



## **PORT OF BEIRUT**

A PROPOSAL FOR THE FUTURE  
PORT DISTRICT AS A RESPONSE TO  
EARLY 21ST AND 20TH CENTURY  
URBAN DEVELOPMENT PRACTICES  
IN THE CITY OF BEIRUT.

Master's Thesis, Spring 2023

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ENGINEERING

AAHM10: Degree Project in Architecture - Advanced Architectural Design  
Port of Beirut: A Proposal for the Future Port District as a Response to Early 21st  
and 20th Century Urban Development Practices in the City of Beirut.

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March 2023



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FIG. 01: Aerial view on the port after the explosion (collage based on Bing Maps and Google earth imagery).

## INTRODUCTION

This first chapter gives an overview of the thesis' background, relevance and framework. It describes the events that led to the interest in urban development of the port, defines the sites boundaries and the direction the proposal is aiming at. It also gives a general overview on the cities recent history and aims at creating an understanding of the broader context of the site.





FIG. 02: View on the port of Beirut at a state after the blast in August 2020.



FIG. 03: Impact of the Beirut Blast (Beirut Recovery Map).

## RELEVANCE

**BACKGROUND:** In August 2020 a warehouse containing explosive substances caught fire and blew up, leaving Beirut with severe humanitarian and material damage spreading across the entire municipality (Fig. 03). After two years, a discussion about the future of the port had opened. Considering its location in the center of Beirut, the interest in urban development is high.

**THE PORTS CONTEXT:** For this thesis I was assuming that the damaged urban structure surrounding the port will be gradually repaired to a similar state as before the blast, instead of being restructured and redeveloped. I assume that the future context of the port will be comparable to the context before the explosion. I see a slow recovery through the public sector (as it already happens and has happened after the civil war) paired with the transformation of some areas following economic interests (as it happened with the Central Business District) as very likely. A reconstruction of the whole city, supported by the government, is less likely due to the lack of financial and institutional resources.

**DIRECTION OF THIS THESIS:** Economical strength is a highly relevant factor for achieving a sustainable future for Beirut and Lebanon. But a development that is led by only economical interests and conducted by private companies with little control by local (municipal) institutions has shown in the case of the modernization of the Central Business District that it can cause damage in cultural heritage as well as favor social segregation with little to no benefit for the local citizens and leaving mostly the social elite as winners. Although it is still a popular area, social activities and appropriation of spaces has been decreased significantly compared to the central city before transformation (United Nations, 2005).

This raises the question how the new port area can combine economical interests with the citizens needs, since these have suffered the most from the explosion and now form the largest group of stakeholders. How can a sustainable port district for future Beirut be achieved?



FIG. 04: Suggestion for the spatial development of the port: Option 1 (Haid and Seyger, 2021).



FIG. 05: Suggestion for the spatial development of the port: Option 2 (Haid and Seyger, 2021).



FIG. 06: Suggestion for the spatial development of the port: Option 3 (Haid and Seyger, 2021).

- A:** Container terminal
- B:** Multipurpose terminal
- C:** Free zone and storage
- D:** Repurposed area / urban development

**OPTION 1:** The first option presented by the study of the Roland Berger institute maintains most of the former spatial configuration. Described advantages are quick and cost effective rebuilding and avoiding changes in the infrastructure. However, the repurposed area

(D) is relatively small and heavy container traffic remains in the city center. The study describes an expected short term inefficiency of the port and the limitation of money generated and channeled from the repurposed area to the rebuilding of the port.

**OPTION 2:** This option uses one of the landfills formerly used for waste disposal to extend the container terminal. By doing this a larger area can be claimed for repurposing and urban development. The advantage of this option is the potential self funding of the rebuilding due to the large area for urban

development. Additionally, most container traffic could be removed from the city center. It requires further investigation about the possibility of using the landfill but this option has been identified as the most attractive in the study and is therefore used as a basis for this thesis.

**OPTION 3:** The last option presented in the study uses both of the landfills in the east and has a slightly bigger area for repurposing. The difference to the second option lies mainly in the spatial organization of the port while the

amount of claimed land doesn't differ much. This option would impact the port's functionality a lot during the building period and requires more research about feasibility and economic benefit.

**SPECIFYING THE SITE:** This thesis is based on a study by the Roland Berger Institute, co-financed by the German Federal Ministry of Economic Cooperation and conducted between November 2020 and January 2021. The study is based on interviews and open sources and, while acknowledging its own limitations in terms of its sources, determines the best future scenario for the port. The study describes the role of the port for Lebanon's economy and suggests several options to restructure and reorganize the port, considering the interest for urban development as well as functionality, efficiency and safety of the port (Haid and Seyger, 2021).

The option chosen for this thesis is described as the most attractive by the authors. It offers a large area for urban development without changing the existing port layout and while maximizing the ports efficiency and accessibility by reducing cargo traffic in the city center and connecting it better to the hinterlands (Fig. 05).

**GENERAL PROGRAM:** For the claimed land the study suggests urban development in form of housing, cultural and educational uses as well as the establishment of port related industries to generate money to finance the ports reconstruction.

The focus of this thesis lays on the development of the by the study defined area for repurposing. The program will include housing and public uses. Port related industries as well as the exact layout of the industrial port play a minor role since it depends on further extensive research. However, the main aspects of the relocation to the eastern landfills such as the reduction of traffic around the city center will be considered. The program will be further defined by research and analysis in chapter II.



**AIM:** The proposal presented in this report aims to contribute to a discussion about the future development of the port. It tries to suggest a solution that reacts to the needs of present and future citizens of Beirut in terms of providing a healthy living environment.

**CHALLENGE:** As a foreigner, working in a culturally and climatically unfamiliar context is the greatest challenge of this project. I am hoping to develop a proposal that relates to the local populations idea of good urban development and responds to the climatic, social and historical context of the site.

The social challenge is what urban development can offer to the citizens who are the main victims of the catastrophe.

**METHOD:** To achieve this, my approach is to develop the proposal based on a comprehensive research and site analysis and refer to local sources or sources directly related to the city and its context. The starting point is the site and program suggested by the study from the Roland Berger institute while a more detailed program will be developed by analyzing the current city and responding to its strengths and weaknesses concerning the life quality it offers to its residents.

