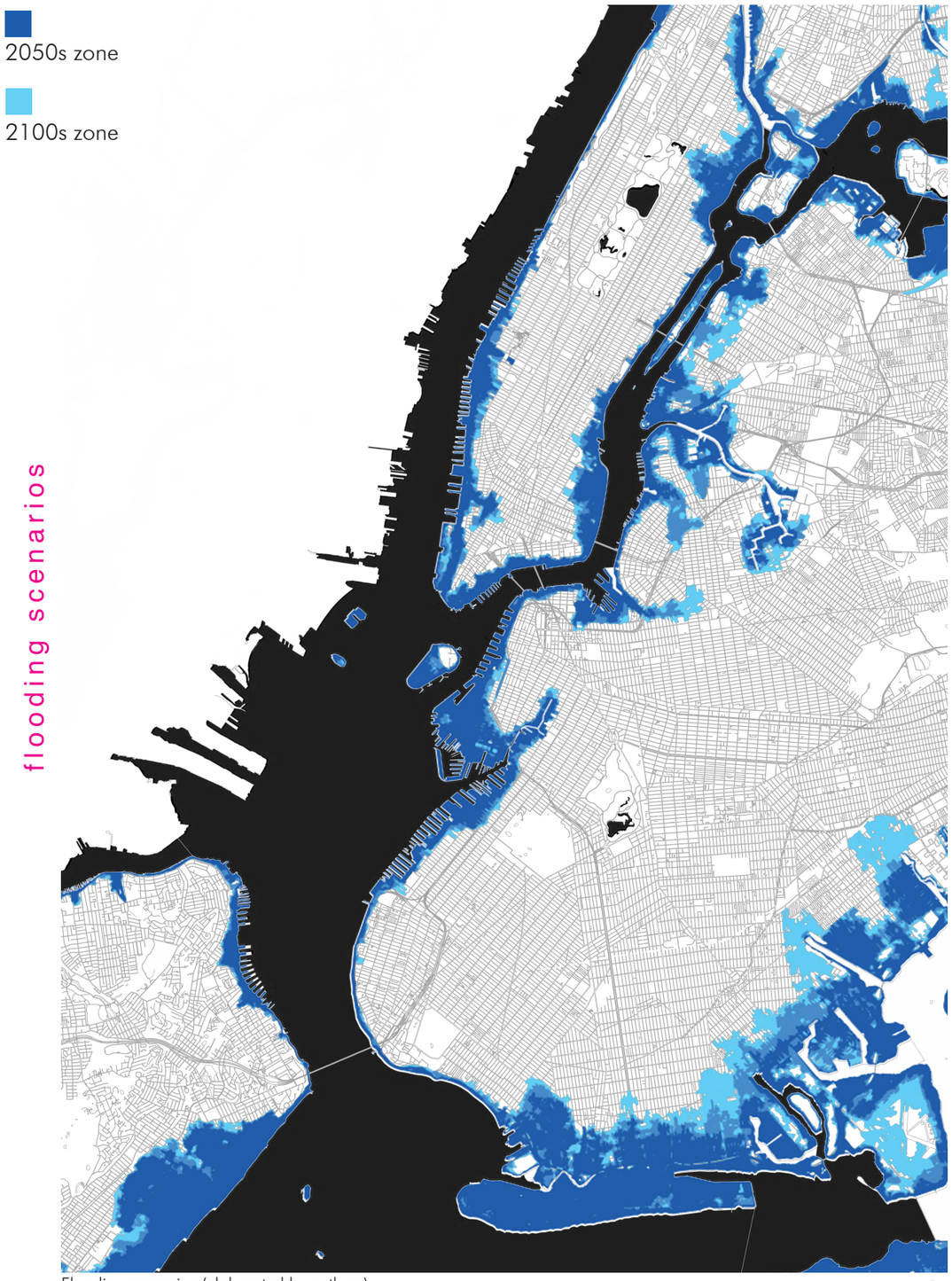
Sea level rise is accelerating and exacerbating the potential for catastrophic flooding as time passes. New York is home to nearly half a million New Yorkers, 21% of whom live in just three zip codes. $101 billion in property value sits on the same land, as do more than 1,500 miles of road and 100 public schools. These numbers nearly double when assessed at 9 feet above the high tide line (Sandy's peak flood elevation as measured at the Battery in New York City). In Brooklyn and Manhattan, the most socially vulnerable populations are, respectively, about 30% and 80% more *likely* than the population as a whole to be flooded at this level. (Climate central, 2014)

based on the assessment presented in the IPCC Sixth Assessment Report (2021)

based on a study conducted by the Climate Central Risk Finder

Time interval	Sea level rise projection (SSP3-7.0)	Impacted people
2020s	0.10 m	320
2050s	0.35 m	1.850
2080s	0.87 m	16.446
2100s	0.93 m	56.265
2150s	1.52 m	112.549

Projections are relative to a 1995-2014 baseline.
SSP3-7.0 is a medium to high reference scenario resulting from no additional climate policy under the SSP3 socioeconomic development narrative.
SSP3-7.0 has particularly high non-CO_2 emissions, including high aerosols emissions.



Flooding scenarios (elaborated by authors)
Source: FEMA, 2021

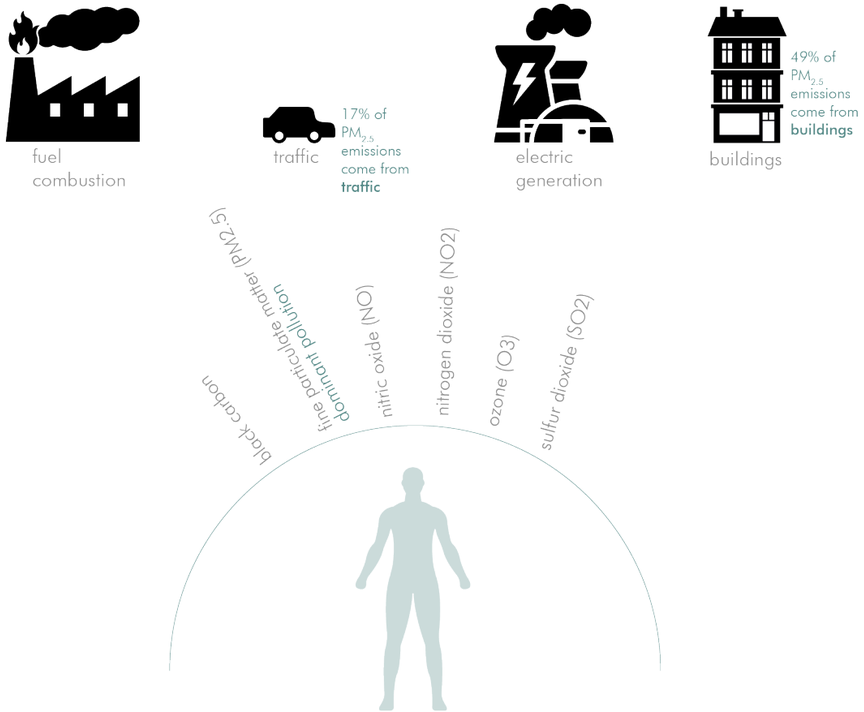
air pollution

Air quality is a measure of the condition of the air around us. The less air pollution there is, the better the air quality.
Like many cities, New York City's air contains particles, liquid droplets, gases, and other contaminants that could impact health. Two pollutants, particulate matter and ground-level ozone, are of particular health concern.

Although New York City's air does not currently meet federal air quality standards, it has improved significantly over the past two decades.

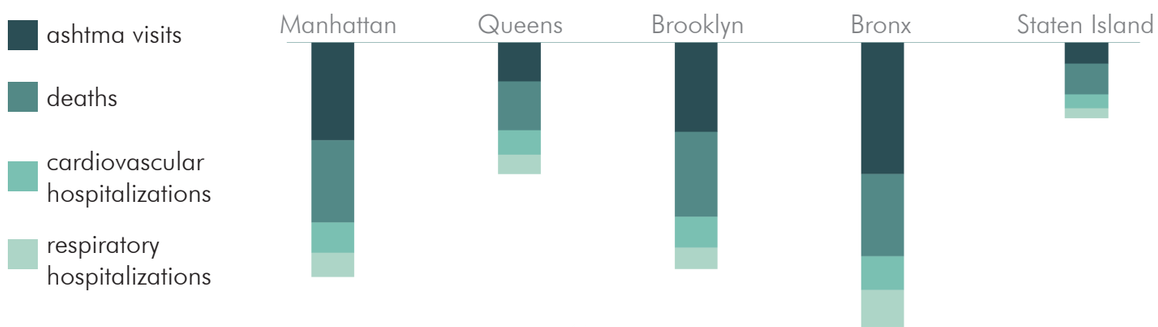
In NYC, health impacts from fine particulate matter, black carbon, and sulfur dioxide are higher in high-poverty neighborhoods.
(NYC Health, report on air quality)

Particulate Matter
Also known as particle pollution or PM, is a complex mixture of extremely small solid particles and mists. Particulate pollution is made up of a number of components, including acids (such as nitrates and sulfates), organic chemicals, metals, and soil or dust particles. Smaller particles of 10 micrometers in diameter or smaller more easily bypass the natural defenses of the body, and are more easily inhaled deep into lung tissue, where they can cause health problems.

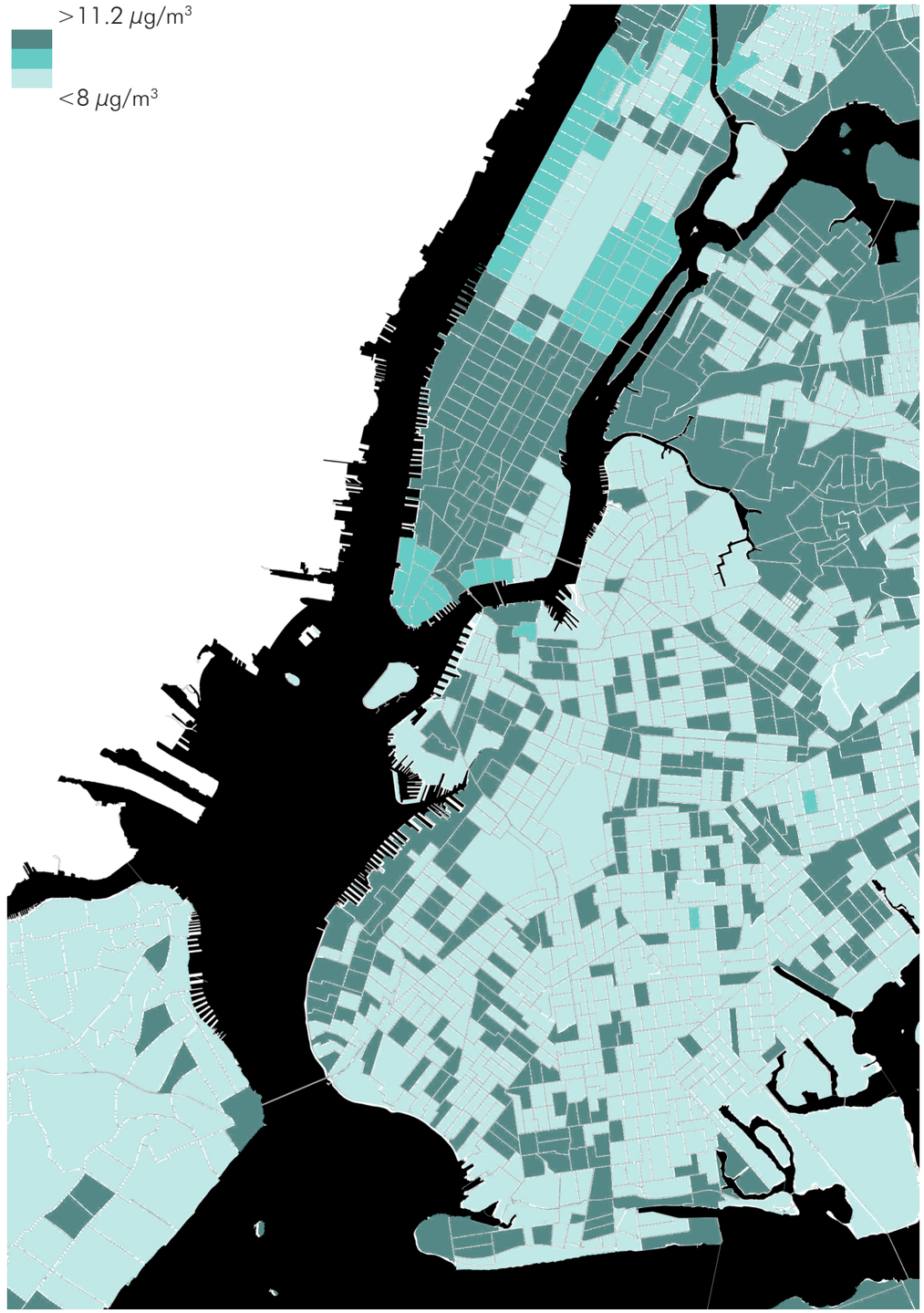


The types of air pollutant and their main sources are from NYC Environmental Protection, 2019.

ashtma exacerbation;
cancer;
cardiovascular disease;
lung disease + reduced lung function;
stroke;
death;



annual average of $PM_{2.5}$



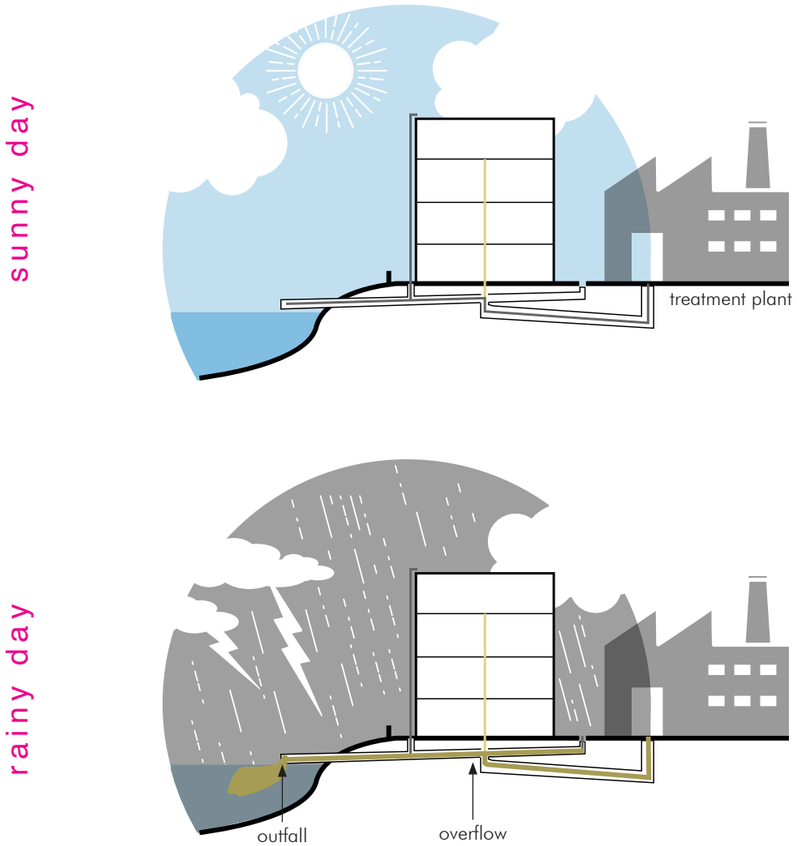
Annual average $PM_{2.5}$ in NYC (elaborated by authors)
Source: NYC health report, 2017

water pollution

A combined sewer system (CSS) collects rainwater runoff, domestic sewage, and industrial wastewater into one pipe. Under normal conditions, it transports all of the wastewater it collects to a sewage treatment plant for treatment, then discharges to a water body. The volume of wastewater can sometimes exceed the capacity of the CSS or treatment plant (e.g., during heavy rainfall events or snowmelt). When this occurs, untreated stormwater and wastewater, discharges directly to nearby streams, rivers, and other water bodies (EPA).

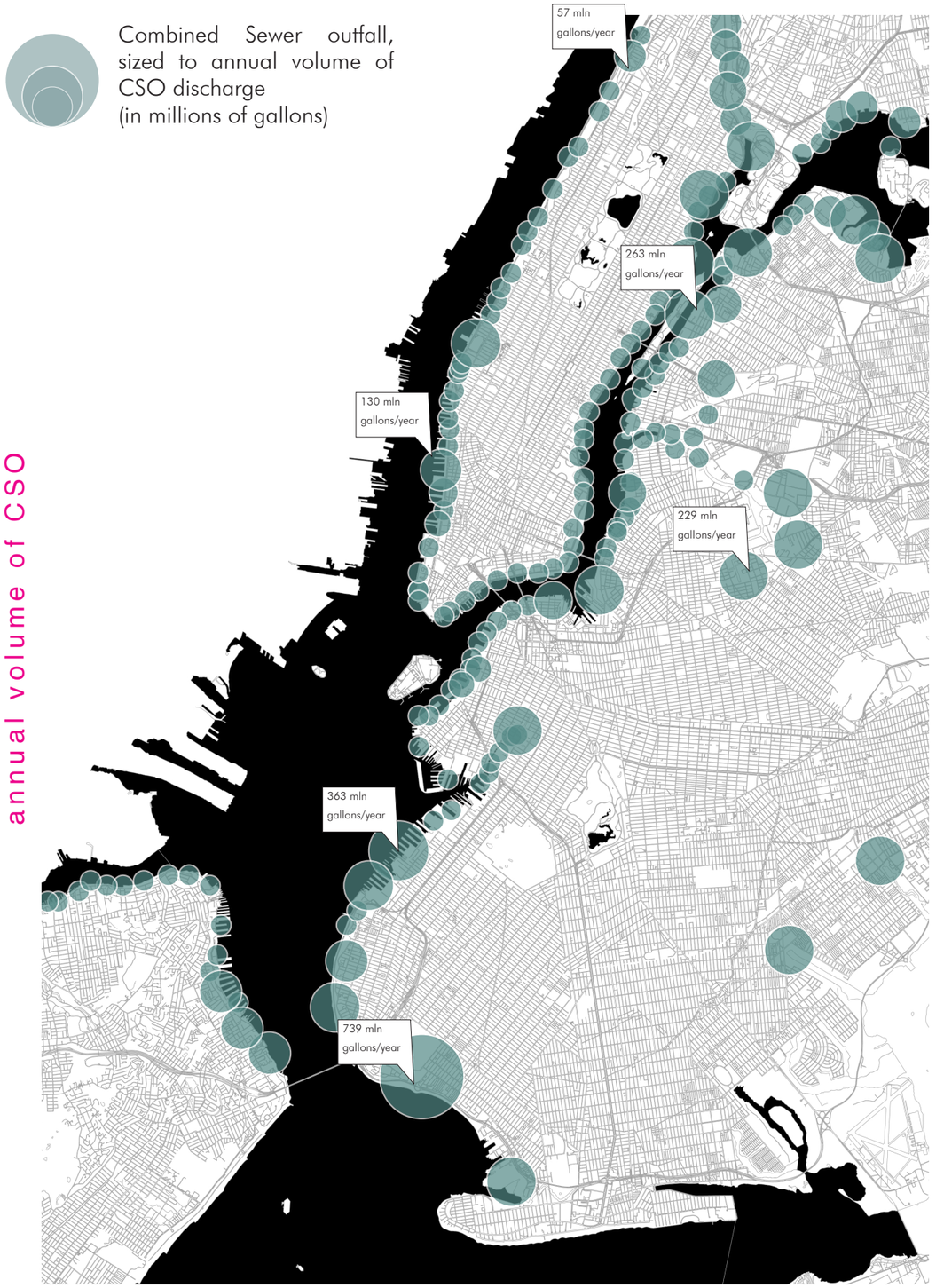
Combined sewer overflows (CSOs) contain untreated or partially treated human and industrial waste, toxic materials, and debris as well as stormwater. They are a priority water pollution concern for the nearly 860 municipalities across the U.S. that have CSSs.

Most of New York City, about 70%, has a combined sewer system. During rainstorms, combined sewer systems can become inundated with stormwater which could overload the capacity of the wastewater treatment plant. When this happens, the mixture of raw sewage and stormwater runoff is diverted to the nearest water body through an outfall. These events are called Combined Sewer Overflow, or CSO.