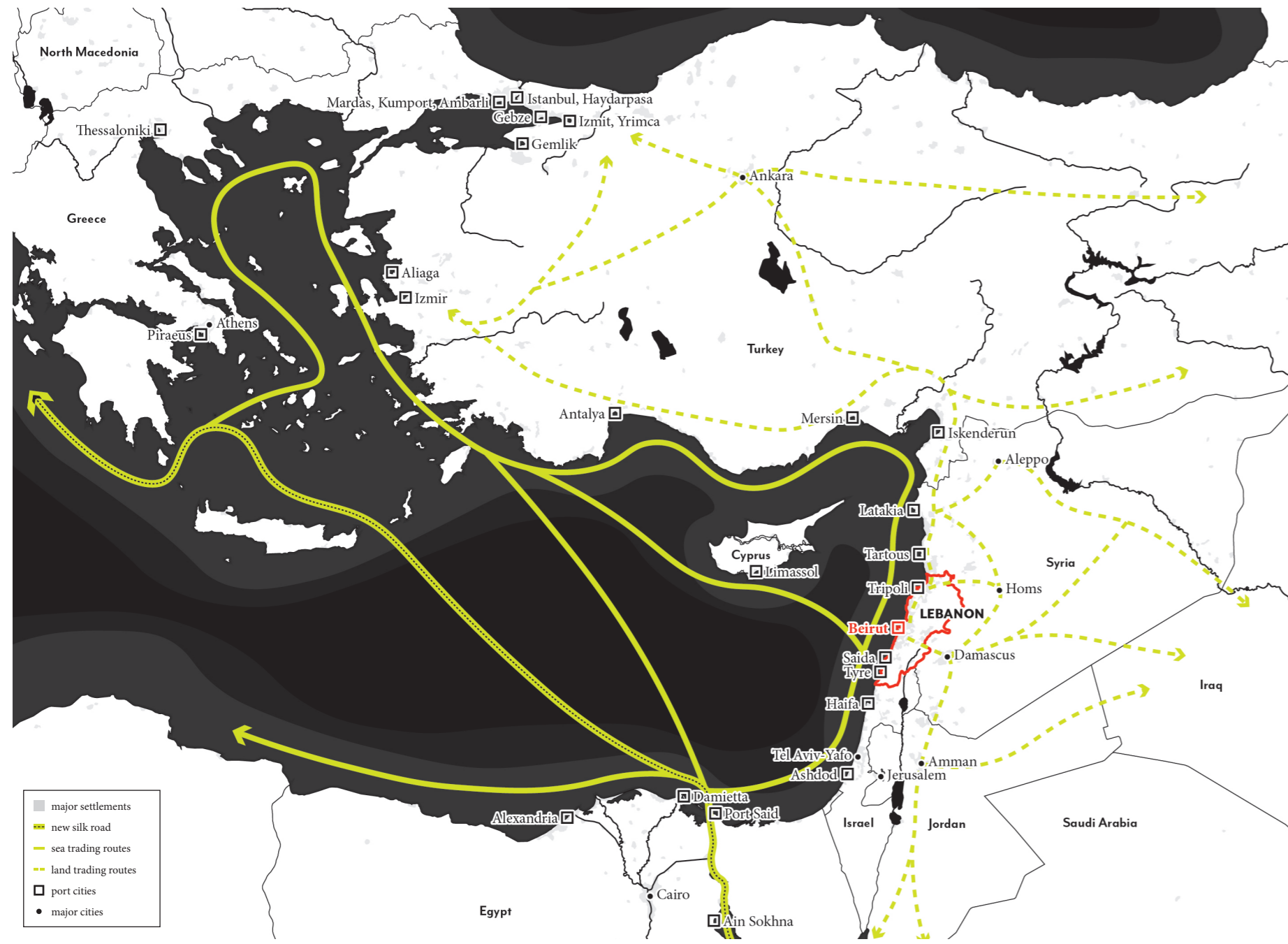


FIG. 07: Map of the eastern Mediterranean sea (based on Haid and Seyger, 2021).

**CONTEXT OVERVIEW:  
LEBANON**

**LOCATION:** The Mediterranean sea supports several of the world's busiest shipping routes and is framed by around 90 ports. (Haid and Seyger, 2021). Many European ports are spread along the northern coast of the Mediterranean sea, giving access to the European Transport Network, while the southern ports allow access to northern Africa.

Through the Suez Canal the Mediterranean sea has direct access to the western Pacific ocean, leading further into Asia. A connection that could be strengthened by the New Silk Road project. The ports along the eastern coast, such as Beirut, can work as transshipment points as well as offering connections to western and central Asia by land.

**COUNTRY PROFILE:** Lebanon has a total population of 6.769.000 (2021) inhabitants with an annual growth of 0.9% (2020). In 2019, 88.8% of its citizens lived in urban contexts (compared to 72% average in Western Asia), while around one quarter to one third lives in Beirut and the surrounding urban area. The population density of 661.7 (2021) individuals per square kilometer is significantly higher than the average density of 59.1 (2021) in Western Asia.

The service sector makes up the biggest part (80.7%, 2019) of Lebanon's economy with around 64.3% (2020) of the population employed in that sector. The GDP's growth had been in a downwards trend in the recent decade and was decreasing by 5.6% in 2020.

The international trade balance can be interpreted as a contributing factor to this development with an import value of 3,468 million USD and an export value of -15,472 million USD, resulting in a negative imbalance of -12,004 million USD (2020) (United Nations 2022).

**INFRASTRUCTURE:** The civil war (1975-1990) left much of Lebanon's infrastructure destroyed. The railroad network that was used for passenger and freight transport between Lebanon and its surrounding countries had been out of function since 1976 while its traffic had been moved to the motorways. Oil was formerly imported from Saudi Arabia for refinery and domestic use as well as export to Europe and the United States. The pipelines had been taken out of function in the mid of the 20th century (Haid and Seyger, 2021).

**CONCLUSION:** The Port of Beirut's important role for international trading has not only suffered from the 2020 blast but already from the mid 1900s when important oil pipelines had been demolished and the railroad network went out of service. A well-functioning port alone can therefore not solve Lebanon's ongoing economical crisis but has to go hand in hand with a general revival of the country's infrastructure and trading network.



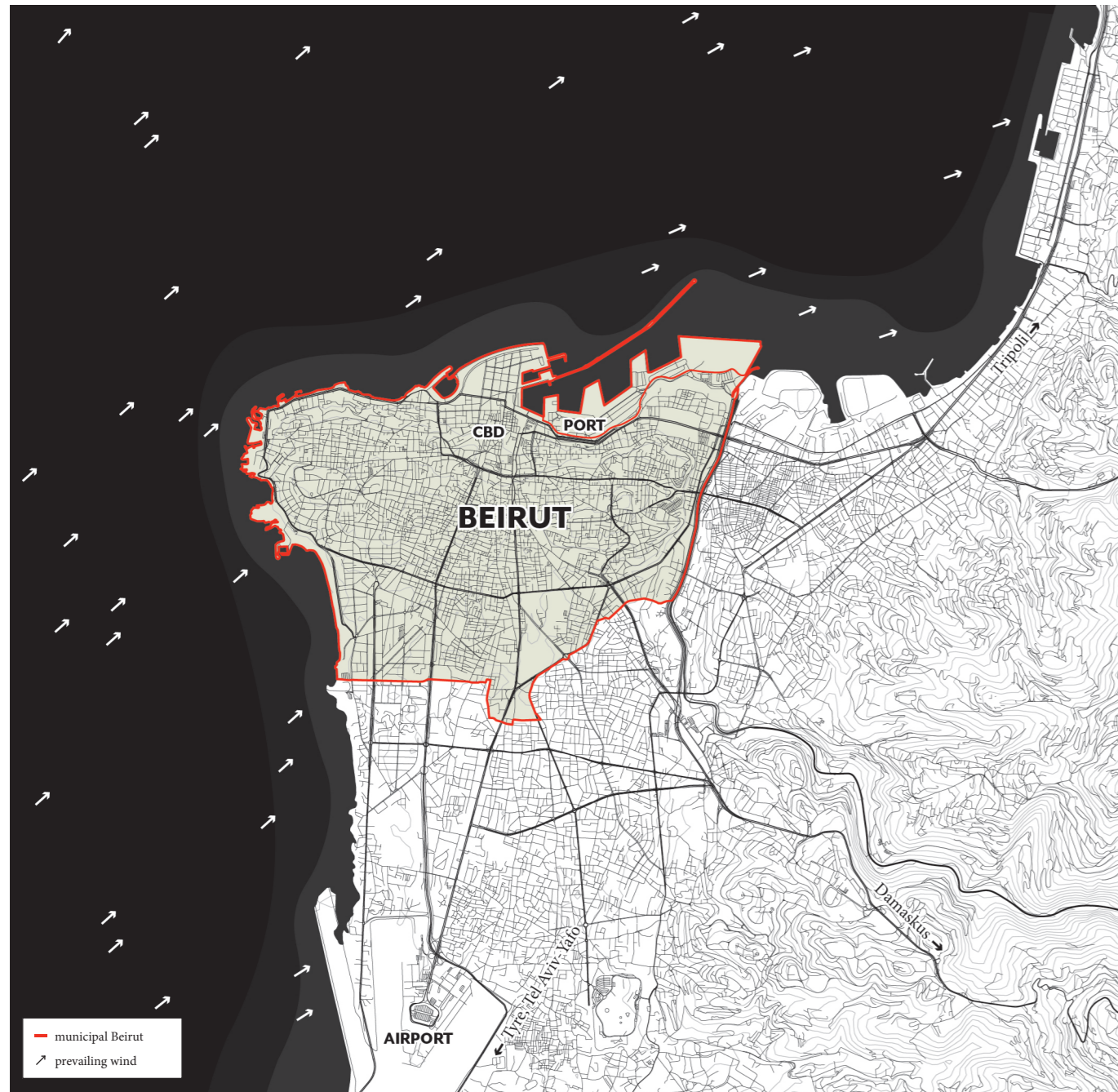


FIG. 08: Map of Beirut, its context and the port (scale 1:100,000), prevailing wind direction at noon in mid-July.

### CONTEXT OVERVIEW: BEIRUT

**POPULATION:** Population estimates range from 2,406,900 (2019) in Greater Beirut (United Nations, 2022) to less than a million, or up to 1,291,280 within the continuously build up urban area (UN Habitat Lebanon, 2021). In 2016, municipal Beirut consists of approximately 500,000 inhabitants (Kaloustian, Bitar and Diab, 2016).

**AREA:** 111.22km<sup>2</sup> in the continuously build up urban area (UN Habitat Lebanon, 2021)  
21.25km<sup>2</sup> within the municipalities boundaries (UN Habitat Lebanon, 2021)

**POPULATION DENSITY:** 19,509 individuals per km<sup>2</sup> within the continuously build up urban area (UN Habitat Lebanon, 2021)  
25,000 individuals per km<sup>2</sup> in municipal Beirut which ranges around the highest densities of cities worldwide (Kaloustian, Bitar and Diab, 2016).