CSO diagrams in a sunny day and rainy day (elaborated by authors)
Source: www1.nyc.gov/

Combined Sewer outfall, sized to annual volume of CSO discharge (in millions of gallons)



Annual volume of CSO (elaborated by authors)
Source: NYC health report, 2017

R E D H O O K

by authors, 2022

03.2 how Red Hook became Red Hook

but first, where is Red Hook?

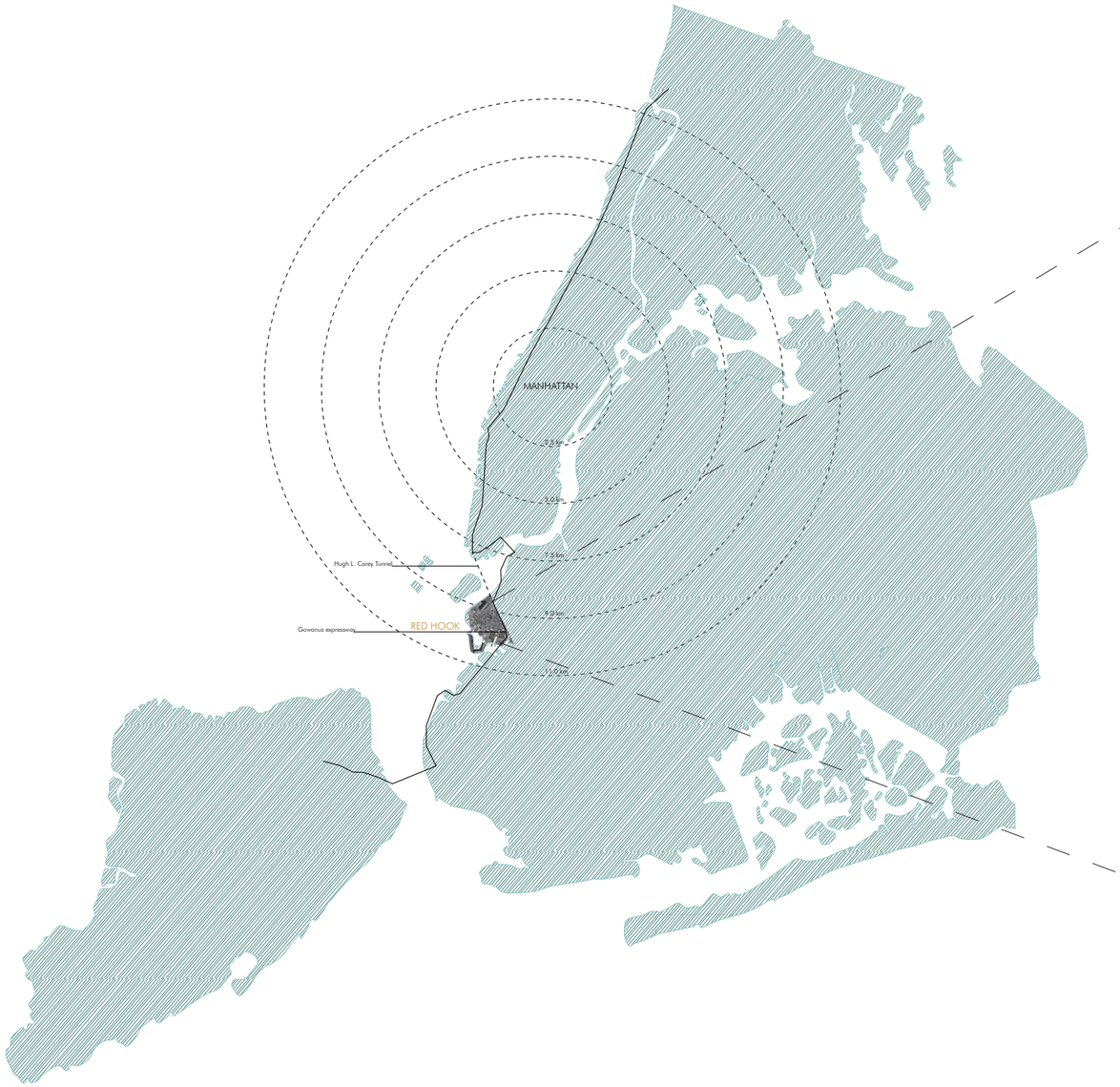
where is

Red Hook is a neighborhood in northwestern Brooklyn, New York and it is located on a peninsula projecting into the Statue of Liberty and Lower New York Bay and is bounded by the Gowanus Expressway and the Carroll Gardens neighborhood on the northeast, Gowanus Canal on the east, and the Upper New York Bay on the west and south.
The waterfront has beautiful views of New York Harbor and an industrial aesthetic held over from a previous life. Its unique character is far from the "Manhattanism" that Rem Kolhaas counted in "Delirious New York".

how was / how is

1. *Brooklyn 102 Structures and Phenomena of Red Hook*, Brooklyn Studio, Leuven, 2012

The name is derived from the words 'Roode Hoek' or Red 'Corner', given by the Dutch settlers in 1624, because of the color of the soil and the shape of the landmass.
At the beginning of the settlement period most of the area was covered with marshlands and little creeks.
The Dutch transformed the landscape in the 18th and 19th century for cultivation and farming, adding ponds and mills.
The location of Red Hook was chosen as the location of an important stronghold during the Revolutionary War against the British Army (the Battle of Brooklyn).
In the 1850s, the Atlantic Basin and Erie Basin were due due to booming industrial productivity. [1]
Today these areas are the most at risk for flooding.



Red Hook's changing coastline from 1770 to 2021 (elaborated by authors)
Source: Bernard Ratzer's map of Brooklyn, 1770

RED HOOK'S TIME LINE

1636

FOUNDATION OF RED HOOK

Red Hook was founded by Dutch settlers in 1636. The name is derived from the words 'Roode Hoek' (red corner) referring to the red appearance of the clay soil and the original shape of the area, which is very different from what it is today.

Revolutionary War 1776

Fort Fiance

At the end of the 18th century the low open fields of Red Hook were chosen as the site of an important fort during the Brooklyn Revolutionary War against the British Army.

1825

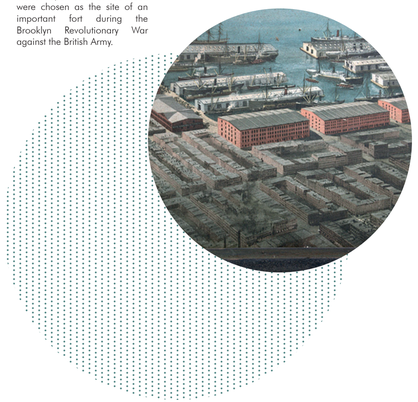
opening of Erie Canal

The opening of the Erie Canal and the connection to the Great Lakes accelerated land speculation in the area for port development.

1840-1866

BASINS' CONSTRUCTION

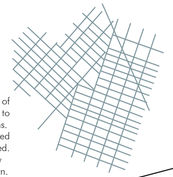
In 1840, Brooklyn developer Daniel Richards obtained approval to build the sea docks at Red Hook (Erie Basin, Atlantic Basin).
The docks stimulated further development in the area due to the flourishing grain business.
The dredged land was used to fill up the surrounding marshalands.



1847

the grid

Richards helped the implementation of the Brooklyn street grid in order to improve the connectivity of the basins. To do so, the Dutch ponds were filled up and low-lying areas were flattened. The neighborhood of Red Hook now became a part of the City of Brooklyn.



1860

dredging of Gowanus Canal

In 1860 the Gowanus creek was dredged and converted into a 3 km long canal, becoming a new commercial waterway.
For many years the canal has been used as a dumping ground for local industries, reaching worrying levels of pollution.

Civil War (1861-1865)

DECAY

1870-1930 DECAY

The relocation of port activities to New Jersey in the 1950s and the beginning of containerisation in the early 1960s resulted in high unemployment in the area and turned the vibrant community of Red Hook into a criminal neighbourhood.

1936

inauguration of Red Hook Recreational park

This park (then known as the Red Hook Recreation Center) officially opened on 12 August 1936, Mayor Fiorello H. LaGuardia was greeted by the thunderous applause of over 40,000 local residents, many of them children.

RED HOOK HOUSES

The Red Hook Houses are a social housing development located in Red Hook, they are the largest housing development in Brooklyn.
This complex was the first social housing project to be built in New York and was intended to house the many workers who worked in the vibrant port of Red Hook in the 1930s.
The Red Hook Houses consist of 30 residential and 4 non-residential buildings, with 2891 units and approximately 7,000 residents.

1939

Gowanus expressway's construction

1940s

movement of harbor activities to New Jersey

1960s

"the CRACK capital of America"

LIFE magazine labeled the Red Hook Houses complex as the "crack capital of America."
The story quotes a resident saying, "There are only two kinds of people left in the project, them and us. They have guns and money and run the streets. They kill each other and anybody in the way."
(Life Magazine)

1970s-1990s

1980s

residents established community organizations

first wave of gentrification

2004

IKEA

second wave of gentrification

2012 HURRICANE SANDY

work in progress...

The graph shows the social-economic trend of Red Hook from its foundation to nowadays

03.3 **Wandering** around Red Hook

how to get to Red Hook?

transporta-tion

Red Hook is surrounded by water on three sides, and on one side is "cut off" by the elevated expressway, which makes entering the neighborhood difficult both by walking and by car. Red Hook is therefore defined as an isolated neighborhood, in part because it is not directly accessible by subway.
The closest station is Smith-9th Streets which is a 25 minute walk (under the elevated expressway) from the main street of the neighborhood or accessible by bus.
The only bus that "enters" the neighborhood and connects it to northern Brooklyn is the B61.
To get to Red Hook, it is possible to move via water, but it is an underutilized option because the ticket is not included in the subway pass.

HOW CAN I REACH RED HOOK?

COLUMBUS CIRCLE - VAN BRUNT STREET

Train A + Bus B61 (about 55 min.)	2.75$
via West st. (about 1 hr.)	
Train A + **Train F** + Ferry (about 1 hr. 25 min.)	5.50$
via Broadway (about 40 min.)	3.50$

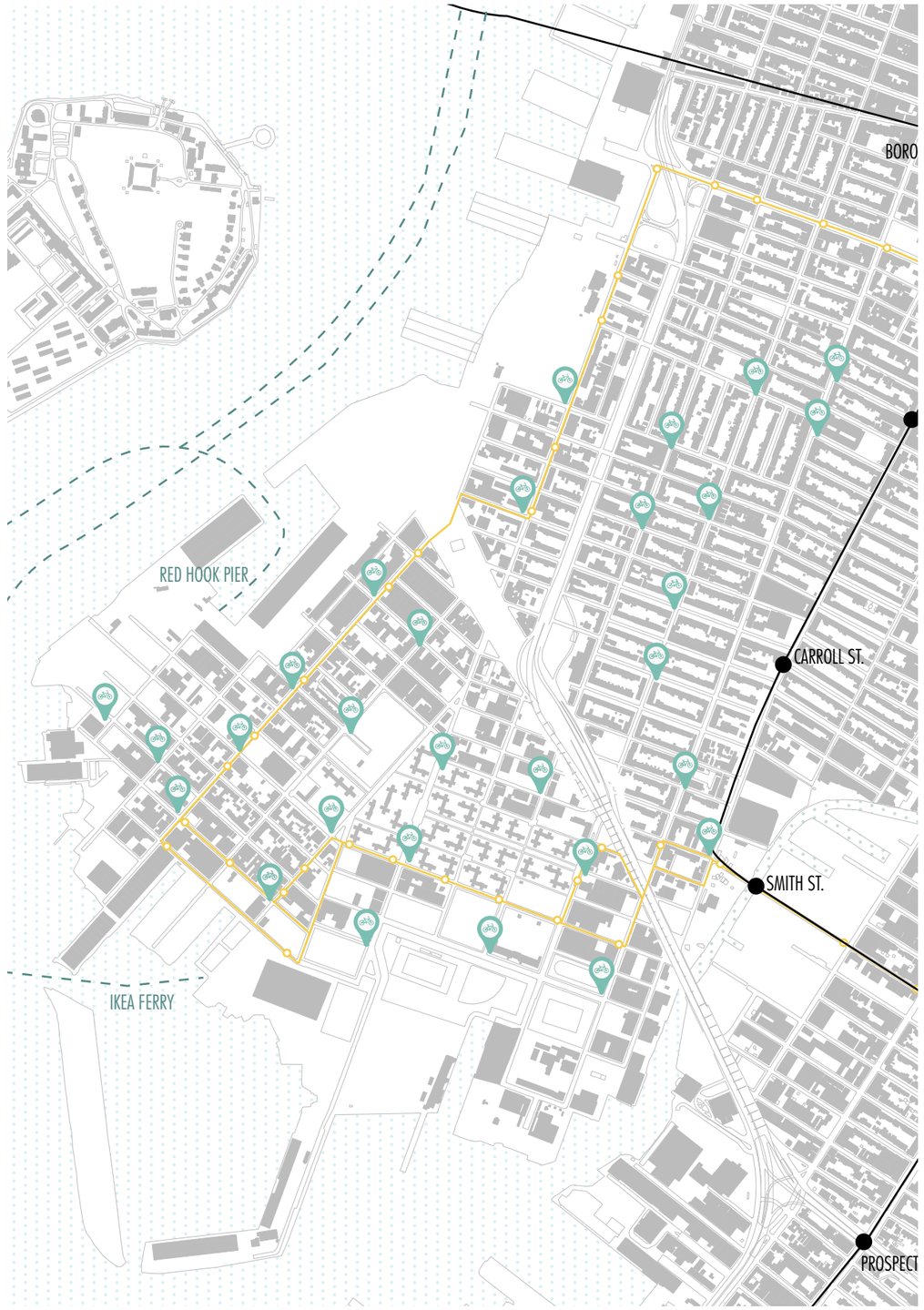
DUMBO - VAN BRUNT STREET

Bus B57 + walk (about 40 min.)	2.75$
via I-278 W (about 15 min.)	
Ferry + walk (about 30 min.)	2.75$
via Brooklyn Bridge Park (about 15 min.)	3.50$

JFK AIRPORT - VAN BRUNT STREET

Airtrain +**Train A** + Bus B61 (about 1 hr. 45 min.)	10.50$
via Atlantic Av (about 1 hr. 15 min.)	

Source: Moovit app, Google maps



transportation map in Red Hook (elaborated by authors)
Source: MTA website, ferry nyc website, citibike nyc website

Photo from Smith-9th street Station looking at Manhattan, by authors, 2022

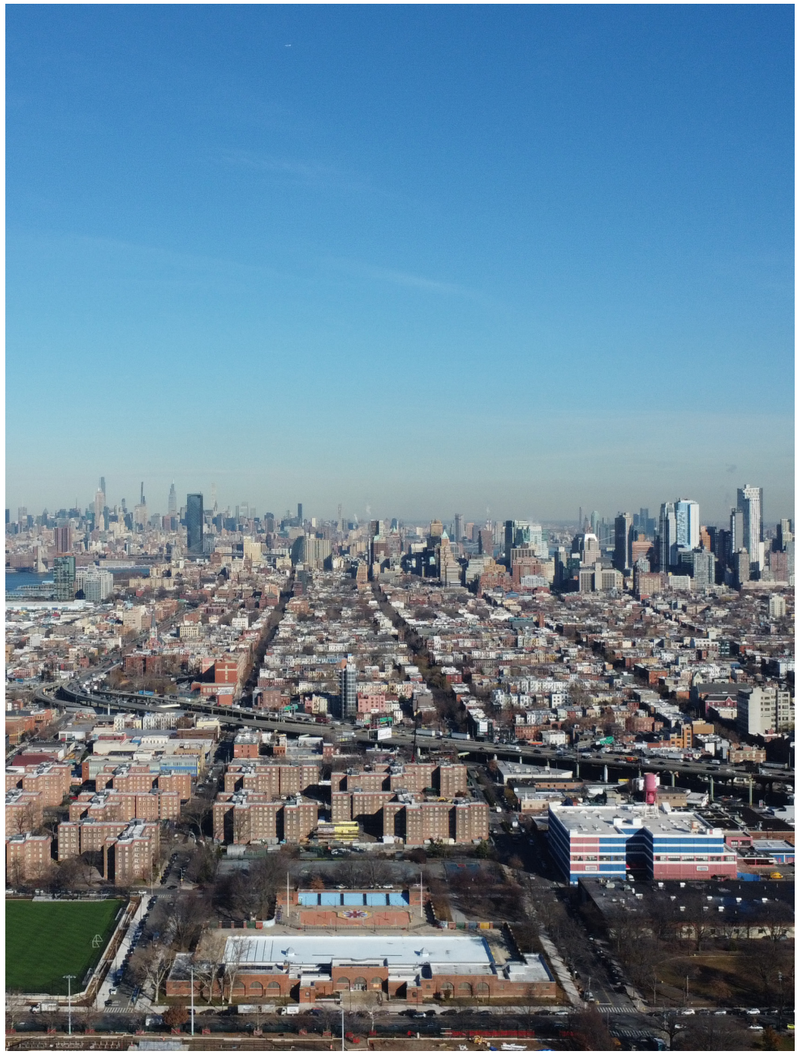
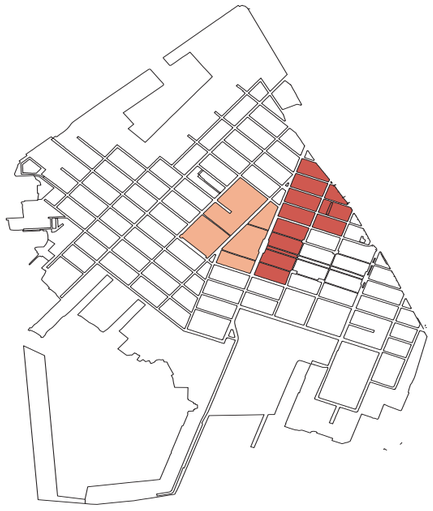


Photo taken by the drone looking at Gowanus Expressway, by authors, 2022

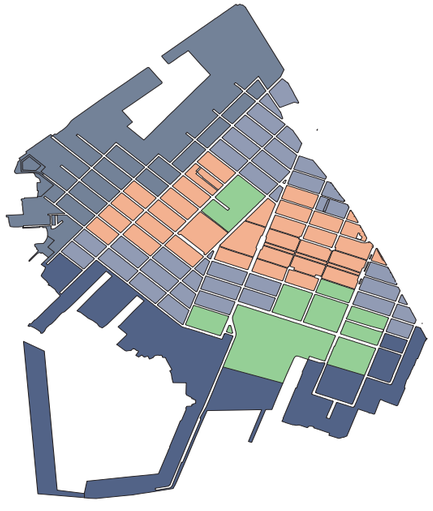
Photo taken under the Gowanus Expressway, by authors, 2022

land use

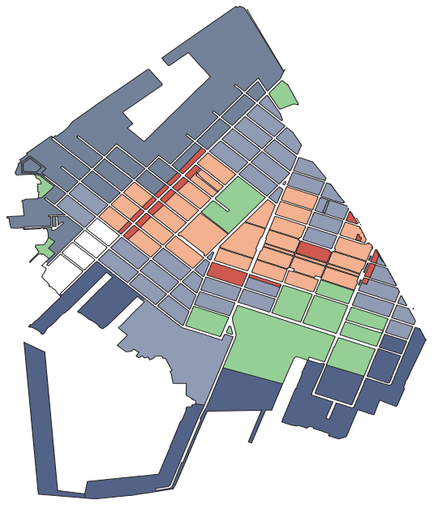
In the first zoning law of 1916 Red Hook was mostly unrestricted except for two zones one commercial and one residential. This is because the first zoning of New York City had focused primarily on Mnahattan.
The mixed use that characterizes the neighborhood is a direct result of this unrestricted zoning that allowed the development of industrial areas alongside residential and commercial areas.
In 1961, a new zoning law was drafted, since the free areas in Mnahattan were scarce, the municipality decided to concentrate the building activity in the neighboring municipalities, preferring an industrial use in the Brooklyn area.
This is why the Red Hook waterfront has a predominantly industrial footprint.
In 2011, the 1961 Urban Act was reenacted into a new Urban Act, which gives greater flexibility to the rezoning of former industrial areas, encouraging progressive private development of these areas.



Zoning 1916



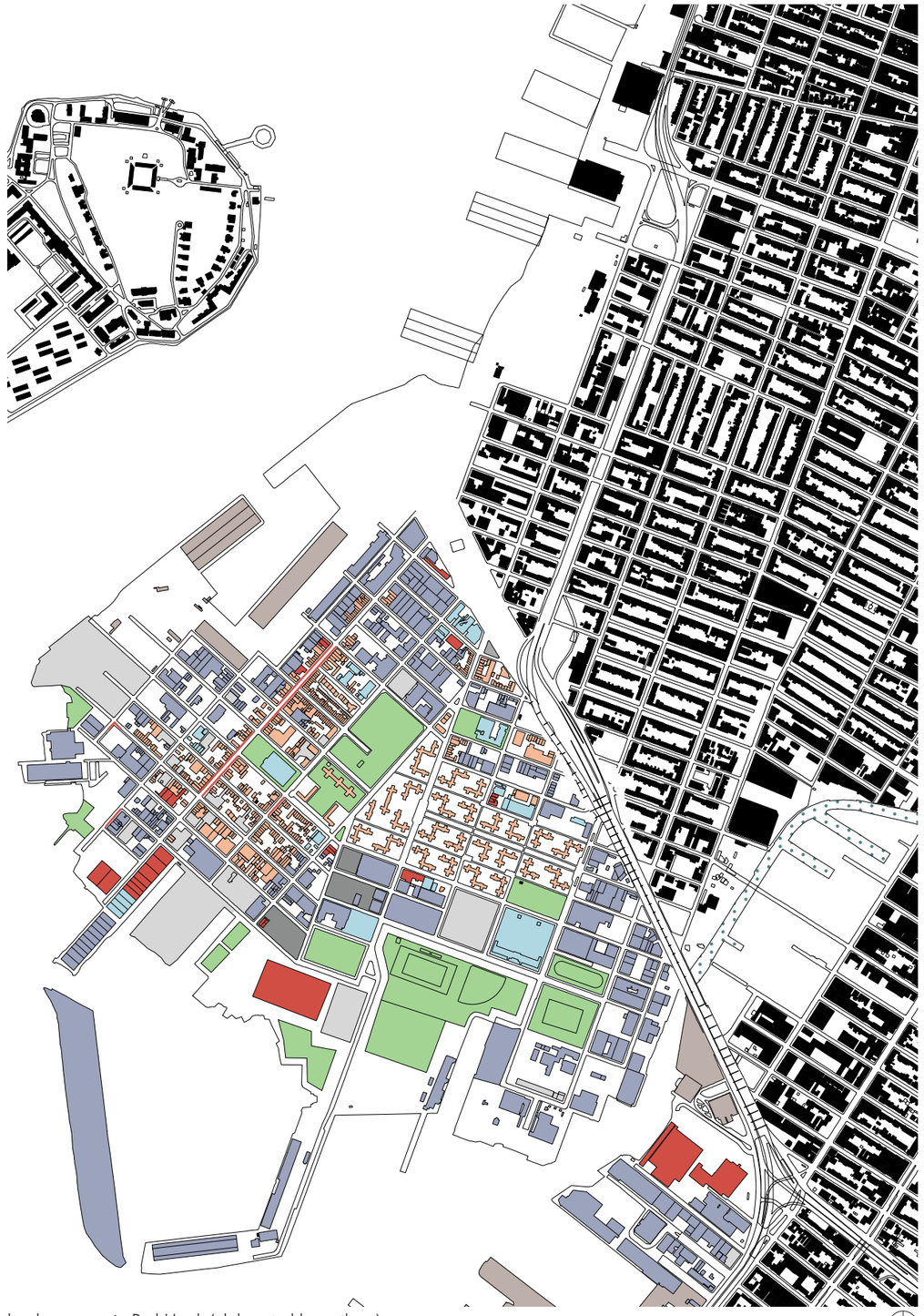
Zoning 1961



Zoning 2011

Land use categories

- Commercial street
- Commercial
- Residential
- Public Facilities & Institutions
- Outdoor Recreation
- Industrial & Manufacturing
- Transportation utility
- Parking
- Vacant lot
- Unrestricted



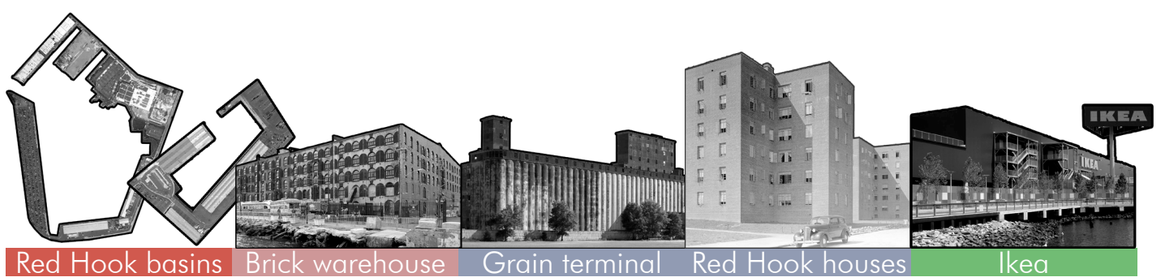
land use map in Red Hook (elaborated by authors)
Source: explorer.morphocode.com, oasis map NYC

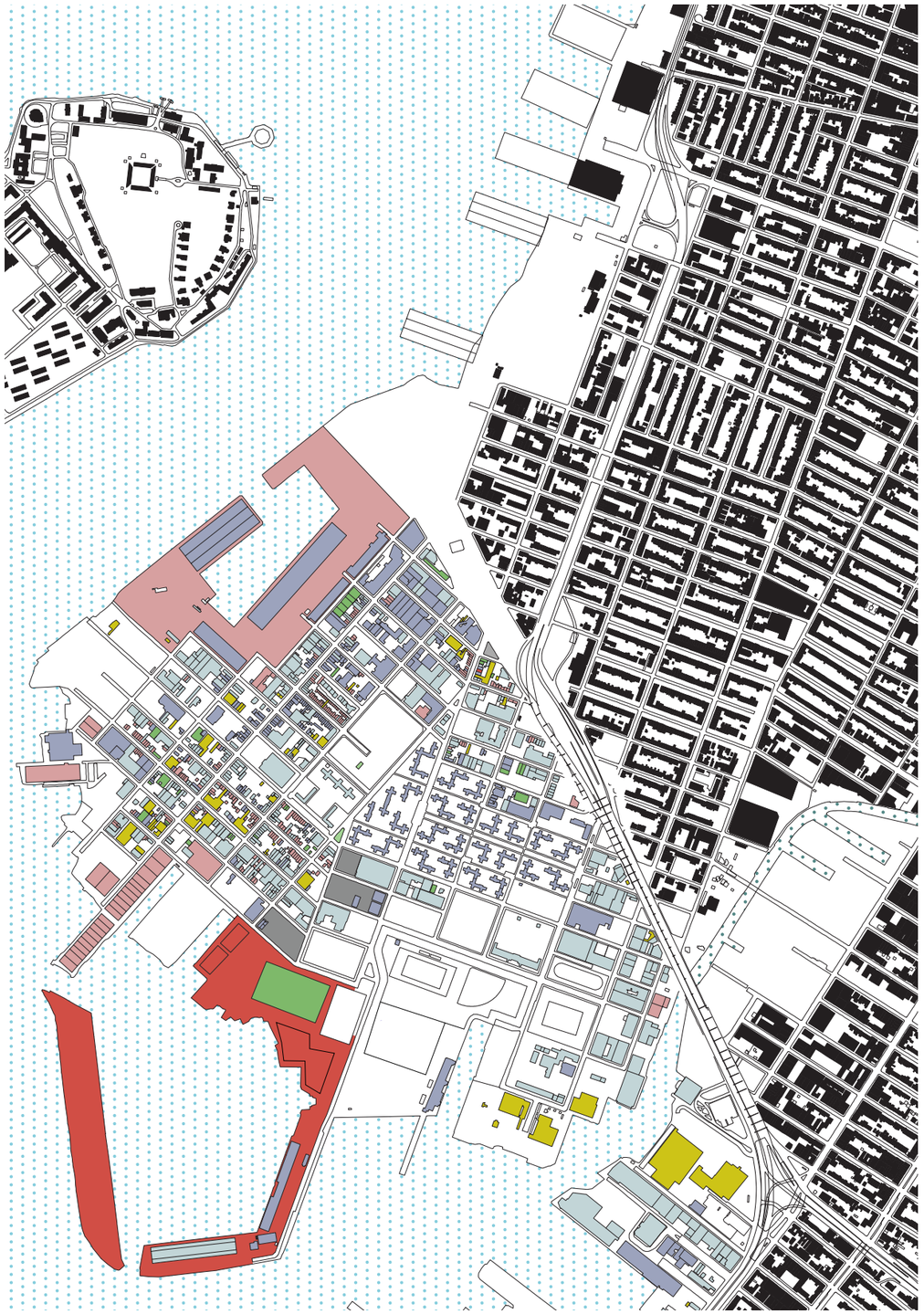
historic footprints

Red Hook is characterised by an old building stock, few buildings were built after the 2000s, the best known being Ikea, dating from 2004, others are single family houses located near the centre (Van Brunt, Coffey street).
Most of the historic heritage dates from the second half of the 20th century, many are workshops or public buildings, few are dwellings, while many of the pre-20th century buildings have historical significance, such as the Grain Terminal, the Red Hook houses and some warehouses on the waterfront.

Historic footprint

- 1800-1849
- 1850-1899
- 1900-1949
- 1950-1999
- by 2000
- unknown

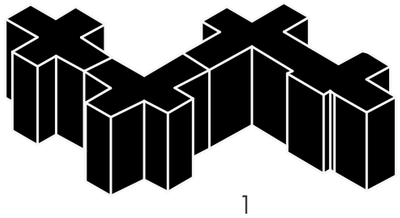




historic footprint map in Red Hook (elaborated by authors)
Source: https://www.oasisnyc.net

built and unbuilt

Red Hook is a former industrial area and this connotation is reflected in most of its buildings.
The Red Hook waterfront is characterised by numerous brick warehouses, designed for the storage and processing of large quantities of grain, with heights ranging from 2 to 6 storeys.
Over time many of these brick warehouses have been demolished and partly replaced with new long narrow buildings made of corrugated iron and approximately 10 metres high, these are mainly located at the piers.
Along the main streets we find old single-family terraced houses and small shops dating from the end of the 19th century, no more than four storeys high, often flanked by similar terraced houses reinterpreted in a contemporary way.
In the heart of the neighbourhood are the council houses dating from the 1930s, some of which are more than six storeys high, where the poorest people in the neighbourhood live.
In the district we also find many workshops located mainly near the motorway and they are mostly low, deep buildings suitable for the car repair industry or similar.
Not all blocks are fully built, many are lots that appear empty, sometimes used as storage, parking or simply abandoned.



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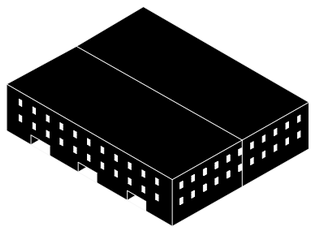

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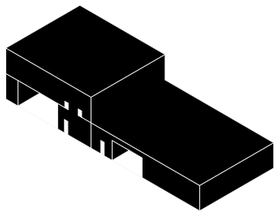

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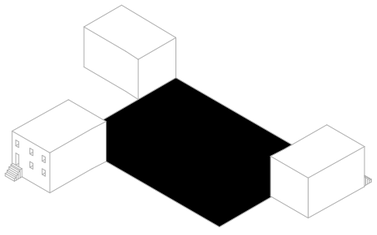

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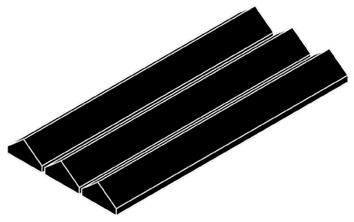

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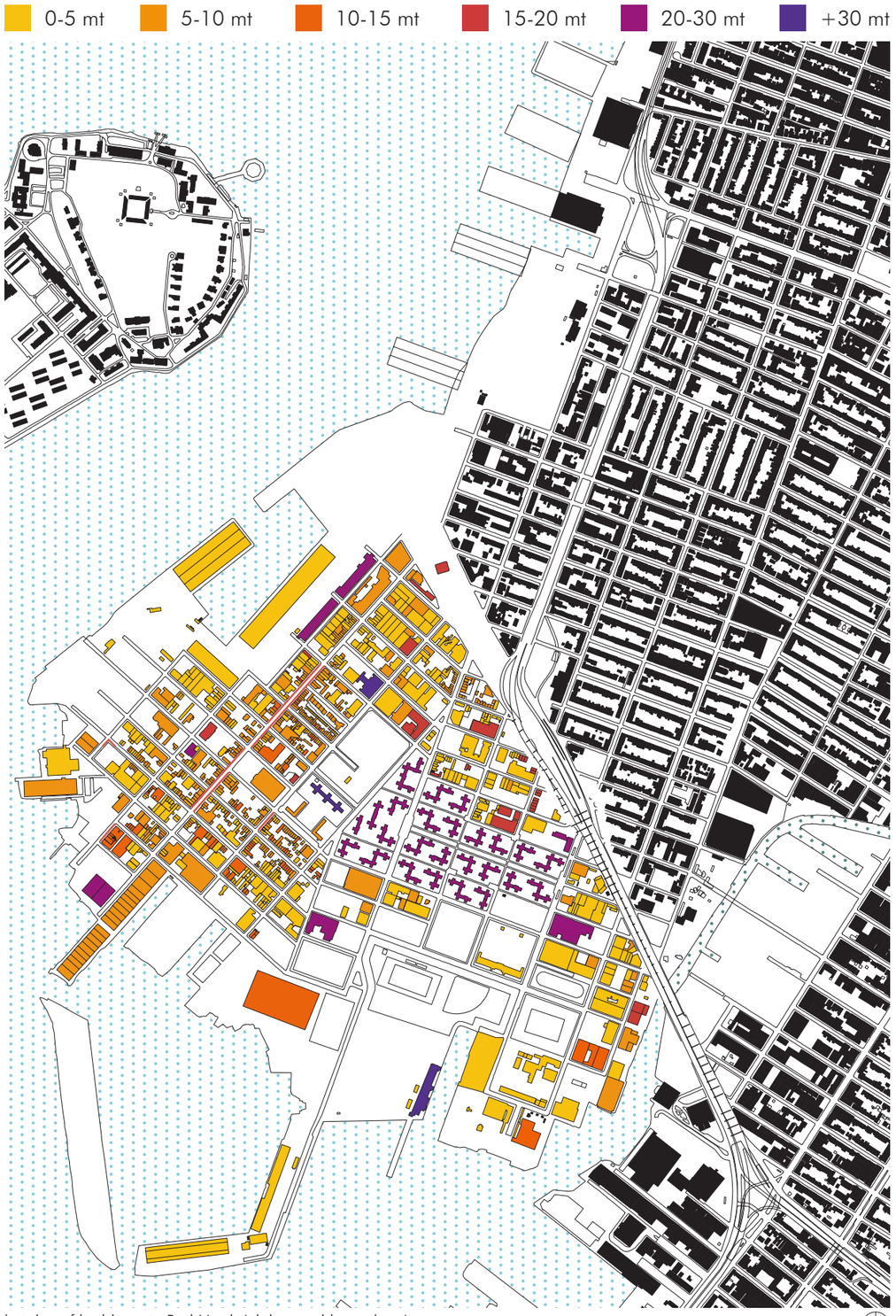
1. Red Hook houses
2. Row house
3. Warehouse
4. Studio + workshop
5. Vacant lot
6. Corrugated building



heights of buildings in Red Hook (elaborated by authors)
Source: https://www.oasisnyc.net, Google maps

Photo of Red Hook Houses, by authors, 2022

Photo of an industrial building on the waterfront, by authors, 2022

Photo of a wine store on Van Brunt Street, by authors, 2022

local frictions

There are many social and urban fractures in the neighbourhood. The population of Red Hook has two types of residents: low-income residents on the one hand and wealthier residents on the other.
These groups are divided both demographically and geographically, the former being concentrated in the low-income housing and accounting for about 70% of the entire population of the neighbourhood, the other living in the townhouses of the centre.
Another contrast is undoubtedly the pollution of the Gowanus canal, which in recent years has reached a level of pollution that is worrying for the health of the citizens.
Another reason for conflict is the expressway, which was never wanted by the neighbourhood's inhabitants, for fear that it would become yet another urban fracture serving to isolate the neighbourhood even further.
These frictions are being resolved over time: the poor and the rich, who previously tended to clash, are now socially intertwined through various community networks, established after the tragic events of the shooting of Patrick Daly, a highly respected elementary school principal, and Hurricane Sandy.Frictions with the Gowanus canal is also being resolved, with canal cleaning work beginning in 2019.

The diagram below represents an illustration of the local frictions of the place elaborated by authors.