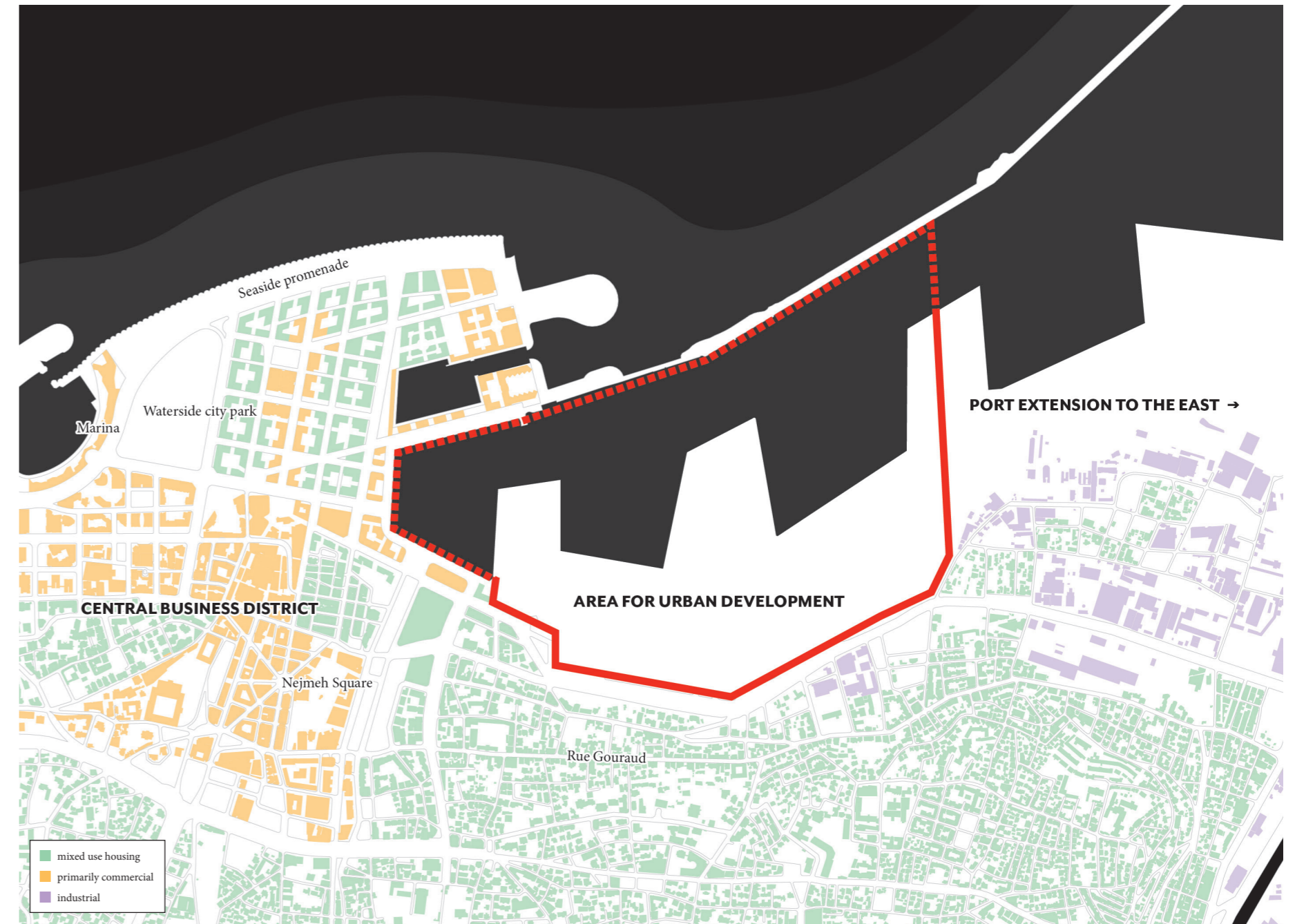


FIG. 09: Zoom on the port and its context. Moving the functional port further to the east clears the highlighted area for urban development.



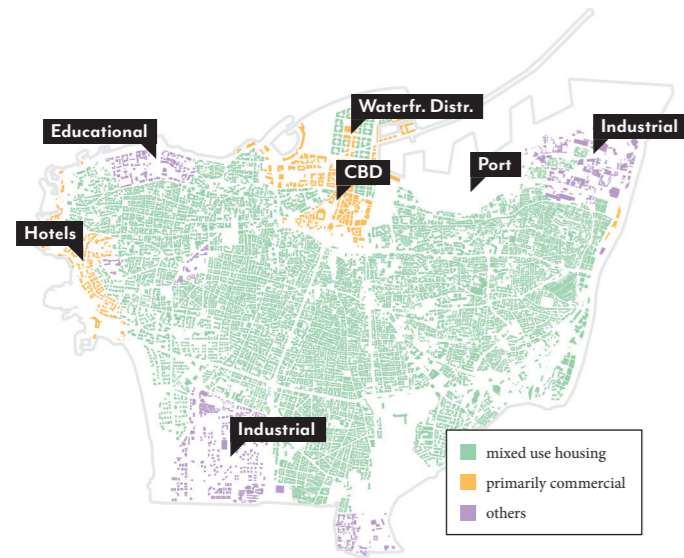


FIG. 10. Main land use in municipal Beirut (based on Google maps entries).

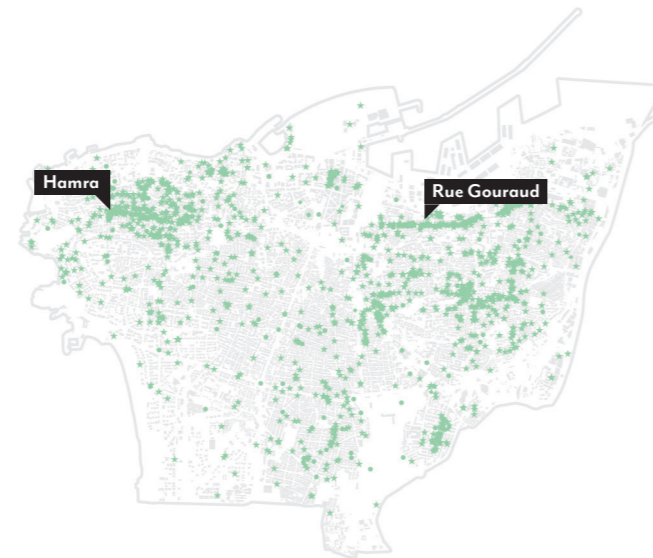


FIG. 11. Public attractors in municipal Beirut (based on publicly accessible GIS data).

**LAND USE AND PUBLIC ATTRACTORS:** Mapping the land use in municipal Beirut shows that most of the city consists of a mixed structure of housing and commercial uses. The Central Business District and the concentration of hotels along the western coast form two clearly visible centers with primarily commercial uses. The northern coast hosts the port, waterfront district and a number of educational uses. There are two industrial centers within the municipalities borders. One in the south and one next to

the port (Fig. 10). Housing at the waterfront seems to be relatively rare.