commercial areas

isolation

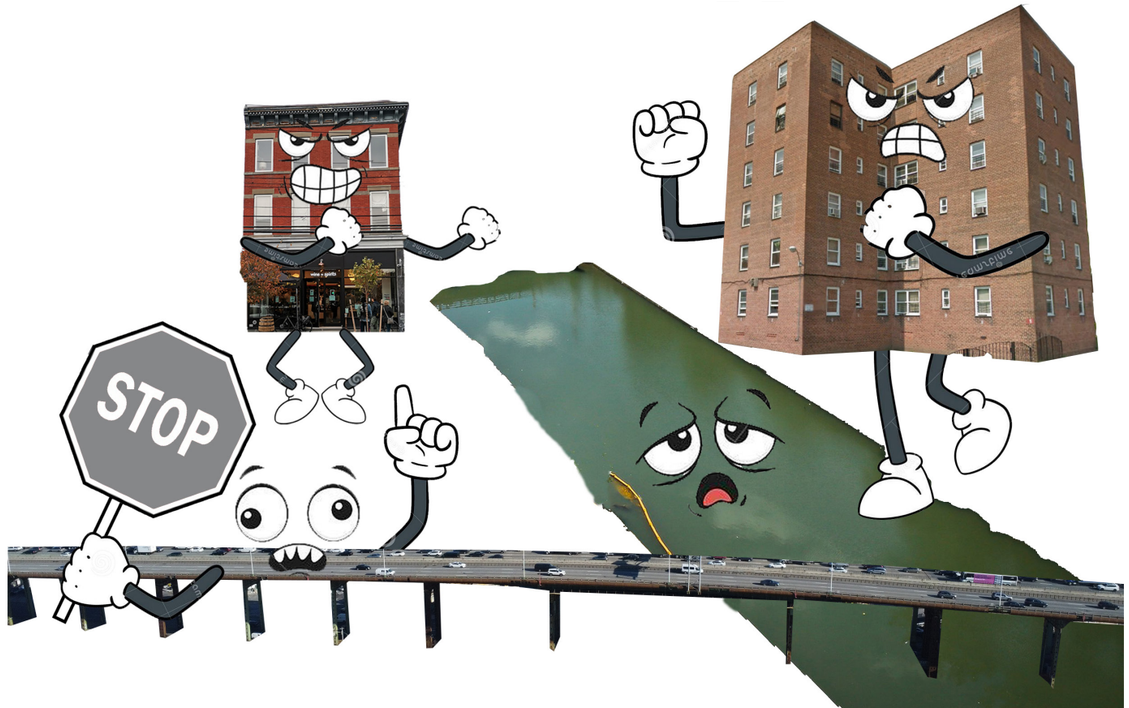
double isolation

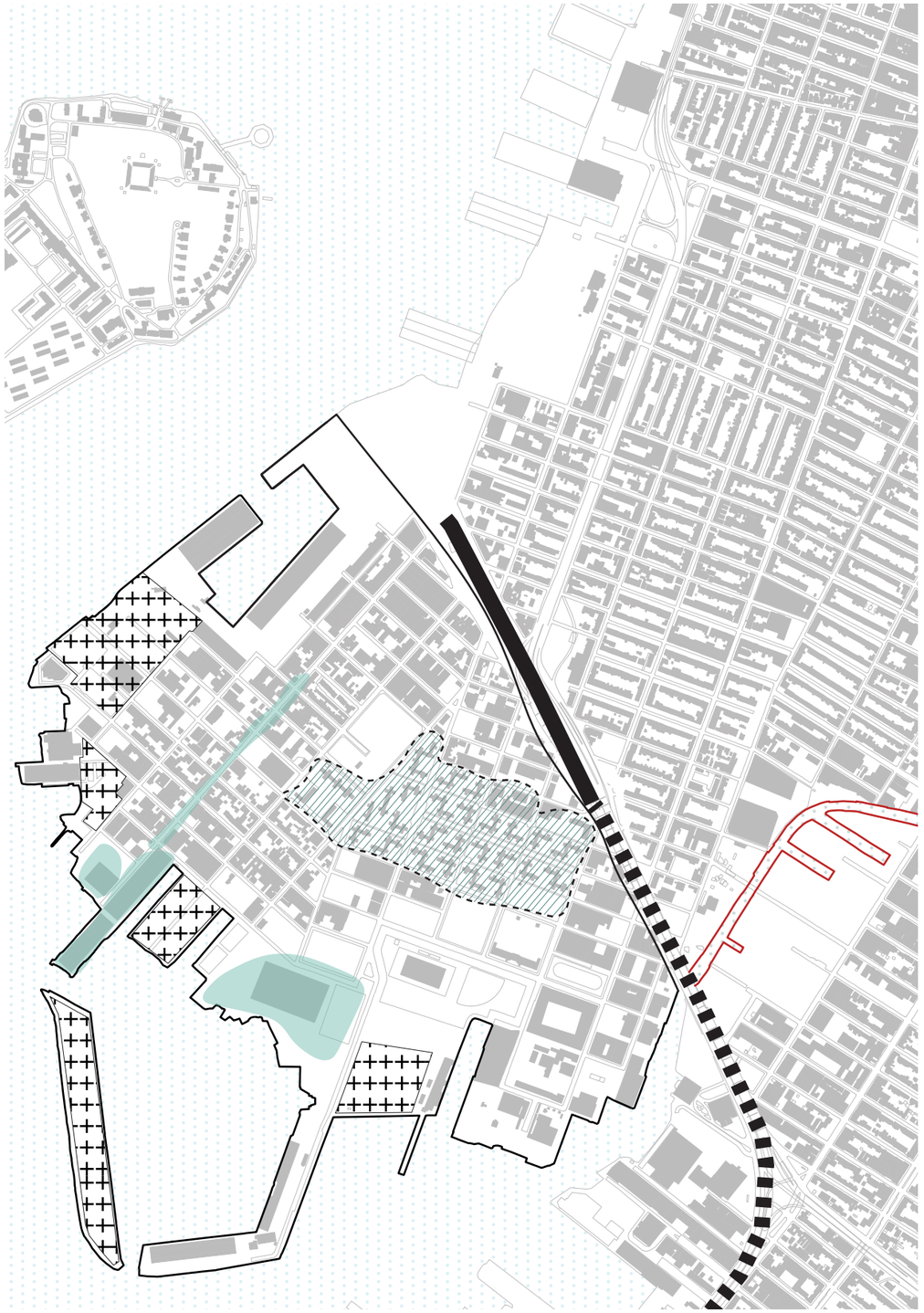
polluted Gowanus Canal

urban void

fracture

permeable fracture





local frictions map in Red Hook (elaborated by authors)
Source: critic elaboration carried out by the authors

day trip in Red Hook

Red Hook, despite its secluded location and difficult accessibility by public transportation, offers several interesting sights for New York City residents and tourists.
The presence of Ikea certainly makes it attractive to residents, but there are a few restaurants and activity spots that can be visited in a day or more by walking.

In the diagram below, a hypothetical "day trip in Red Hook" has been described in which the most attractive places have been included, such as the Columbia Street Farm where it's possibile to buy vegetables, the Brooklyn Waterfront Artists Gallery (BWAC) where you can visit an exhibition of artists, or the Sunny's Bar, an historical bar where you can grab a beer.

1 Ikea
1 Beard St, Brooklyn,
NY 11231
10 am - 9 pm

1 Red Hook Park
638 Columbia St,
Brooklyn, NY 11231
7 am - 8 pm

2 Columbia street farm
560 Columbia St,
Brooklyn, NY 11231
7 am - 8 pm

3 BWAC
481 Van Brunt Street,
Door #7A, 11231
1 pm - 6 pm (weekends)

1 Hometown Bar-be-que
454 Van Brunt St,
Brooklyn, NY 11231
12 pm - 10 pm

4 FOOD BAZAAR
480-500 Van Brunt St,
Brooklyn, NY 11231
7 am - 10:30 pm

what you wanna eat for lunch?

2 Brooklyn Crab
24 Reed St,
Brooklyn, NY 11231
12 pm - 10 pm

wanna grab a beer?

3 Sunny's Bar
253 Conover St,
Brooklyn, NY 11231
3 pm - 12 am

3 Louis Valentino, Jr. Park and Pier
Ferris St &, Coffey St, Brooklyn,
NY 11231
6 am - 1 am

2 Pier 44 Waterfront Garden
258 Conover St,
Brooklyn, NY 11231
6 am - 9 pm

5 Red Hook Lobster Pound
284 Van Brunt St,
Brooklyn, NY 11231
12 pm - 9 pm

eat

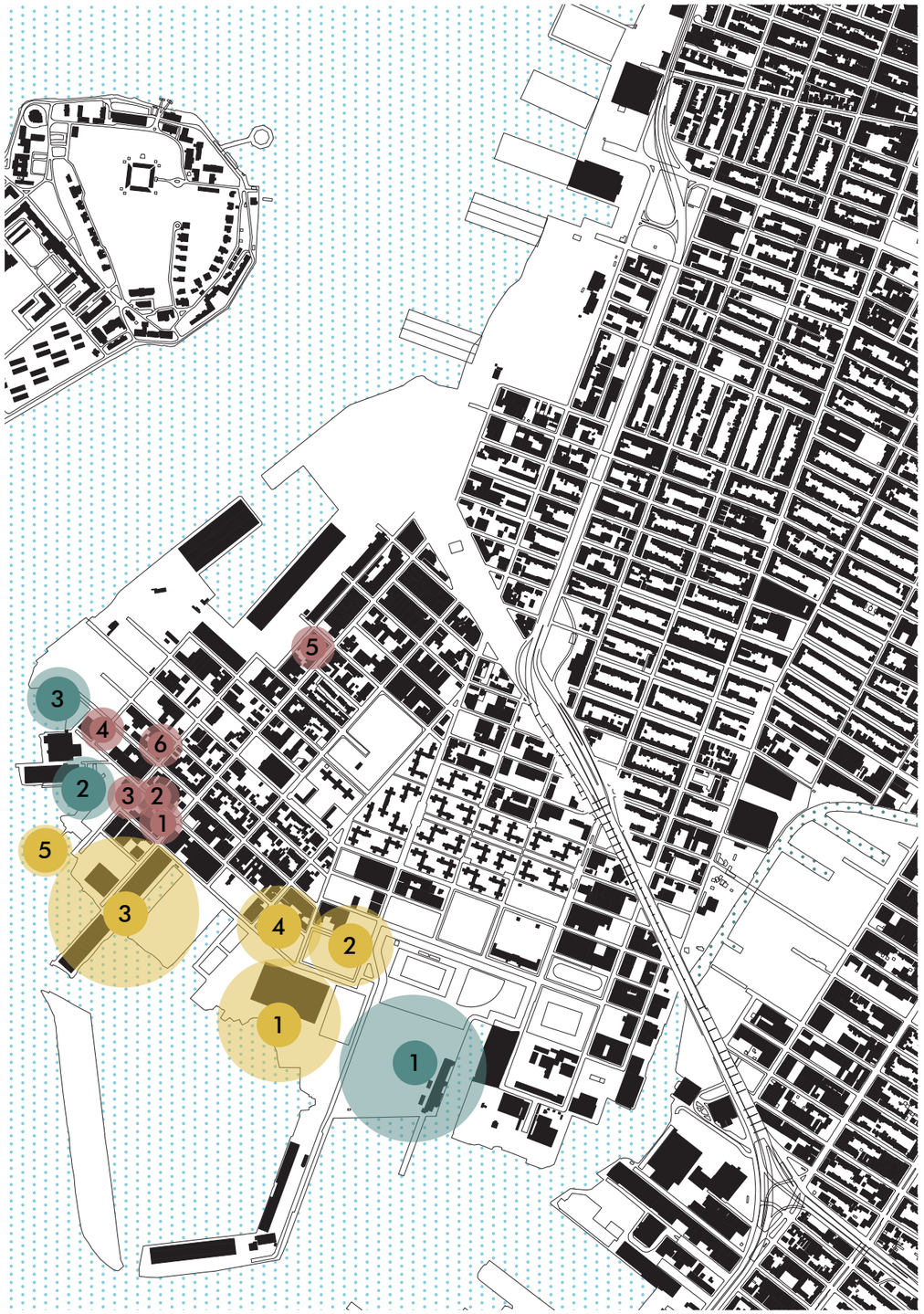
drink

5 Waterfront Museum
290 Conover St,
Brooklyn, NY 11231
1 pm - 5 pm (saturday)

4 Steve's Authentic Key Lime Pie
185 Van Dyke St, Brooklyn,
NY 11231
12 pm - 6 pm

3 Widow Jane distillery
218 Conover St,
Brooklyn, NY 11231
11 am - 7 pm (saturday)

where you can go shopping or visit
where you can run
where you can eat and drink



landmarks in Red Hook (elaborated by authors)
Source: Google Maps

comparisons

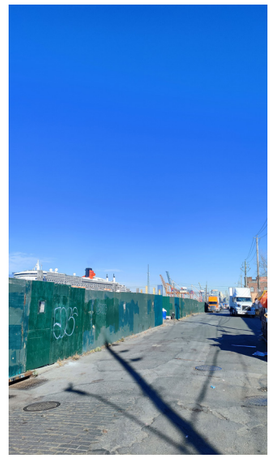
The photos taken by us want to compare opposed aspects and impressions of the neighborhood.

by authors, 2022

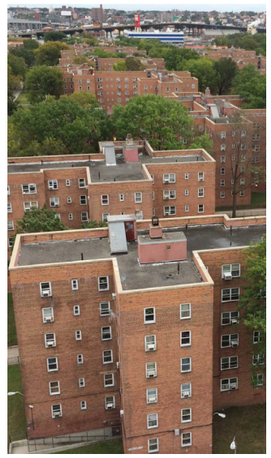
open spaces



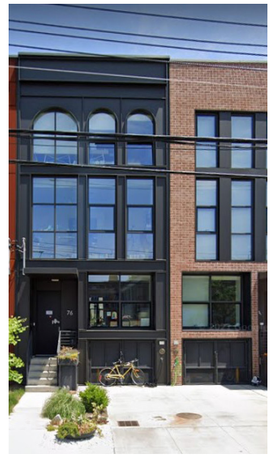
boundaries

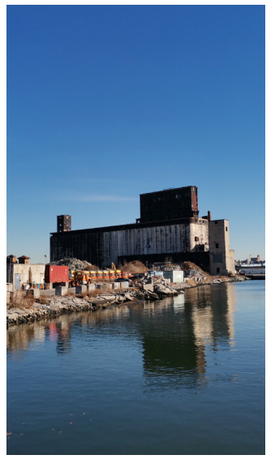

Red Hook houses

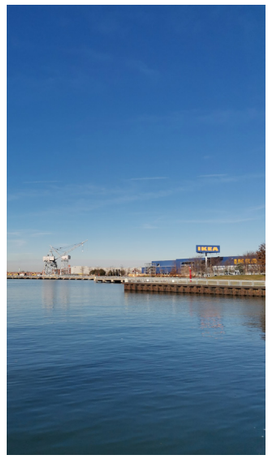




houses of Red Hook

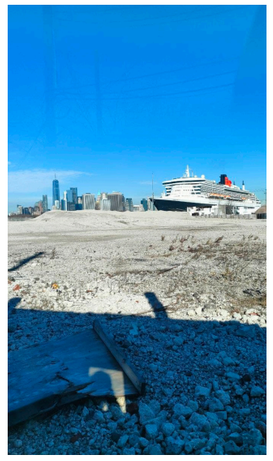




landmarks



vacant lots



03.4 **Water** and Red Hook

what is the role of water?

flood map

1. *Raising Red Hook: Preserving a Neighbourhood on the Edge of the World,* David Tucker, 2019

The Preliminary Flood Insurance Rate Maps, released in 2015 as part of citywide flood map update, establish the floodplain currently subject to building code and zoning regulations.

Red Hook is the most vulnerable area in New York City to flooding and will be the first victim of the climate change. Today's coastline was constructed by pushing the ocean away.
Nature is pushing back and will eventually return the coastline to a state resembling the marshes that the Dutch originally occupied.[1]
In October 2012, during the Superstorm Sandy Red Hook was among the hardest hit areas in the city and after the storm most of the neighbourhood remained underwater for weeks.
Superstorm Sandy was a 100-year storm, however, experts predict that due to climate change similar storms will have a far higher frequency.
As a peninsula, Red Hook is exposed to the ocean on three sides, but it can also be flooded from the interior.
The current peninsula is mostly man-made land, and the low lying coast is extremely vulnerable to flooding.
Ocean levels globally are predicted to rise as a result of climate change, so these threats will cause permanent flooding in Red Hook's residential, commercial and industrial areas forcing residents to leave their homes.

a portion of the area subject to flooding from the 1% annual chance flood. These areas are subject to high velocity wave action (a breaking wave 3 feet high or larger).

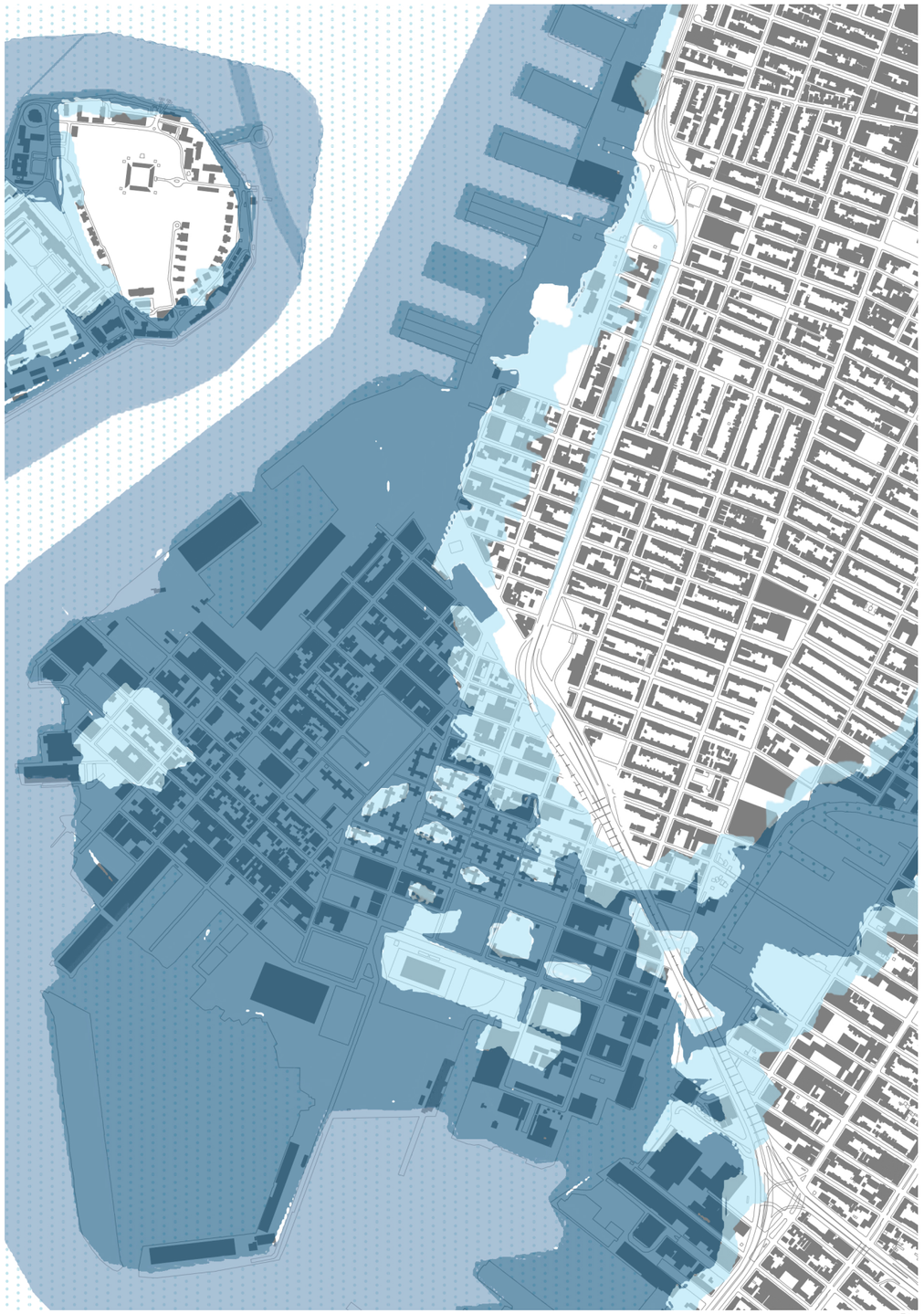
V (1% floodplain)

a portion of the area subject to flooding from the 1% annual chance flood. These areas are **not** subject to high velocity wave action but are still considered high risk flooding area.

A (1% floodplain)

the area subject to flooding from the 0.2% annual chance flood and referred to in the Zoning Resolution as the 'moderate-risk flood zone'.

X (0.2% floodplain)



flood map in Red Hook (elaborated by authors)
Source: https://zola.planning.nyc.gov/

Photo of Red Hook after Hurricane Sandy, by Spencer Platt, 2012

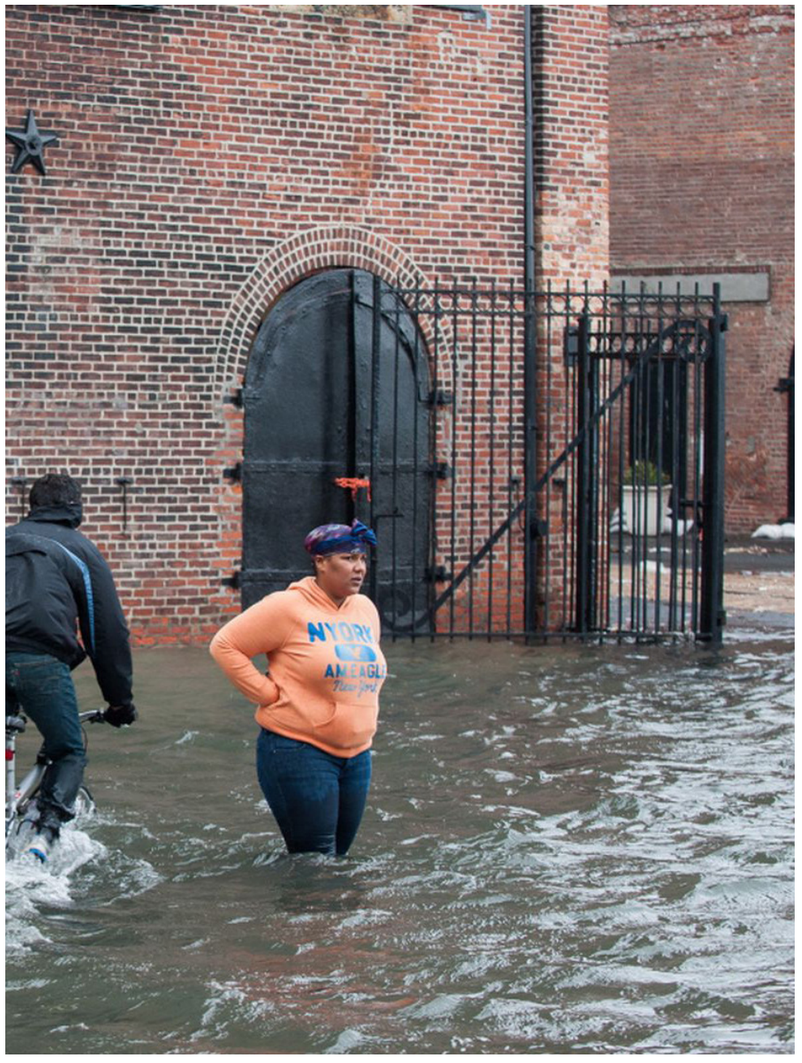


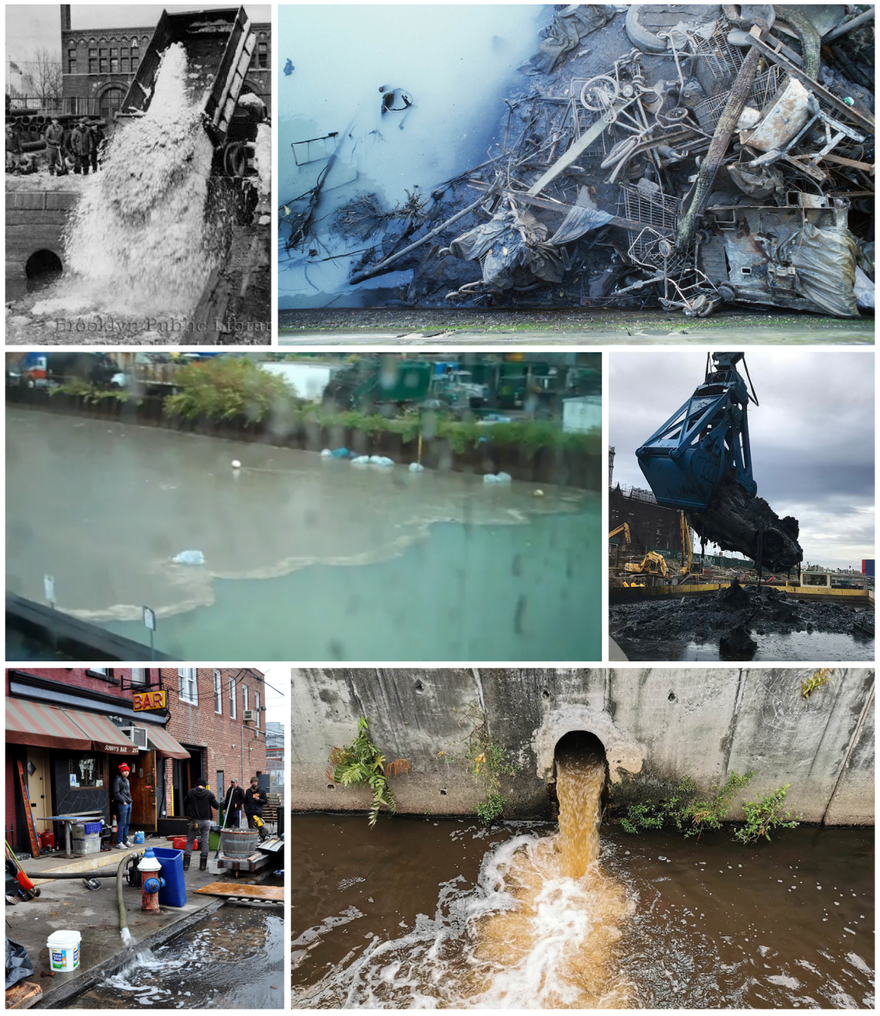
Photo of Red Hook after Hurricane Sandy, by Craig Warga, 2012

Photo of Red Hook after Hurricane Sandy, by Henri Salonen, 2018

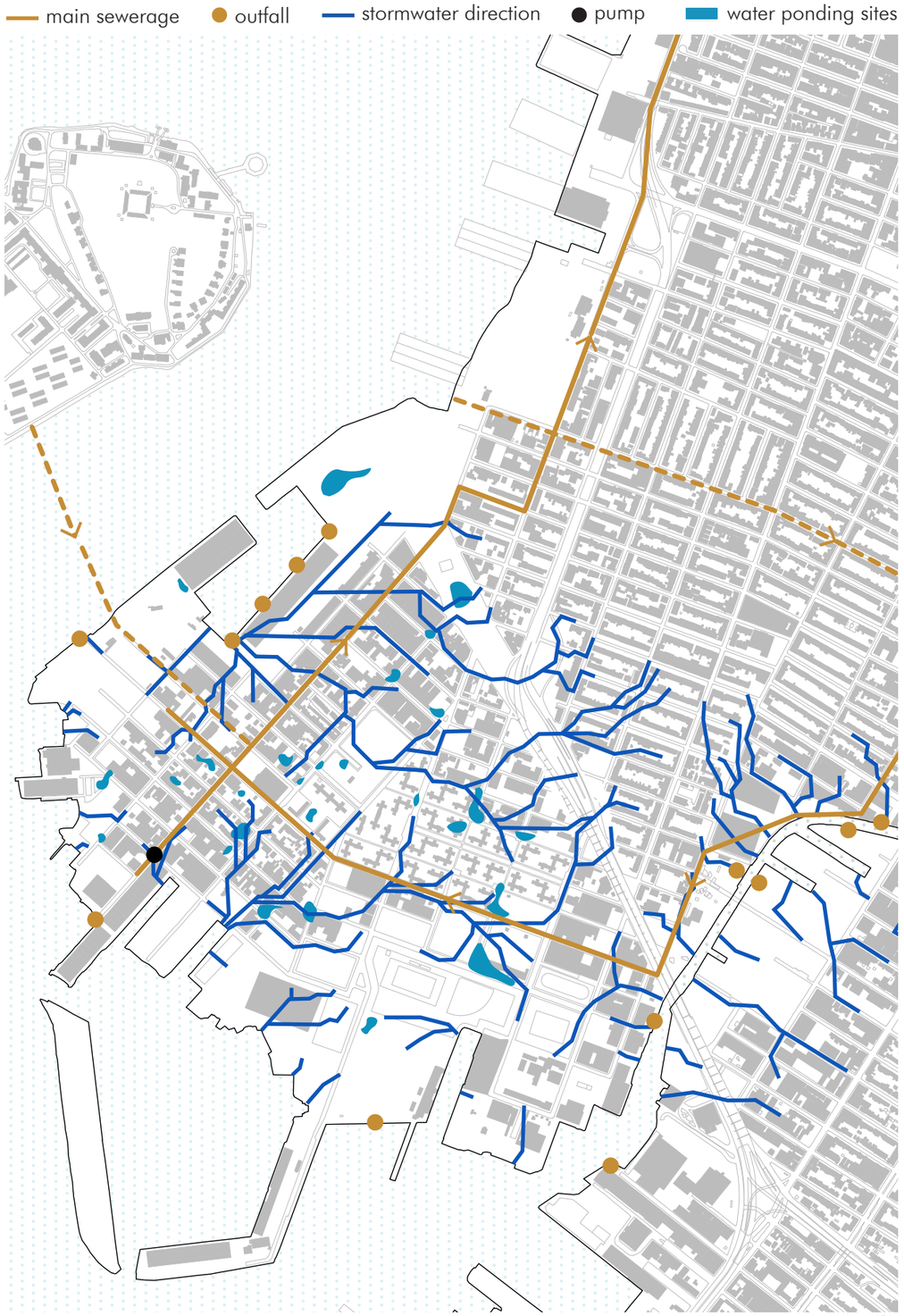
sewage system

On average CSO events occur about once a week (and often up to 70 times a year in some drains) and the average weekly polluted discharge reaches 1 billion litres across the city.

About 60% of New York City has a combined sewer system. In a combined sewer system, there is a single pipe that carries both stormwater runoff and wastewater from buildings. This mix of water is usually sent to a single wastewater treatment plant.
During heavy rainstorms, the combined sewers receive higher than normal flows, when this occurs the network becomes overloaded and some of the untreated sewage is discharged directly into the city's watercourses through outfalls near the watercourses. These events are called combined sewer overflows (CSOs) and significantly affect the water quality and recreational use of local water bodies.
The blue lines on the map represent the predicted direction of stormwater runoff flows, assuming all manholes are blocked. The runoff model is based on the existing slopes of the terrain (topography).



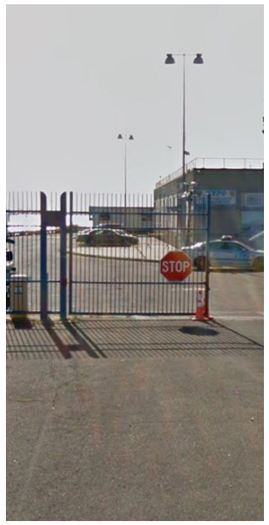
photos of the sewage system
Source: https://redhookwaterstories.org



sewage system and predicted direction of stormwater runoff (elaborated by authors)
Source: https://redhookwaterstories.org

the watefront

The active port of Red Hook that made the neighborhood flourish in the 19th century declined gradually in the 20th century leaving a legacy of underutilized industrial architecture.
The Red Hook waterfront has enormous potential as it enjoys privileged views of the Statue of Liberty, Governors Island and Lower Manhattan.
Nevertheless, walking along it, one realizes that it is not possible to walk it in its entirety because the path is often obstructed or discontinuous because of the industrial and abandoned areas.
The presence of gates, railings, and other obstacles do not allow you to enjoy the view, so that the waterfront is sparsely populated, except by locals who bring their dogs around.
In the map on the right there is a distinction of places where you can't enter, locations where you can enter but without functions, and areas with activities where you can walk around.



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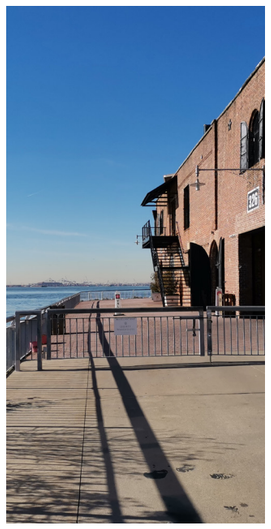
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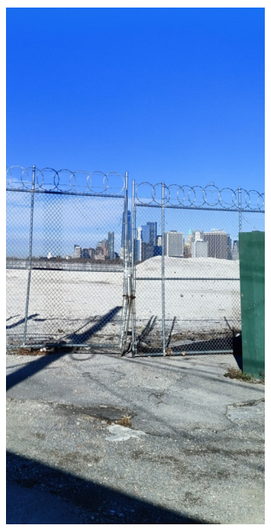
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waterfront accessibility in Red Hook (elaborated by authors)
Source: Google Maps, site inspection

03.5 People of Red Hook

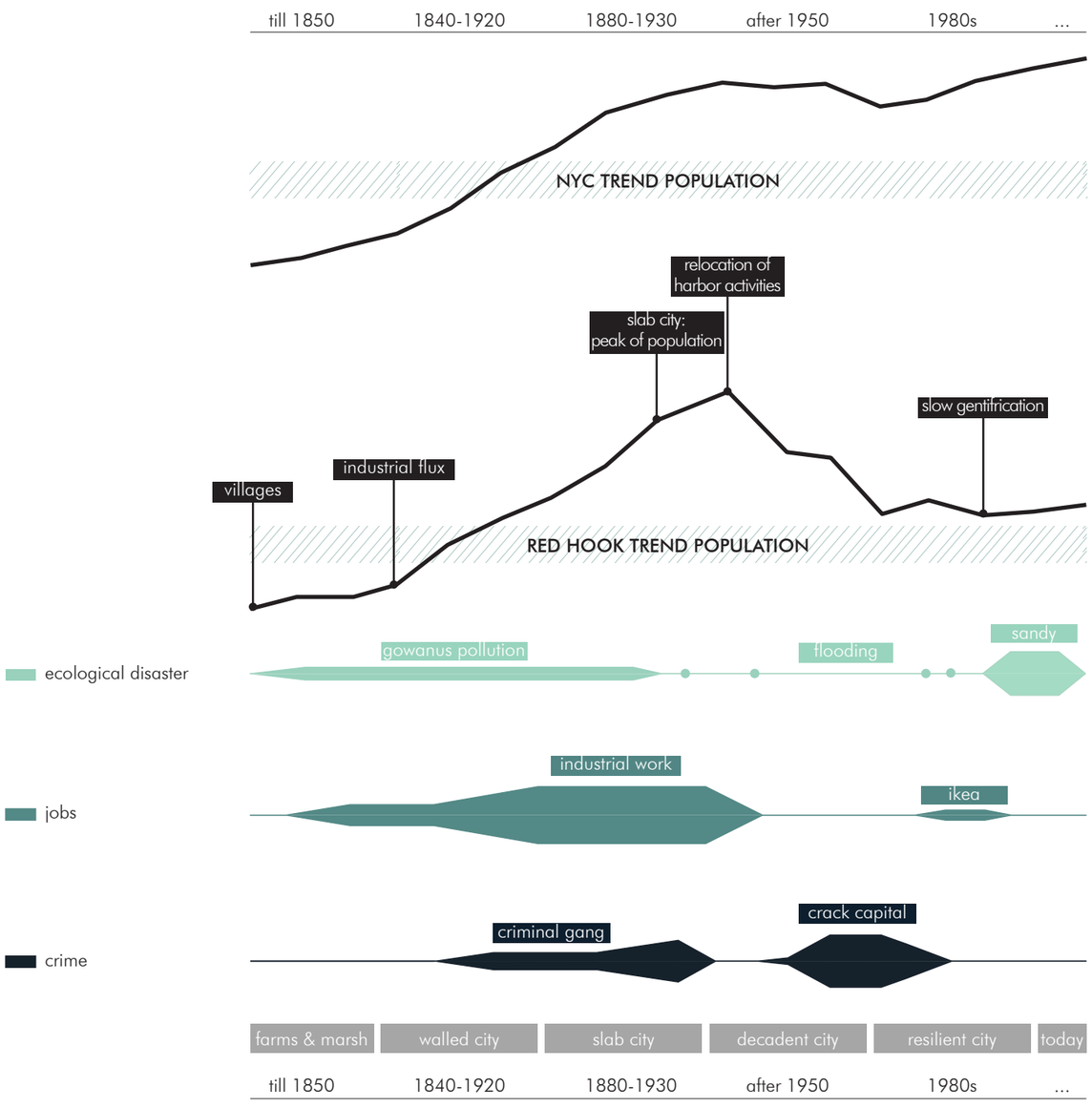
how many people live in the neighborhood?

people

In the 1990s, Life magazine named Red Hook as one of the "worst" neighbourhoods in the United States and as "the crack capital of America".

According to 2010 United States Census data, the population of Red Hook is approximately 11,000.
Approximately 70% of the inhabitants live in the Red Hook Houses. Most of these are of Hispanic or black origin, mostly with low incomes, the remaining 30% of the inhabitants live in single-family houses on the main streets of the neighbourhood.

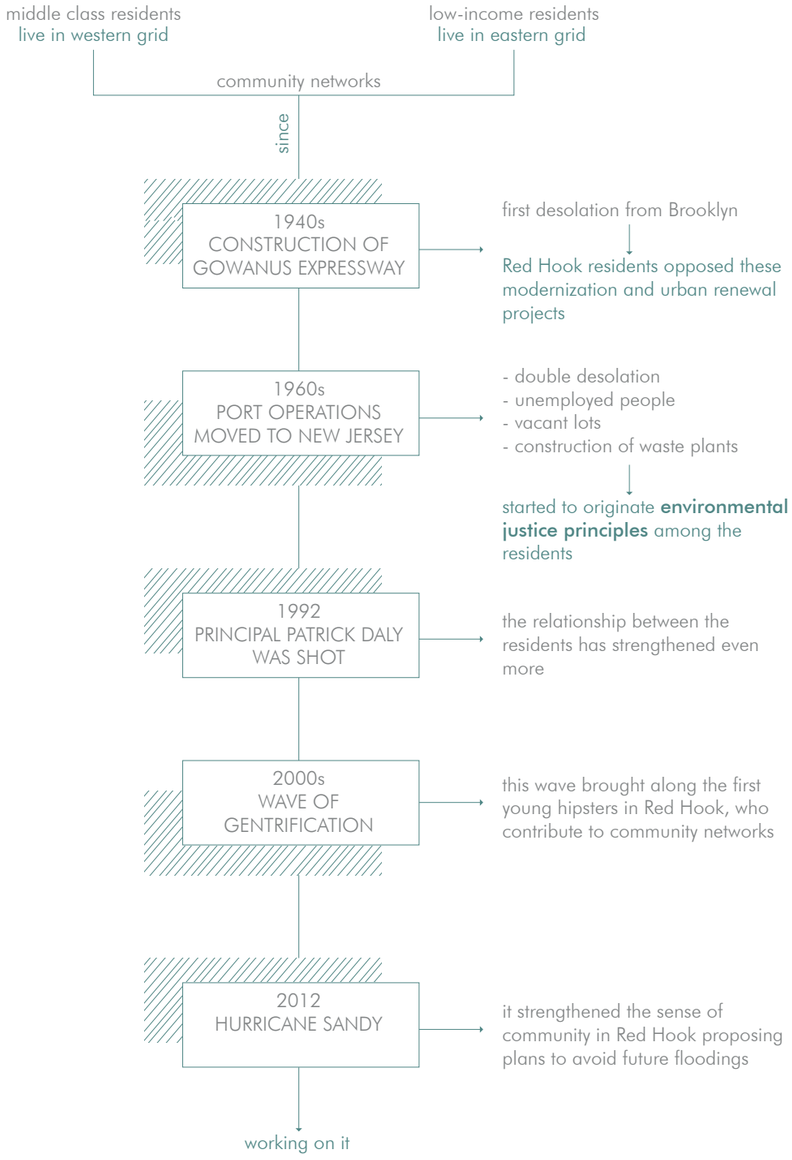
In the diagrams below the demographic trends of Red Hook and New York from 1850 to the present day are compared, trying to give reasons for the positive or negative peaks.
The other diagrams represent respectively the conceptual volume of pollution, employment and crime in the neighbourhood during the above mentioned period.



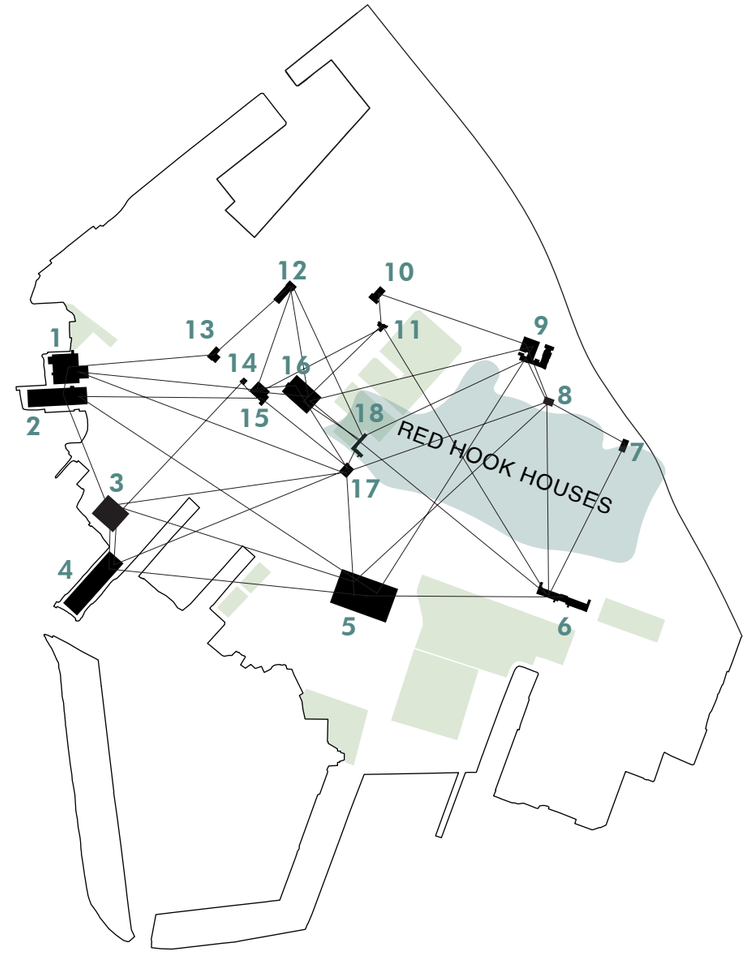
ethnicity map in Red Hook (elaborated by authors)
Source: morphocode.com, U.S. census bureau

"being isolated together"

In the 1940s a wave of gentrification arrived in Brooklyn starting in Brooklyn Heights and subsequently arrived to Carroll Gardens (1970s). Red Hook was not affected by this process, mainly due to bad living conditions that characterized the neighborhood at that time and the isolation from the transit system. In the late 1980s the process of gentrification expanded affecting Red Hook. It experienced a slight influx of new residents, mainly artists or young professionals. A second wave took place in the beginning of the 21st century. The residents are intensely connected through a community network that aims to create a collaboration between residents, restaurants, schools, shops, artists to make Red Hook a livable place for all.