When looking at the public attractors such as cultural and educational institutions, bars, restaurants, cafes and shops, two concentrations can be identified. Around the Hamra in the west and the Rue Gouraud in the east, directly below the port (Fig. 11). Due to its location, the Rue Gouraud is highly relevant for the port development and will be looked at more closely later in this report.



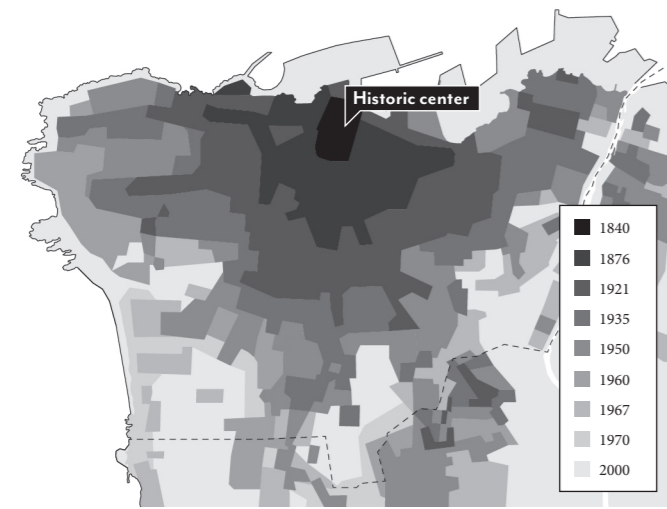


FIG. 12: Sprawl of the city over time (based on Ruppert, 1969).

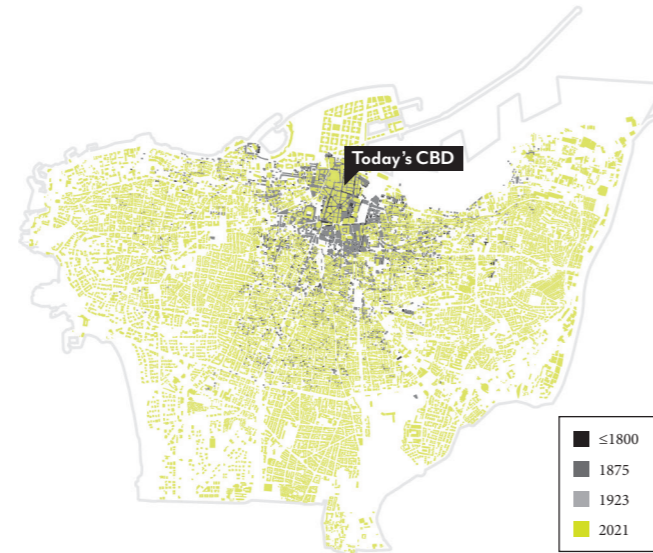


FIG. 13: Overlay of different time periods (based on Toffel, Vimercati, 2009).

**HISTORY OF MODERN BEIRUT:** The urban landscape of today's Beirut is significantly shaped by its recent history and major events. Since major urban sprawl beyond the historic city walls began only around 1860, most of the city is shaped by the 20th century.

The architecture is characterized by the late Ottoman period that generated hybrids of Lebanese and Mediterranean-European ar-

chitecture as well as the French mandate that introduced mass production with concrete and added French elements to the urban design and architecture and lastly the Independence, that generated a more globalized landscape with international hotel franchises, banks and enterprises and lasts until today with the glass skyscrapers of central Beirut.

Overlaying today's Beirut with older layers of the city shows how much the city has changed and how little of the old city's structure is remaining today (Fig. 12+13). Due to several destruction and rebuilding cycles in its history the city has renewed itself continuously. Especially the recent redevelopment of the city core has limited Beirut's history to few heritage buildings and excavation sites. It

is also visible that most of the city's expansion happened in the 20th century which makes the city a fairly new city despite having a history dating back to the 14th century BC.

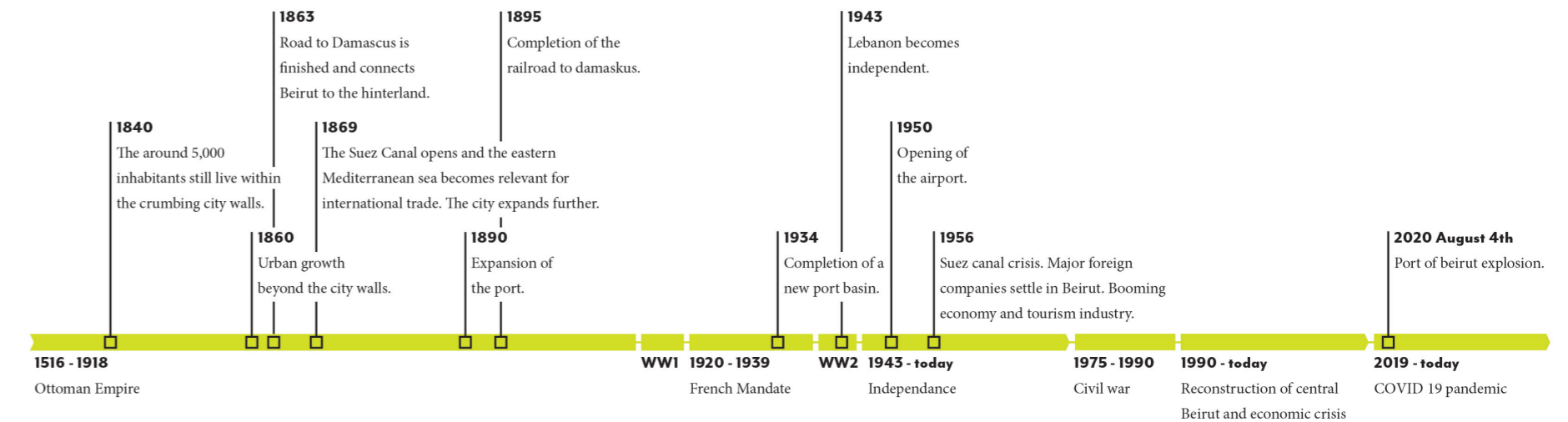


FIG. 14: Timeline from the late Ottoman period until today showing the main events that led to Beirut's modern landscape.