1 Extreme Kids & Crew
2 Red Hook Rise
3 Hook Arts Media
4 BWAC
5 Red Hook Farms
6 Red Hook Recreation Center
7 Joseph Miccio Community Center
8 Red Hook Initiative
9 Good Shepherd Services
10 Red Hook Community Justice Center
11 Falcon works Artists Group
12 Pioneer Works
13 South Brooklyn Community High School
14 Kentler International Drawing Space
15 Realty Collective, LLC
16 P.S. 015 Patrick F. Daly
17 Brooklyn Public Library
18 Red Hook Houses Farm



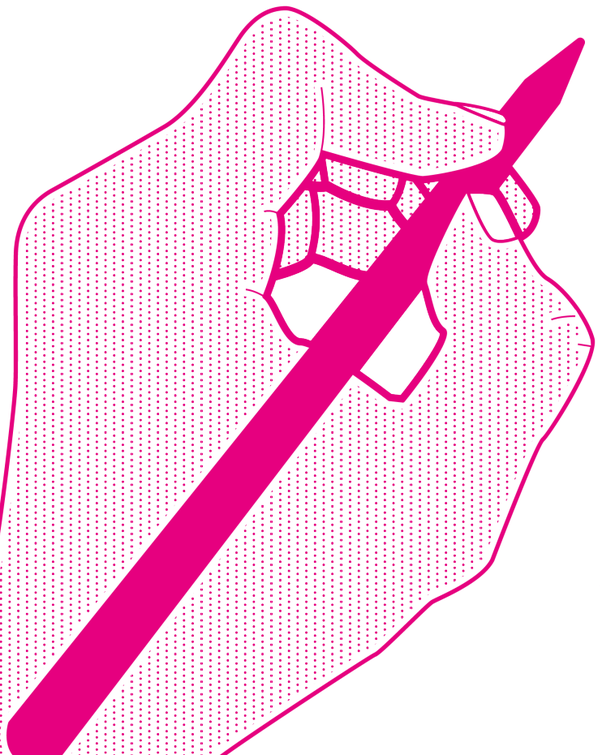
Community based organizations in Red Hook (elaborated by authors)
Source: Google Maps, Brooklyn community foundation website

what people think about Red Hook / how they helped us to design

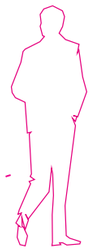
Walking through Red Hook we had the chance to meet some people who live there and ask them some questions.
It was necessary for us to understand what the people living in this neighborhood think about Red Hook.
We have prepared some starter questions in order to understand the problems and potential this area has.
Our questions mainly concerned the sensations of living in this neighborhood, what the inhabitants feel to walk the streets, to experience the waterfront, to live with the problem of the lack of transport, to have a home in a place with a high risk of flooding.
We wanted to understand their fears, their concerns, but also what they love about this neighborhood, so that we can design something they can live.

STARTER QUESTIONS

1. Think about the area of Red Hook, what comes to your mind first about it?
2. What do you like and dislike about the area? What do you want to change?
3. Where do you feel safe? And where do you prefer not to go alone?
4. Do you think Red Hook is a local place where many people know each other? If yes, do you like it in this way? Or do you prefer to live in a more active place like Manhattan?
5. Do you enjoy the Red Hook's waterfront?
6. Are you aware of the flooding problem in Red Hook?
7. What would you think it's necessary to "solve" the flooding problem?
8. What could local people do to prevent the problem? And what could do the government of NYC?

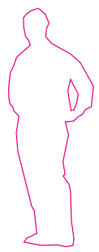


MORE AWARENESS - EMERGENCY SHELTER - VACANT LOTS - EVACUATION DRILLS - ACTIVITIES ON THE WATERFRONT - AFFORDABLE FLOOD INSURANCE - MORE GREEN



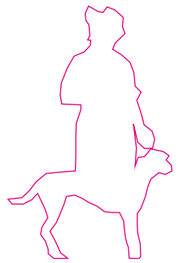
NATE, 42 years old

1. Amazing view from the waterfront. The Statue of Liberty seeems to be so close.
2. I don't like being isolated from the rest of Brooklyn and the lack of transportation.
4. I love the local aspect of Red Hook because the community really works together.
6. I have been living here for 5 years so I have not experienced Sandy firsthand.
I am aware of the flooding problem, but I think it would be great if there was a specific place in case of an emergency. I have known many people who had no electricity for weeks during the hurricane.



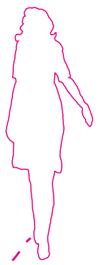
RICKY, 27 years old

2. I like Van Brunt Street because there a lot of restaurants, and some parks. I really don't like the Gowanus Expressway because because I live nearby and I always hear a lot of car noise. I feel like isolated because of that, it divides Red Hook from the rest of Brooklyn.
4. I like Red Hook because I was born and raised here, but sometimes I would like it to be a more active neighborhood, more for young people, and above all I would like it to be more connected to the City.
5. I rarely go to the waterfront because I work in Manhattan and have no time.
I don't like going there because there is nothing to do.
7. I don't know if it would be useful, there are many vacant lots on the waterfront and under the highway, perhaps they could be a potential to help prevent flooding and to make greener the neighborhood



JESSE, 30 years old

1. A place where I love to go is Louis Valentino Park because there is a lot of space for my dog to run and be outdoors. Unfortunately in winter there isn't people, but it has lots of potential because of the view.
6. 7. Yes i'm aware of the flooding problem, but what I can say it's that Sandy has strengthened the community a lot, and there are a lot of associations that help people to understand the problem. What we need would be a trained emergency team who can organize seasonal evacuation drills and a flood resilience strategy.
8. Local people can organize associations and help to design the neighborhood, but the government should project a real plan to prevent flooding, not just workshops.



KAREN, 54 years old

2. At first I hated ikea because I was afraid it would bring too much traffic in the neighborhood, now I think it's nice and I like the park next to ikea too.
3. I feel safe everywhere.
5. I like the waterfront but honestly I go there only when I have lunch at some restaurant close by, because there isn't much to do there.
7. I think it's not possible to "solve" the problem, but what can we do it's try to prevent it and make citizens aware of the problem. A great thing would be an affordable flood insurance.

PRECEDENTS

precedents:

the beltway park
brooklyn park bridge
hunter's point waterfront park
green streets in Portland
floating neighborhood
BQX transport

04

04.1 Precedents

fill the void under the elevated

PRECEDENT:
The Bentway Park
Location: Toronto, Canada
Year: 2018
Architect: Public Work, Greenberg Consultants, Inc.

The surface below the expressway is transformed as a linear park.
The project consists of 1.75 kilometers of multi-use trail and 500 meters of connections to the Exhibition Go Station underneath Toronto's Gardiner Expresswayand. The trail is used as a network that connects seven downtown neighborhoods.
The project is maintained and operated by a not-for-profit organization called "The Bentway Conservancy".
The starting point for conceptualizing the project was the structure itself. The expressway's series of supportive concrete columns - "bents" - create a series of 'civic rooms' that can function collectively or on their own to offer spaces for a diverse range of programming and events.
The Bentway is part of a new breed of public spaces that are deliberately conceived and designed as places-in-progress rather than finished compositions, spontaneous places that leave space for others, for people.

Ideas for our project

linear park

street canal

bioswales

COMMUNITY INVOLVMENT

This project is a great example of public support. The driving force for the project began from the generous donation from the Matthews' family of $25 million. The Bentway project was announced in the fall of 2015. The community had two different reactions; some were expressing excitement towards the project, while others were concerned with the type of crowd the park could attract.

UNDER THE ELEVATED

The Bentway Project was able to transform an underutilized brownfield space into an innovative public space. This public park project was able to change the idea of park space. The Bentway was able to tie in surrounding neighbourhoods, while also providing unique and transformative design. This space provides public engagement through its recreational spaces.

STORMWATER MANAGEMENT

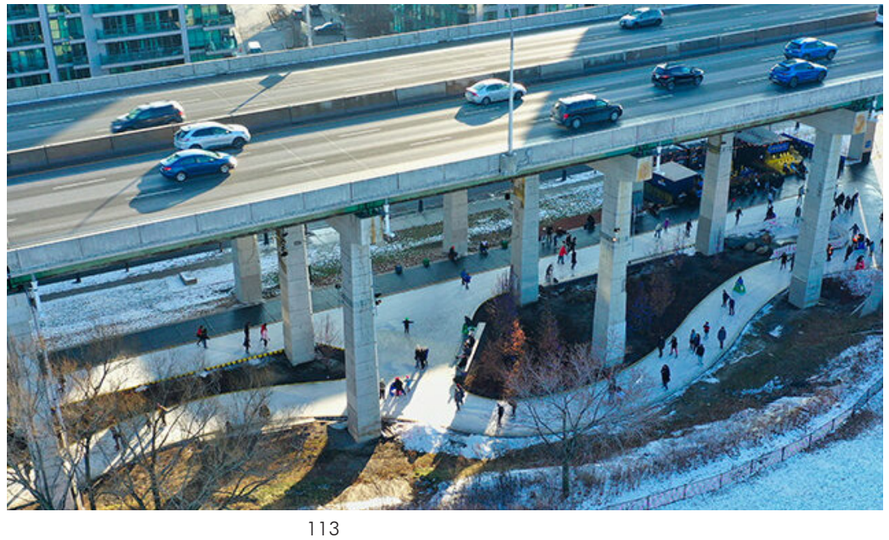
The stormwater design captures rainwater from the expressway above, holds it on site, and promotes filtration and infiltration. Gardiner drainage is intercepted by a series of bioswales, underground storage features and infiltration trenches. Water is naturally treated in the bioswales, which reduce the velocity of runoff to promote infiltration and act as a filter.

Site plan
Source: https://publicwork.ca/

summer

All photos by
www.thebentway.ca

winter



protect the coastline / revitalize the waterfront

PRECEDENT:

Brooklyn Bridge Park

Location: New York City, USA
Year: 2003-2013
Architect: Michael Van Valkenburgh Associates, Inc.

Brooklyn Bridge Park is a park designed by Michael Van Valkenburgh Associates, and is located on the west side of Brooklyn and overlooks the East River.
The site was a defunct bulk cargo shipping built by the Port Authority of New York in the 1950s but rendered obsolete by the rise of container shipping. Due to its proximity to water and facing the future climate changes and sea level rise, the park has been designed with the dual function of a place for recreation and a place of protection from storms and floods.

The vegetation and the border design have all been satisfied and selected with the aim of also fulfilling a protective function.
The pier 1 has been realized by using hundreds of thousands cubic yards of imported fill from the East Side access excavation in Sunnyside Yards.
This new topography acts as barrier to counteract sea level rise. This type of strategy proved effective during Hurricane Sandy, in fact most of the debris and alluvial water were neutralized by this natural barrier.

Ideas for our project

wetlands

multi purpose levee

living shoreline

RECREATION PIERS

Pier 5, along with Pier 2, is the focal point for active recreation in Brooklyn Bridge Park. The pier itself is covered in a five-acre stretch of artificial turf that can accommodate soccer, lacrosse, rugby, cricket, flag football, and ultimate Frisbee. The fields are surrounded by unobtrusive mesh that collects stray balls, while a system of lights enables night games.

INCREASED GROUND

During the design process, MVVA took into consideration the NOAA water level predictions for 2045 (+40 cm) and a 100-year storm surge of 244 cm and, in order to protect the vegetation, all of the park's tree have been planted at or above +240 cm. Furthemore, one of the park's strategies was to increase the topography to transform the site.

STORMWATER MANAGEMENT

Excess stormwater is collected from buildings, paved areas, lawns, and planting areas, conveyed into underground tanks, and then cycled and cleansed through rain gardens, supporting a lush swath of rain garden plantings.
This runoff collection system reduces the combined sewer overflow and help to control the stormwater run-off.

Site plan
Source: https://www.mvvainc.com/

before

All photos by Brooklyn Bridge Park

after

All photos by Brooklyn Bridge Park

revitalize the waterfront
/
reclaim the Red Hook's original shape

PRECEDENT:
Hunter's Point Waterfront Park
Location: New York City, USA
Year: 2012/2018
Architect: Weiss/Manfredi and Swa/Balsley

Hunter's Point Park is the result of the redevelopment of an old landfill located on the western waterfront of Queens, and it was designed by Thomas Balsley Associates, Weiss / Manfredi, and ARUP.
The park is divided into two main parts, an "active" and a "passive" part.
The north side is conceived as a space programmed to host activities for people, on this side there are basketball courts, a dog track, a playground, a sandy beach without water, and a central elliptical lawn.
The other side plays a passive role, providing paths and views for strolling, contemplating, and enjoying the view.
During the development of the park, the architects knew they had an important opportunity to address urban resilience issues, which is why the park was built to handle storm surges and floods.
The green space, in addition to being a recreational and contemplative place, was designed to accommodate flooding waters, to quickly drain the waters, and to protect the city.
This thanks to some strategies such as rip rap edge, the dual function of some spaces to act both as a recreational place and as a retention basin, the wetland marsh projects created using native species able to withstand periods of flooding of saltwater, and thanks at whose roots it is possible to prevent erosion phenomena in a very unstable ground.

Ideas for our project

multipurpose levee

elevated walkway

floodable park

DOUBLE FUNCTION

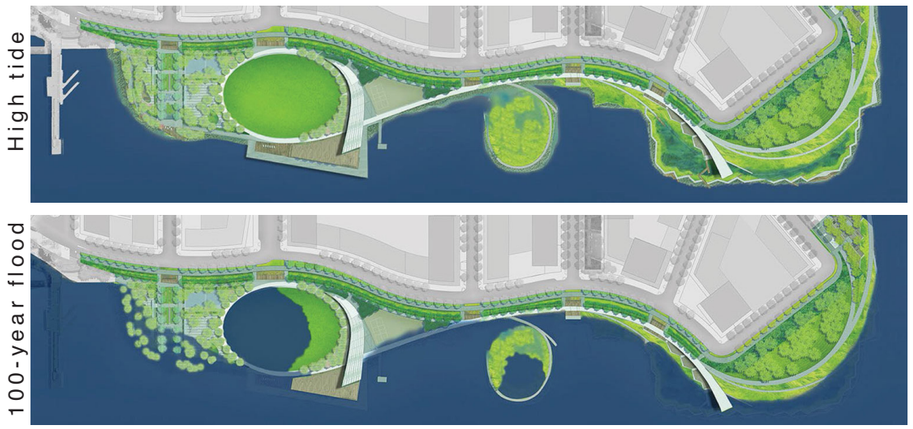
A multipurpose green oval defines the most open part of the site and offers views directly across the river to Manhattan. The peculiarity of the oval is that on sunny days it is a place for socializing, while on rainy days it turns into a basin that collects rainwater and sea water, and then releases the water without damaging the park and the surroundings.

ELEVATED WATERFRONT

The park was conceived with a continuous walkway along the seafront, which in the first phase presents a simpler path, in the second phase the path is winding and elevated. During the walk the visitor is connected to the water and has a beautiful view towards the New York skyline.
The walk leads to an element suspended above the wetlands.

DESIGNED TO BE RESILIENT

The first phase of Hunter's Point South Park was in construction when Hurricane Sandy hit. The oval main lawn, which is made of artificial turf, is sunken, ringed by two concrete steps, with natural grass on the upper level. Sandy flooded the park, but the water was retained by the lawn and then receded with the tide causing no damage done to the park at all.



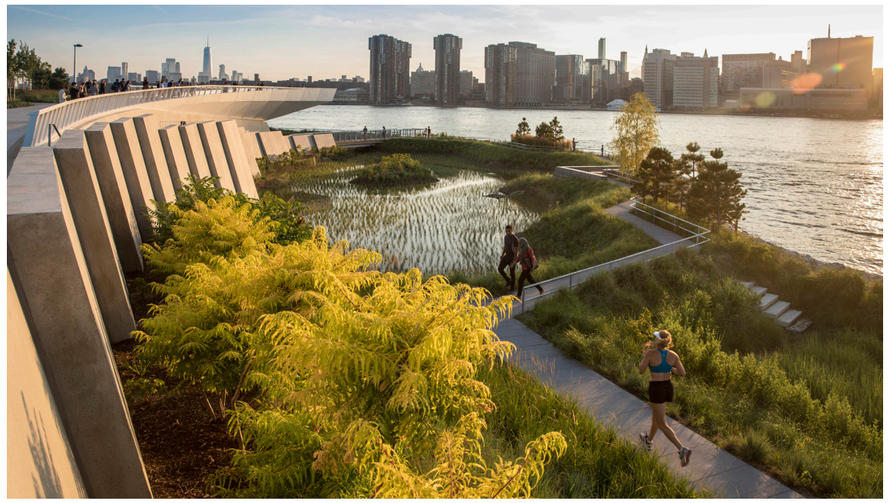
Site plan
Source: https://www.swagroup.com/

before

All photos by Nathan Kensinger.

after

All photos by Vecerka/ Esto, courtesy of SWA/ Balsley and WEISS/ MANFREDI



slow down the surface runoff

PRECEDENT:

Green Street of Portland

Location: Portland, USA
Year: 2007

Portland (Oregon) is known as one of the greenest cities in the United States and is a leader in the use of strategies that manage stormwater runoff, such as Green Streets, which is a system that incorporates special planters that decelerate runoff and filter pollutants from the water before it reaches the storm pipe system.

The planters are filled with a native species called Grooved Rush and each also includes a Black Gum tree. Both of these species tolerate saturated soil conditions.

On rainy days, the sewage system, in addition to collecting water from house drains (wastewater), must collect the water that falls in the form of rain on our streets and sidewalks (rainwater).

In case of heavy rains, the sewers can fill to capacity and a mix of wastewater and rainwater can end up going into the local waterways.

This system is important because collects and absorbs rainwater before it can enter the sewer system. The Green streets are located in areas where they can have the greatest impact on improving the health of surrounding waterways.

This strategy, in addition to reducing polluted rainwater entering Portland's rivers and streams, also help to reduce air temperature, improve air quality, promote biodiversity, improve pedestrian and bicycle safety, increase the urban green space, and beautify neighborhoods.

Ideas for our project

bioswales

URBAN GREEN SPACE

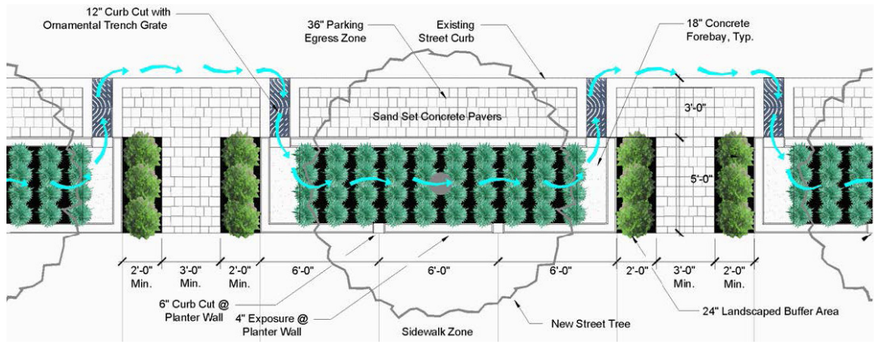
The use of this green system makes the streets of the city more livable and greener. Bioswales have a positive impact on human wellbeing and health thanks to the reduction of the "heat island effect"; they can also be used as recreational areas open to the public.

AIR QUALITY IMPROVEMENT

Trees, parks, and other green infrastructure features can reduce particulate pollution by absorbing and filtering particulate matter. In this way it is possible to have an improvement in air quality, and also a place that provides a habitat for wildlife species, especially birds.