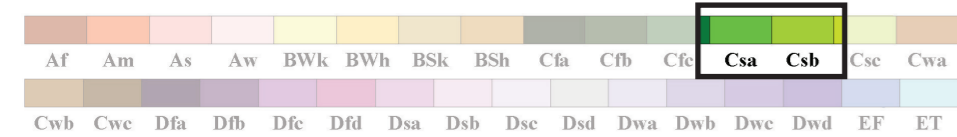
## RESEARCH & ANALYSIS

The second chapter presents a more comprehensive research about the sites direct context, including the climate, architectural heritage and the public space. It also includes case studies of the port's closest neighborhoods and sets guidelines for the design of the proposal.



## World Map of Köppen–Geiger Climate Classification

projected using IPCC A2 Tyndall SC 2.03 temperature and precipitation scenarios, period 2001 to 2025



### Main climates

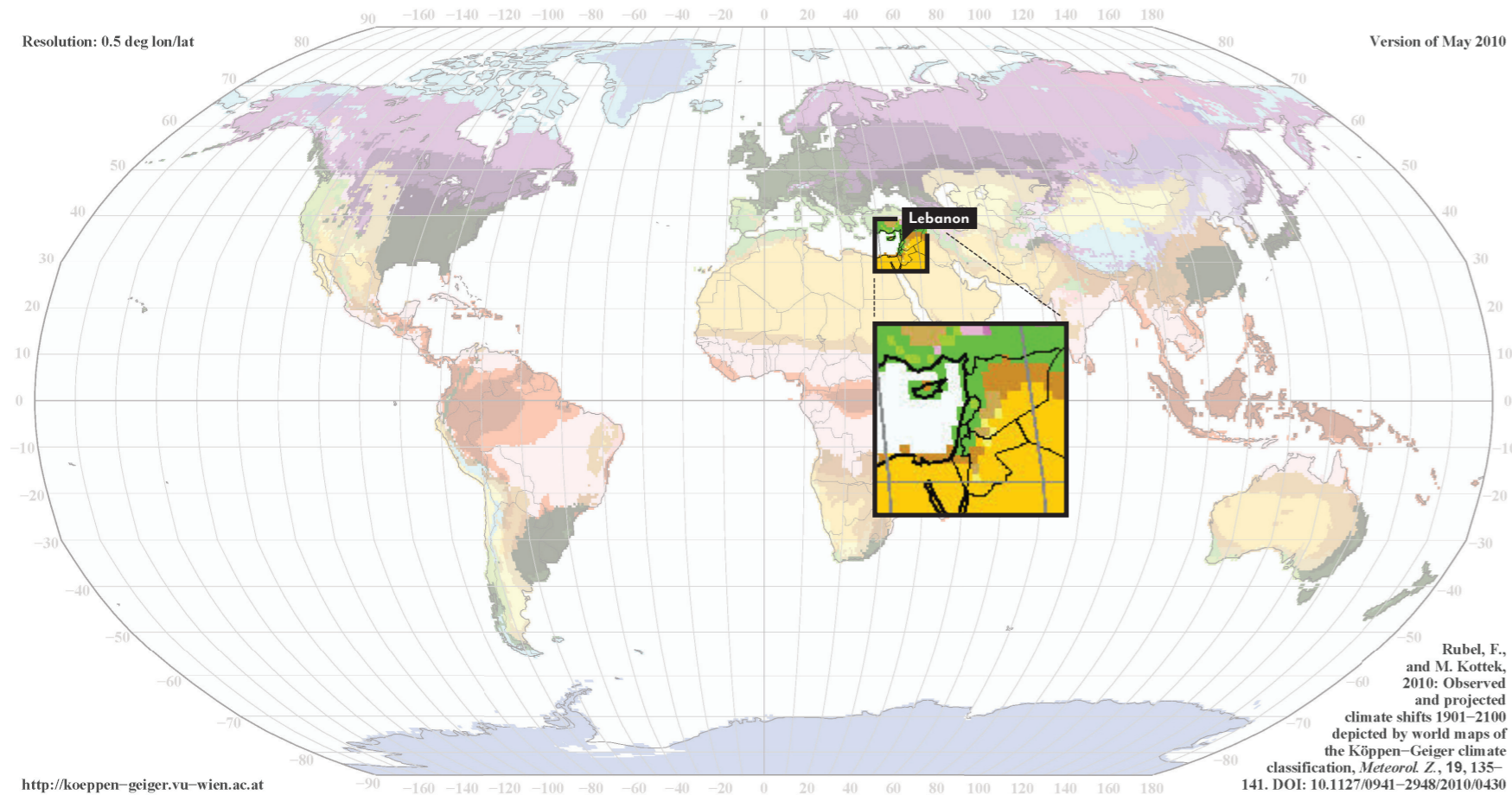
A: equatorial  
B: arid  
C: warm temperate  
D: snow  
E: polar

### Precipitation

W: desert  
S: steppe  
f: fully humid  
s: summer dry  
w: winter dry  
m: monsoonal

### Temperature

h: hot arid  
k: cold arid  
a: hot summer  
b: warm summer  
c: cool summer  
d: extremely continental  
F: polar frost  
T: polar tundra



## CLIMATE

**CLIMATE OF BEIRUT:** Beirut is located within a warm temperate climatic zone with hot summers, according to the Köppen–Geiger model (Fig. 15). It is also described as Mediterranean semi-arid climate with four seasons ranging from an average temperature of 30°C in the hottest month to 10°C in the coldest. In the hot seasons the city enjoys a cooling sea breeze, prevailingly coming from south west. In the last 131 years the minimal temperature had increased by 2.9°C and the maximal temperature by 0.13 °C. However, in 2011 the Lebanese ministry of Environment reported an expected increase of the maximum temperature of 4°C during the 21st century. The threat of climate change and the projected temperature increase are of major concern considering the already hot microclimate within Beirut.