PERMEABLE STREETS

By retaining rainfall from small storms, green infrastructure reduces stormwater discharges. Lower discharge volumes translate into reduced combined sewer overflows and lower pollutant loads. In an event of groundwater flooding, bioswales can serve as drainage systems.



Plan
Source: https://www.portlandoregon.gov/

before

All photos by
www.portlandoregon.gov

after

All photos by
www.portlandoregon.gov

build above the water

PRECEDENT:

a sustainable floating community

Location: Amsterdam, Netherlands
Year: 2010
Architect: Space&Matter

Schoonschip is Amsterdam's innovative circular neighbourhood, a community-driven project set to become a prototype for floating urban developments.
The project comprises 46 dwellings on 30 plots for over 100 residents connected by a jetty and features decentralised and sustainable energy, water and waste systems.
Schoonschip is designed around a specific set of values defined by the community of residents and represents an architectural vision responsive to climate change and sea level rise.
Each separate house is insulated and equipped with solar panels. Water pumps extract heat from the water in the canal to heat the homes.
There is only one connection to the national energy grid, through which residents of Schoonschip trade their generated solar power.

Ideas for our project

floating building

green roofs

COMMUNITY INVOLVEMENT

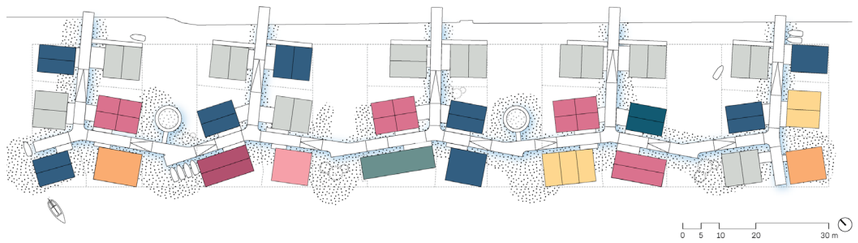
For more than a decade, the members of Schoonschip worked towards the creation of their dream homes. Their journey began in 2010 when frontwoman Marjan de Blok felt inspired and compelled to create an energy-neutral neighbourhood on the water with friends and acquaintances who shared her dream.
Fully completed in 2021 is home to more than 100 residents.

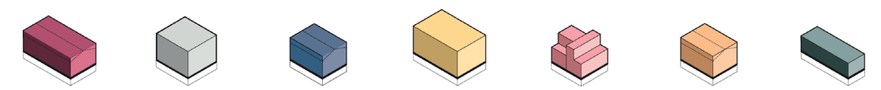
SUSTAINABLE COMMUNITY

500 solar panels are fitted on the roofs and each home has a battery to store surplus energy. There is only one connection to the energy grid through which residents can trade their generated solar power. A smart grid allows residents to trade among themselves. Each plot has a water pump to extract heat from the water. Wastewater from toilets is treated and converted back into energy.

SOLUTION TO FLOODS

On a small scale, Schoonschip explores and applies innovative solutions to some of the most pressing challenges brought forth by climate change. Residents live in highly eco-efficient buildings that were remotely manufactured, and share everything from electric cars and cargo bikes in their mobility hub, to the clean energy they generate on the houseboat roofs.

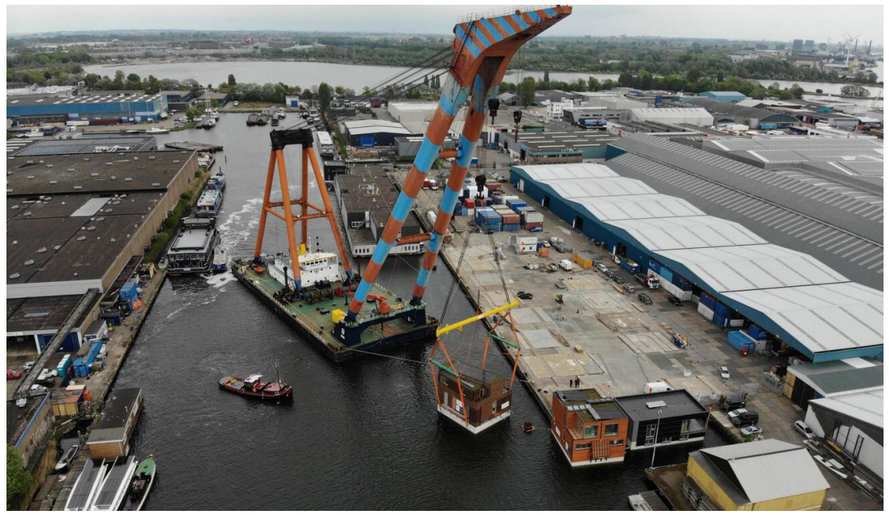


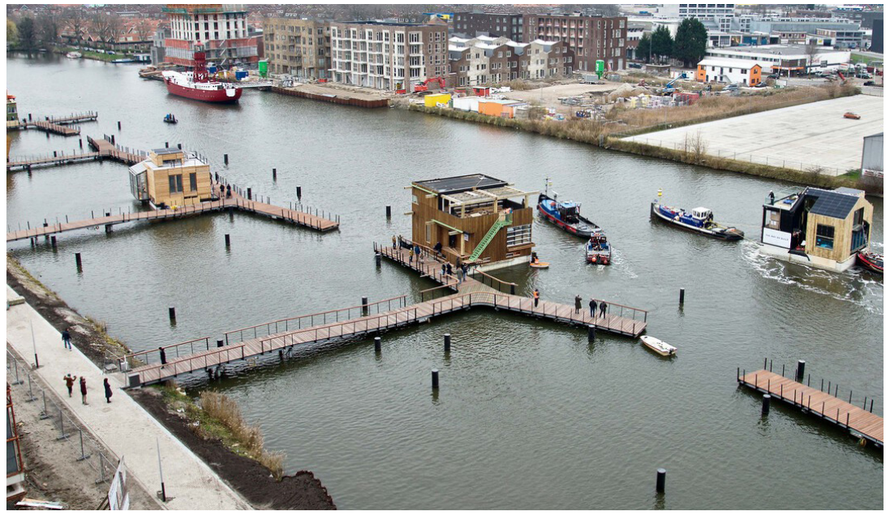


Plan
Source: www.spaceandmatter.nl/work/schoonschip

pre-contruction

All photos by
www.spaceandmatter.nl/
work/schoonschip





living
above the water

All photos by
www.spaceandmatter.nl/
work/schoonschip

connect the neighborhood

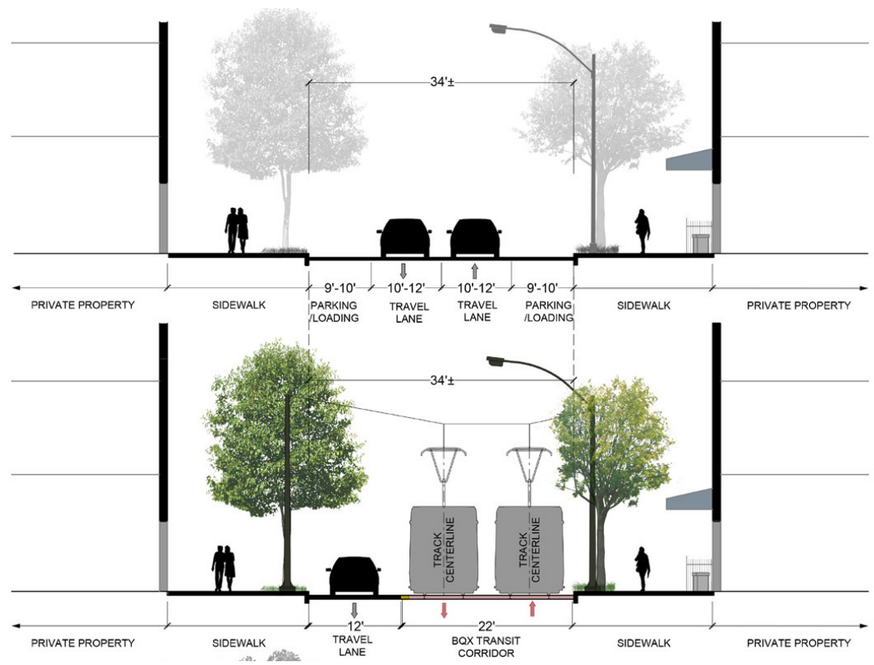
PRECEDENT:
Brooklyn Queens Connector (BQX)
Location: New York, USA
Year: 2029

The Brooklyn Queens waterfront has historically been the heart of New York City's industry, as the City's economy transitioned away from industrial production after World War II, the waterfront became increasingly underutilized and inaccessible. However, the Brooklyn Queens waterfront has changed dramatically over the past 15 years, New York has rediscovered its waterfront, reclaiming it for greenways and bike paths, river access, residential development and job creation in the creative economy.
The Brooklyn Queens Connector (BQX) is a proposed streetcar line in New York City to better connect New Yorkers who have limited transit options to where they need to go, it is expected to cost $2.7 billion and generate $30 billion in economic impact.

The BQX will connect a dozen neighborhoods along an 18 km corridor from Red Hook to Astoria.
The BQX would be efficient, accessible, resilient and sustainable, and would improve streets in neighborhoods along the corridor.
BQX would provide a new transit option for New Yorkers living and working in the areas where subway stop is more than 1km walk away (Astoria, Brooklyn Navy Yard, Red Hook).
The people that live along the proposed route are around 400.000 while those who work there are approximately 300.000 (including Downtown Brooklyn, LIC and Brooklyn Navy Yard).
The BQX would connect to 13 subway lines, 30+ bus routes, nine NYC Ferry landings, and 100+ Citi Bike stations.

Ideas for our project

transport extension



Section samples
Source: BQX Conceptual design report, 2018

renderings

All renderings are taken from BQX Conceptual design report, 2018

ASTORIA

WILLIAMSBURG

RED HOOK

the route

PROPOSAL

05

This is the scenario of what Red Hook and its surroundings might look like in 2100.

This is what inspired us to do this project.

05.1 Strategies

what we want to project?

4 strategies 3 systems

The project is developed through 4 main strategies that aim to make the neighborhood more resilient to climate change.
Three main systems were identified: the waterfront, under the expressway, and elevated walkway.
In the following pages they will be studied in more detail, describing the design strategies and goals.

RECLAIM the water

The idea is to exploit rainwater, an inexhaustible natural resource. This solution would allow the neighborhood to use free of charge a resource that is becoming more rare and expensive every year and to prevent the continuous overloading of the sewer system of New York. At the design level, storage tanks will be placed at strategic points in the city, new buildings will be equipped with storage systems and, where possible, integrated into existing buildings.

PROTECT the coast

The main objective is to protect the neighborhood from the future rise of the seas as well as the many phenomena related to climate change. From this point of view the neighborhood is located in one of the most dangerous areas of New York, some studies suggest that in 2100, about 50% of Red Hook will be under water, so it was decided to design a multipurpose levee that in addition to improving the public space of the neighborhood also acts as a defense system of the city. On the other hand, the areas that cannot be protected will be re-functionalized in a perspective of coexistence with the water.

CONNECT the neighborhood

The connection with the rest of the city is a very important aspect of the project, in fact currently Red Hook is closed by the sea to the west and the highway and east, and is crossed by a single bus line. The idea is to realize two types of connections, the first through a green corridor, connecting the multipurpose levee with Brooklyn Bridge Park, the second through a new public transport service, a streetcar line already thought by the City of New York that would connect the waterfront of Queens and the waterfront of Brooklyn.

SLOW DOWN the surface runoff

Runoff is an important component of the natural water cycle and uncontrolled urbanization is having a negative effect on these hydrological processes. In New York City this phenomenon is of major importance because its sewer system is designed to simultaneously collect rainwater and wastewater from homes, this causes during prolonged rains the system to overload, creating serious problems for the city and its citizens. The goal is to prevent this problem through some strategic interventions that reduce or slow down the amount of rainwater collected by the sewer system, the solutions may be to increase the area of green roofs, increase permeable surfaces, create new green spaces, insert in the main roads bioswales systems that can purify water before discharging it into the sea.

strategies map (elaborated by authors)

strategic plan

strategic plan (elaborated by authors)

0 150 300 450 m

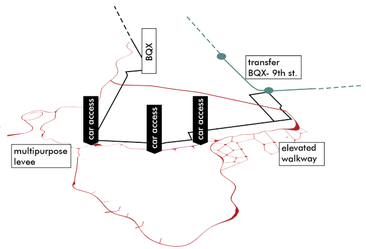
+ new landmarks + existing landmarks new public transportation public transportation stop

conceptual plan (elaborated by authors)

0 150 300 450 m

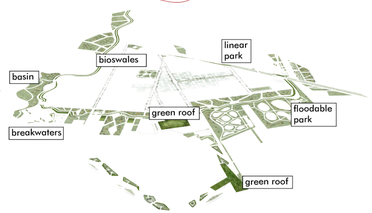
circulation

The waterfront is experienced thanks to an elevated walkway that even at high tide will be passable.
The new BQX trolley will allow faster mobility by connecting to the Smith 9th. station transfer.



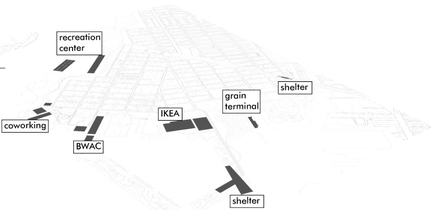
green infrastructures

Waterfront parks act as protection in the event of high water. The elevated walkway allows the water to stop, but for safety a green buffer zone is added to protect homes.



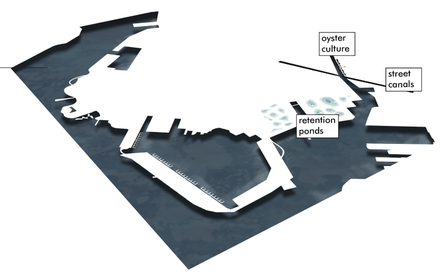
buildings

The buildings have been redesigned to use even during high tide thanks to the elevated walkway. The ground floors are designed for an industrial underwater trail.



water

water, the main symbol of this project, is allowed to flow thanks to the strategies which permit to let water inside the land or stop it.



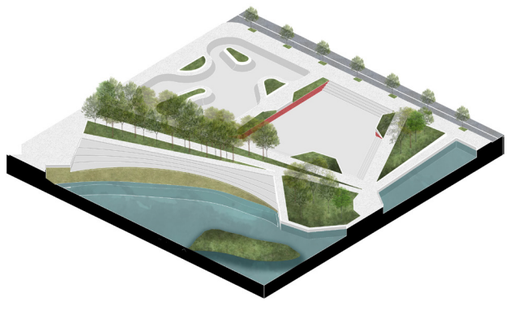
SYSTEM 1: THE WATERFRONT

A place where you can enjoy a privileged view of the Statue of Liberty.

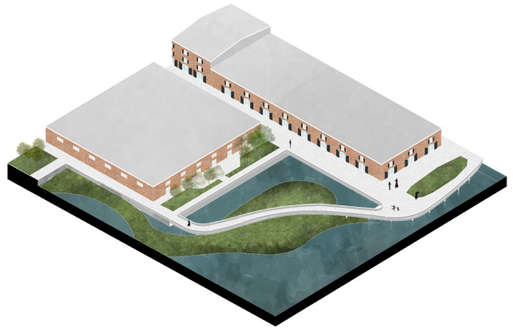
by authors, 2022

system 1: the waterfront

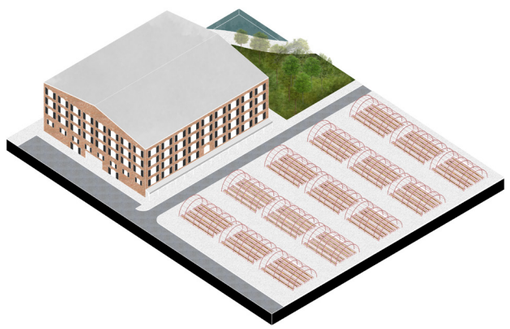
The first system is the waterfront, one of the most important elements of the neighbourhood, an area with limited functions and little used by citizens, but with enormous potential.
The idea is to make it accessible in every part, removing the barriers that make the area a closed and fragmented place.
The waterfront will be re-functionalised, making it an attractive place not only for the inhabitants of the neighbourhood, but for the whole city, it will be transformed into a space that offers fun and relaxation for everyone in the area, the new waterfront includes a floodable park, playgrounds, fitness facilities for adults, bicycle paths, picnic areas, an urban garden, a new market and an emergency shelter.



water square ①
plaza



promenade
over the sea ②



urban
farm ③

floodable
park ④

KEYPLAN

Plan of waterfront
In red is highlighted the location of the section and plan (next page)

year 2030

elevated walkway
wetlands
floodable park
permeable paving
bioswales
breakwaters
transport extension BQX
multipurpose levee
trees
water square plaza

Section

Plan

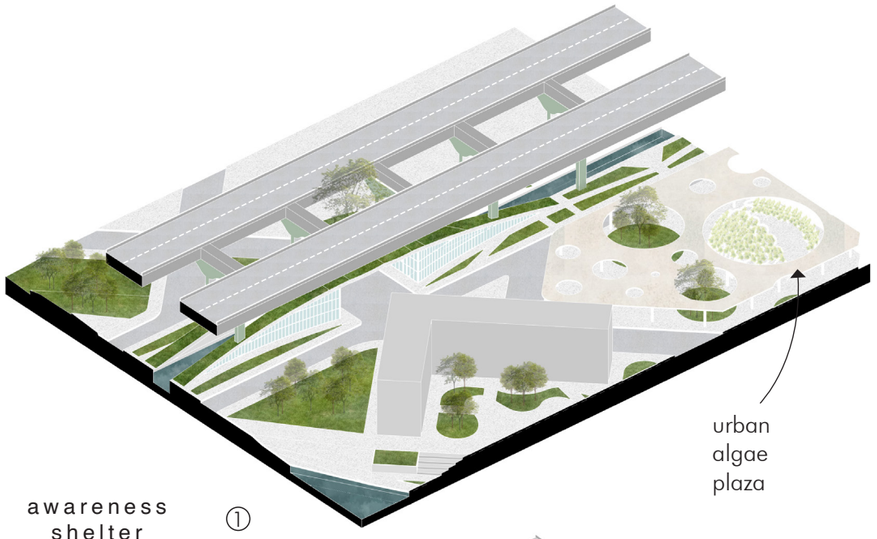
SYSTEM 2: UNDER THE EXPRESSWAY

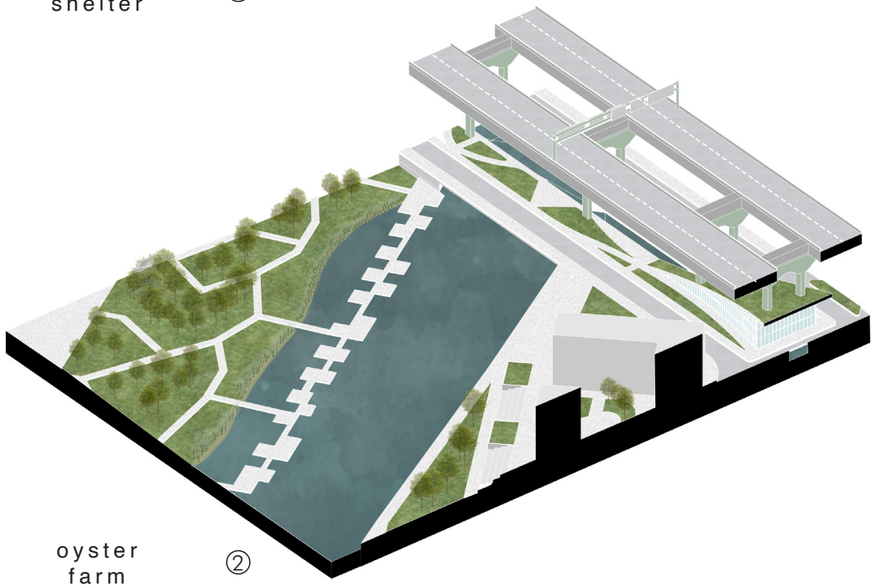
A residual space that comes to life, a space where you can walk, run, live.