The dense city with lacking open spaces has a tendency to accumulate heat, leading to unpleasant outdoor temperatures and increased consumption of cooling energy. During Beirut's hot seasons, the electricity consumption increases by a fourfold already today. Considering hotter temperatures due to climate change the living expenses will increase together with higher energy consumption if no actions to prevent heat accumulation in the city are taken.

The reason for Beirut's susceptibility for heat accumulation lies in the lack of building regulations during its sprawl in the 20th century as well as recent planning policies that allow a high land exploitation factor in the city center that ensures maximized profit from densification with little focus on urban space and quality (Mohsen, Raslan and El-Bastawissi, 2020).

FIG. 15: World map of Köppen–Geiger Climate Classification (based on: Koeppen-geiger.vu-wien.ac.at, Lebanon highlighted by the author).

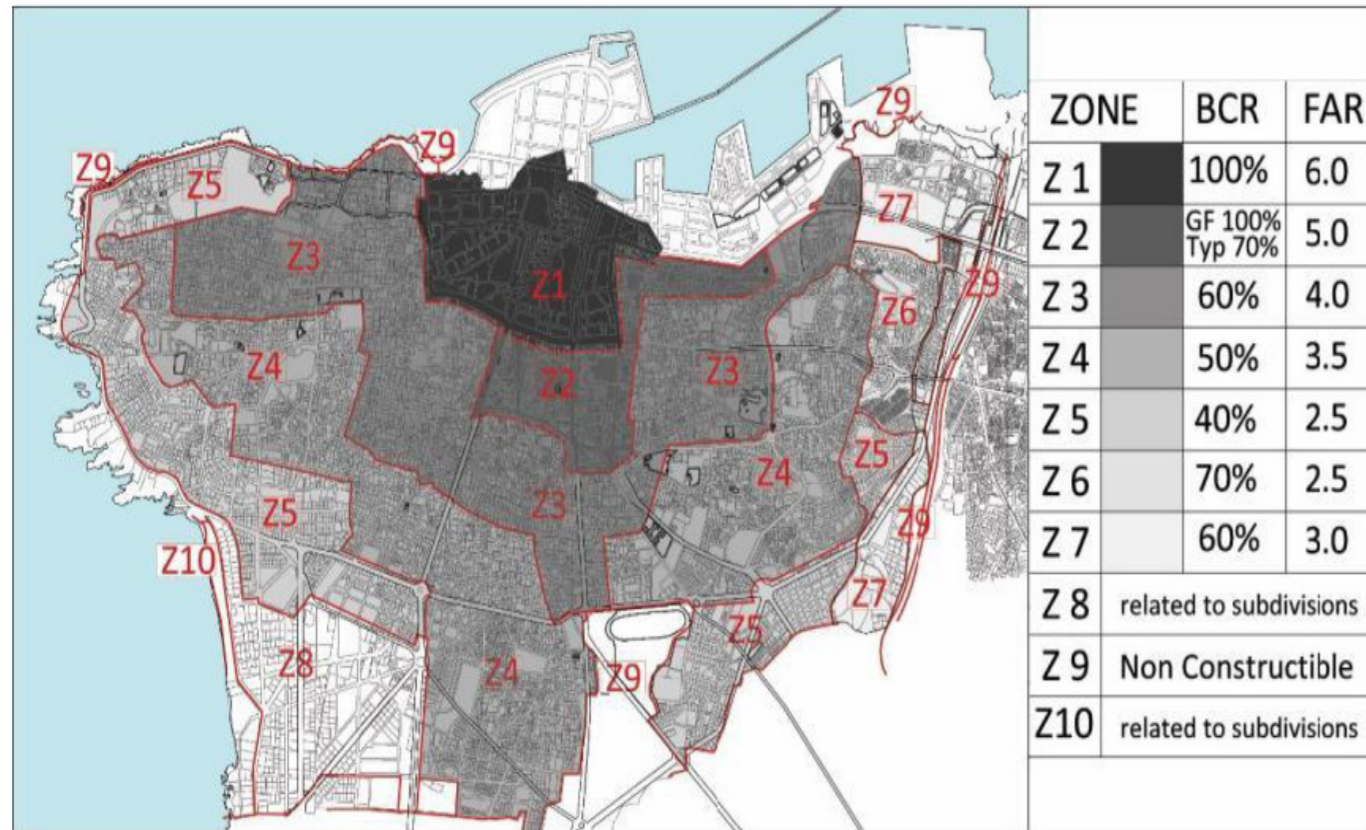


FIG. 16: Beirut zoning Regulation (Mohsen, Raslan, El-Bastawissi, 2020).

**URBAN HEAT ISLANDS (UHI):** Urban environments have a tendency for heat build ups in comparison to non-urban environments. Causes of this effect are natural factors such as general climate, weather, geography and the amount of vegetation and water surfaces combined with human made factors such as the population density, building dimensions, the ratio between open space and build space, street orientation or materiality of spaces (Kaloustian, Bitar and Diab, 2016).

Modern buildings are often constructed using concrete, steel and glass. But these buildings with often big windows absorb solar energy easily which increases indoor temperatures. High amounts of glass in the facades additionally reflect solar radiation down into urban spaces, which heats up outdoor environments as well. Especially in hot climates and considering future climate

change, this a threat for urban life (Enteria, Santamouris, Eicker, 2021).

Additional contributors to heat accumulation in cities are the lack of vegetation, shading, ventilation and the use of materials with a high solar energy absorption (Li, 2016). In the case of Beirut, an increase of the maximum temperature of 4°C has been estimated in 2011 by the Lebanese ministry of Environment until the year 2100.

Beirut's building regulations also play a role in the high density and climate of the city. Natural ventilation is ineffective due to missing wind corridors and a law to vegetate 50% of a lots unbuilt surface has never properly been implemented to the regulation. Especially in the city center, the density is very high with an allowed floor area ratio of 6.0 and a building coverage of 100% (Fig.16) (Mohsen, Raslan, El-Bastawissi, 2020).

**POTENTIAL IMPACTS OF UHI:** Heat in urban environments can effect the quality of outdoor spaces and decrease public live in the cities. Uncomfortable temperatures discourage from outdoor activities and use of public spaces. Besides a general discomfort in overheated environments, urban heat islands also have serious effects on human health. Heat cramps, exhaustion, heart strokes, increased mortality and premature death are results of overly heated environments. A health risk that only increases and spreads as temperatures rise.