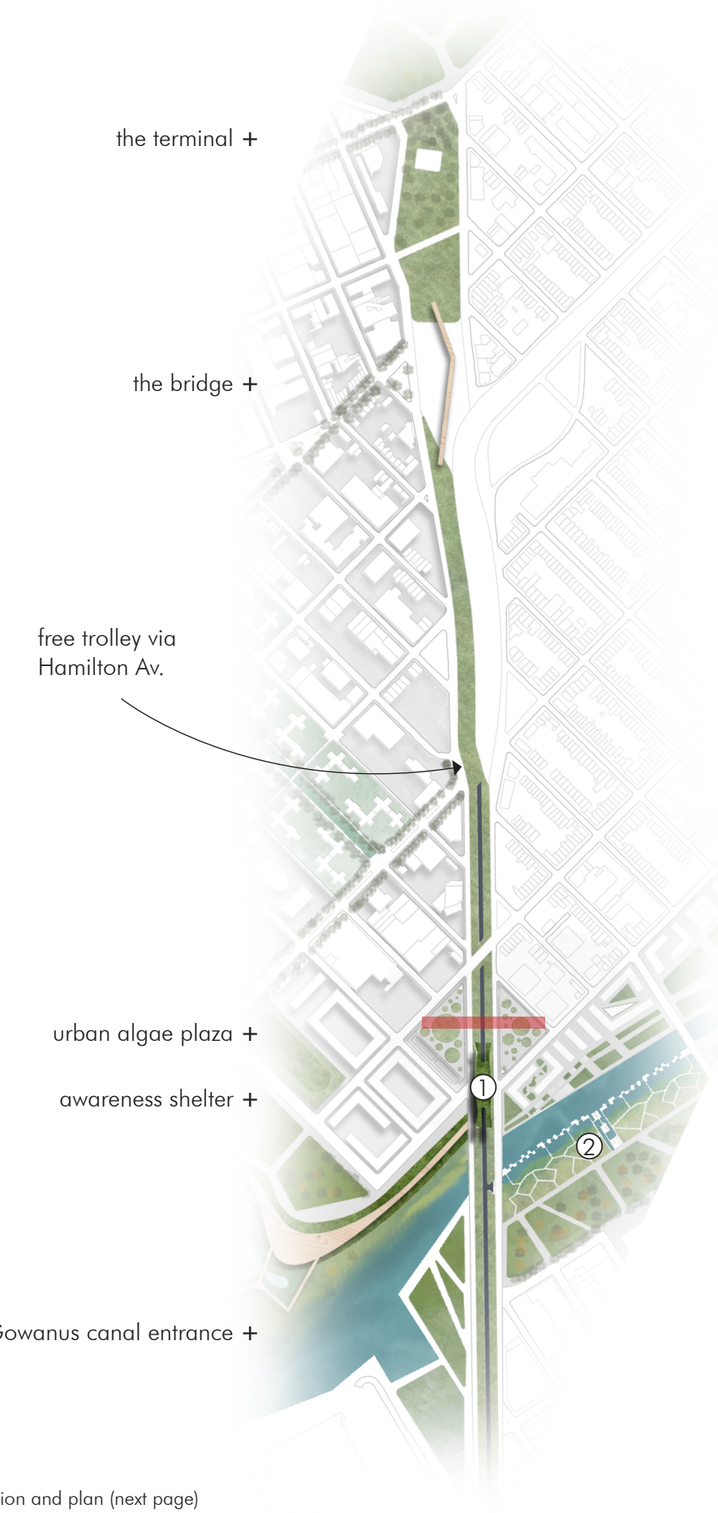
by authors, 2022

system 2: under the expressway

The second system is under the expressway.
Currently, the area under the motorway is an underused and degraded place, representing an urban fracture dividing the neighbourhood from the rest of the city.
The idea is to transform the area under the expressway into a linear park crossed by a canal.
Microalgae systems capable of oxygenating the air and at the same time absorbing CO_2 will be inserted at strategic points.
In the vicinity of the polluted Gowanus canal, an oyster farm will be set up, which will not only encourage the presence of many other aquatic species and bring economic benefits to society, but will also reduce water pollution and help in the event of storms and hurricanes, since oysters filter water during their lives and act as natural breakwaters.







Plan of walkway under the express way
In red is highlighted the location of the section and plan (next page)

year 2030

permeable paving

urban pavillion

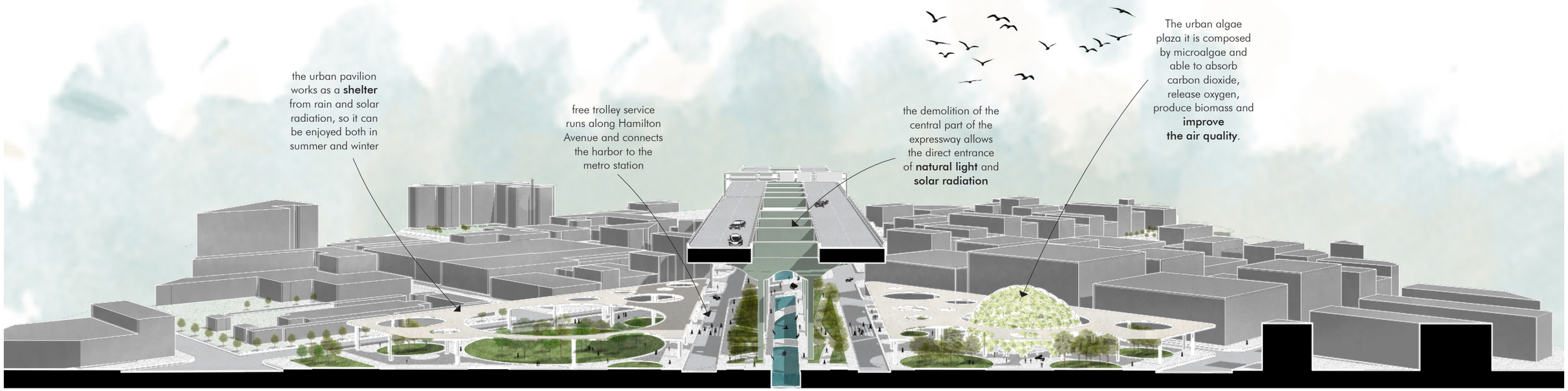
bioswales

street canal

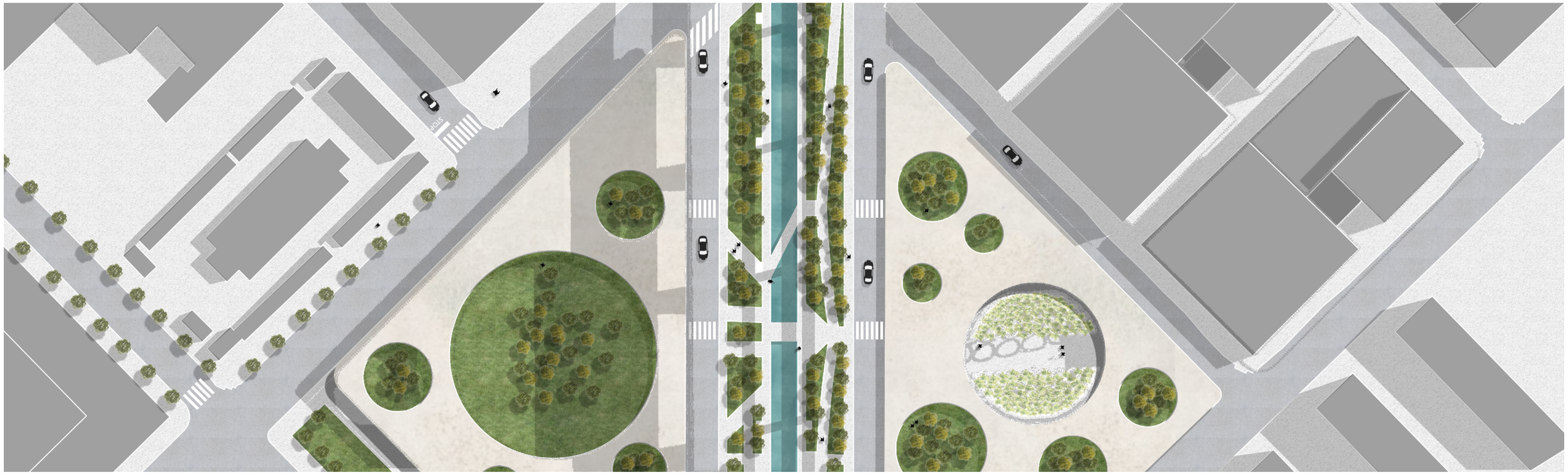
transport extension free trolley

urban algae plaza

trees



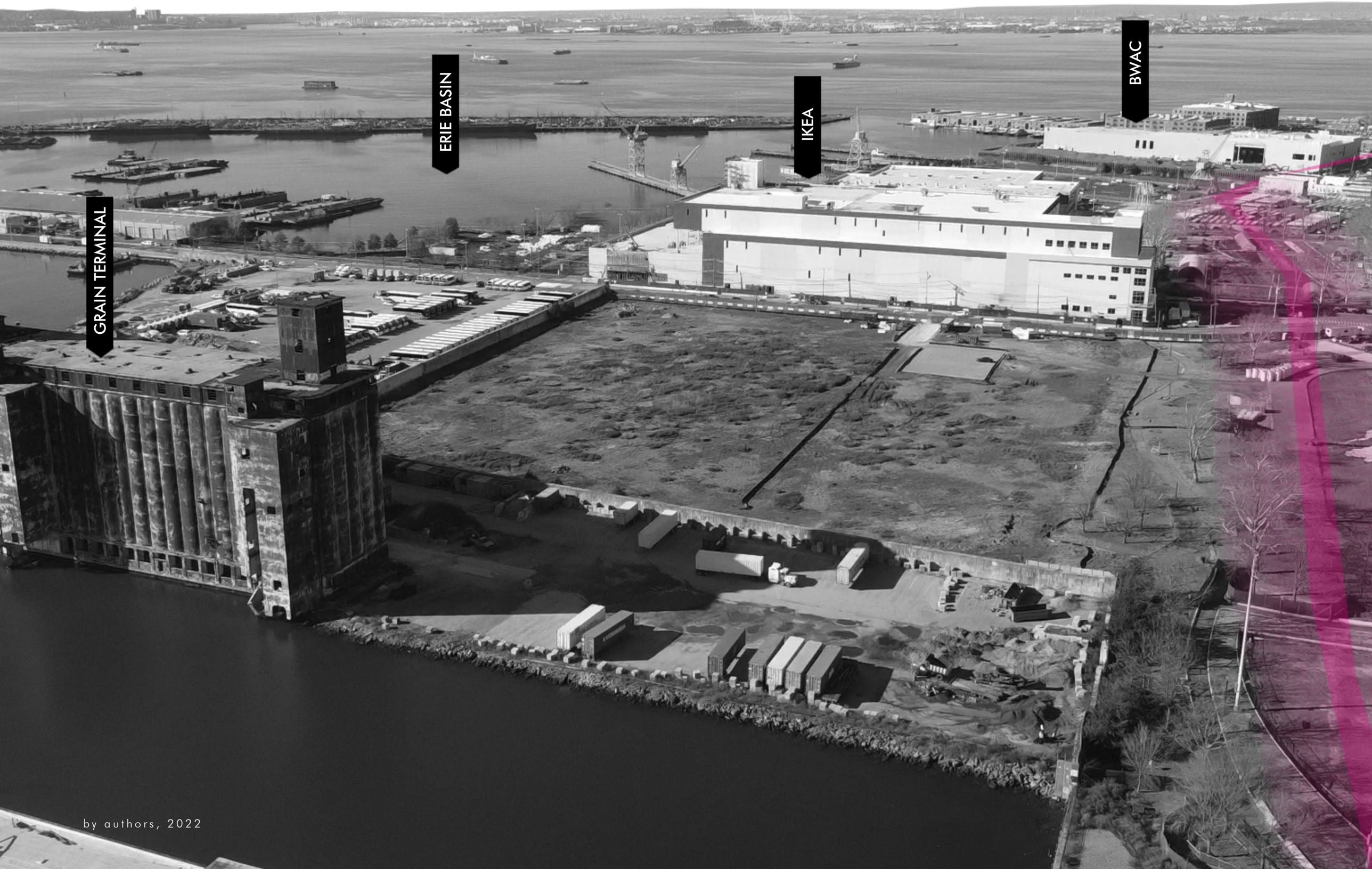
Section



Plan

SYSTEM 3: THE ELEVATED WALKWAY

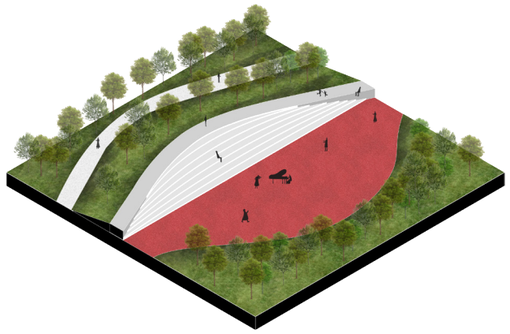
An elevated barrier that functions as a defense against flooding and rising sea.



by authors, 2022

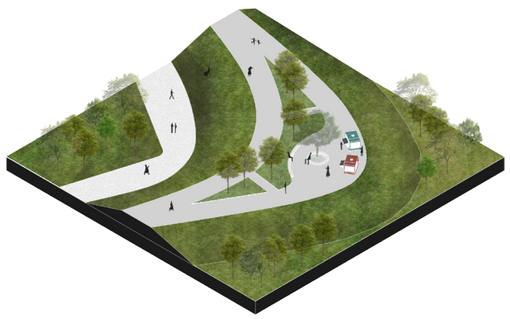
system 3: the elevated walkway

The elevated walkway is the third system. As a coastal area, Red Hook lies within a flood zone, making it particularly vulnerable to flooding. The neighbourhood is characterised by an old building stock of low to medium height that mainly uses first floors, which makes the built environment difficult to adapt to flooding.
As such, the vulnerability to flooding could be a significant obstacle to the economic, social and environmental development of the area, leading investors and residents to move elsewhere and becoming an area of potential widespread contamination due to hazardous materials and waste brought in during a flood.
The idea is to build an elevated defence system near the waterfront that will protect the built environment behind it and at the same time create new multifunctional public spaces attractive to the community.
On the other hand, the areas that cannot be protected will be re-functionalised with a view to coexistence with the water.

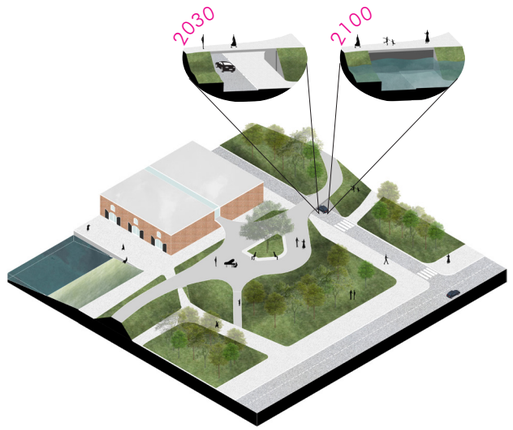


amphitheater ①

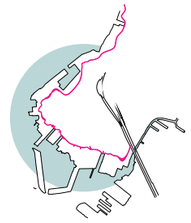
inside the building ②



elevated plaza ③



access car / ramp ④ ⑤



KEYPLAN

Plan of walkway route
In red is highlighted the location of the section and plan (next page)

year 2100

permeable paving

bioswales

elevated walkway

trees

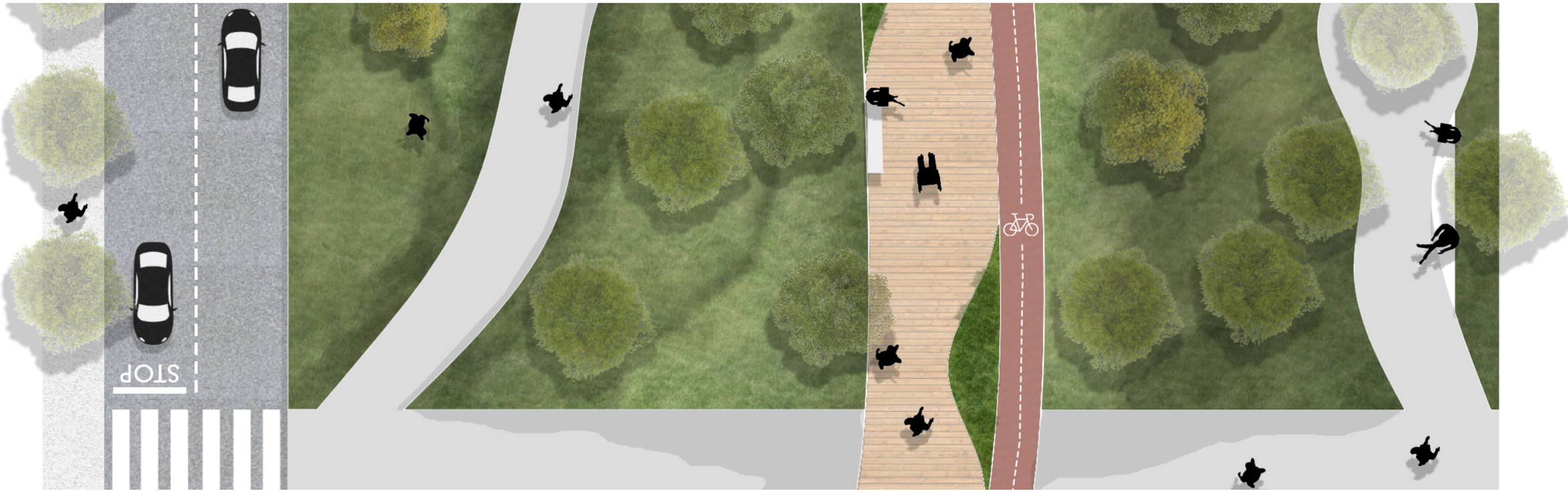
by 2100 the Red Hook is projected to be **completely flooded**. The elevated walkway will act as a barrier to stop water at some areas, while letting it in at others

the cistern helps to avoid the **combined sewer overflows** and collect rainwater for reuse

evapotranspiration

shade

Section



Plan

year 2100

permeable paving

bioswales

elevated walkway

trees

by 2100 the Red Hook is projected to be **completely flooded**. The elevated walkway will act as a barrier to stop water at some areas, while letting it in at others

the cistern helps to avoid the **combined sewer overflows** and collect rainwater for reuse

evapotranspiration

shade

Section

Plan

0 1 2 3 m

year 2030

today

year 2100

coexistance with water

Conclusions

This work represents **a theoretical, analytical and design investigation on the theme of climate change**, with particular attention to the "**water**" component and the renewed paradigms arising from this global phenomenon, which is destined to become a central topic in the debates of the coming years.

Initially, a **theoretical framework** was drawn up in which data, numbers, information, theories and scientific evidence were reported in order to provide a clear understanding of what climate change is and the role that water has, has had and will have in its complex developments.
This data shows that **water plays a fundamental role in the way the world reacts to the effects of climate change**, both locally, through rainfall, flooding and erosion, and globally in the form of rising sea levels.
This should challenge some of the structural limits of current urban forms and create new insights into the configuration of these risk areas, redefining water as a new generator of city form, in a dichotomous coexistence of risk and opportunity.

Next, a neighbourhood in the coastal area of New York City, **Red Hook**, **was analysed**.

New York city and its neighborhood were studied from an historical, cultural, social, geographical, economic and environmental perspective at different scales, **in order to better understand the intrinsic relationship between water and the city and its citizens, and to exploit its potential**.

The project research aimed to act as an urban acupuncture, touching the most vulnerable and potentially interesting areas of Red Hook, **in order to improve its ability to adapt to the water-related consequences of climate change**.
Proposing temporary defensive interventions, such as the elevated walkway, as evidence of **a hidden hope that climate change can be tackled seriously** sooner rather than later, and that the future may turn out to be less tragic and apocalyptic than we all now imagine.

This thesis is not intended to be a solution to the catastrophic events that may or may not occur, but a strategic analysis of actions that can in turn generate reactions, developing a city's capacity to be resilient to climate change while allowing people to better understand Red Hook, New York City and climate change.

Photo of *Red Hook, by Julienne Schaer, 2014*

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