Especially older adults, children and people with existing health conditions are at risk of suffering from heat (Li, 2016).

Avoiding outdoor spaces results in increased cooling energy demands for indoor spaces in hot regions, which causes additional costs for residents and also leads to increased heat emissions to the exterior, air pollution and emission of greenhouse gases, fueling climate change and resulting in a spiral of increasing outdoor temperatures and cooling energy demand (Enteria, Santamouris and Eicker (eds), 2021).



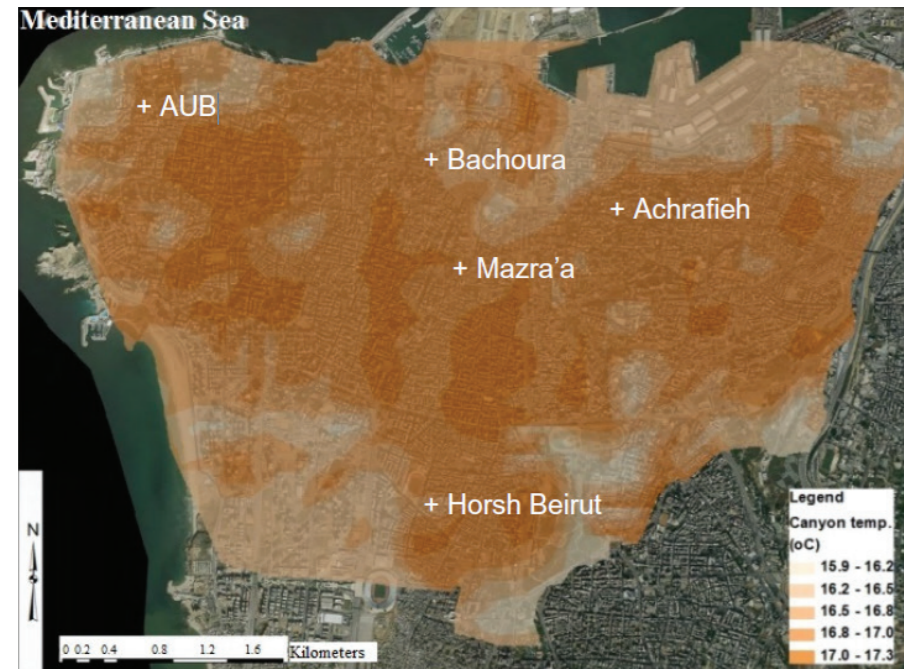


FIG. 17: Canyon average air temperature simulations across Beirut city on February 1st at 1200UTC (Kaloustian, N., Bitar, H. and Diab, Y., 2016).

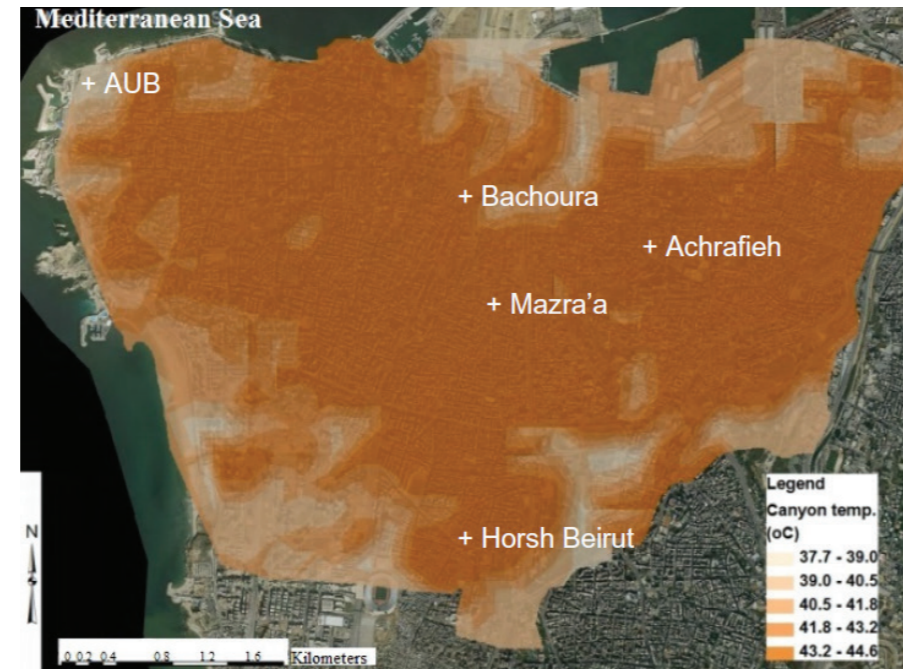


FIG. 18: Canyon average air temperature simulations across Beirut city on July 1st at 1200UTC (Kaloustian, N., Bitar, H. and Diab, Y., 2016).

**TEMPERATURE SIMULATION BEIRUT:** For a simulation of the urban heat in Beirut, Kaloustian, Bitar and Diab (2016) used a simplified model that uses average spatial town characteristics. (The City was divided in cells of 200 by 200 meters and for each cell parameters for roads, walls and roofs were entered. Additionally the occurring vegetation values were added. The model uses atmospheric, anthropogenic and endogenic factors to simulate the cities roof and canyon temperatures.)

The simulation was done for a 24 hour day each in February and July. The detected temperature difference between dense urban areas and green spaces was 6°C in the summer, with temperatures ranging from 37.6°C above green spaces to 44.6°C in dense urban areas. In the winter month the temperatures ranged from 15.9 degrees above green spaces to 17.3 degrees in the urban areas (Fig.17+18).

By changing the parameters the researchers simulated alternative scenarios that resulted in different temperatures. Both, increasing the building heights and the amount of glass as a surface material led to increased canyon temperatures and cooling energy demand. Increasing the tree height as well as lowering the roofs albedo and increasing reflectivity of sun energy resulted in lower temperatures (Kaloustian, Bitar and Diab, 2016).

By considering the factors that can reduce heat build up in the urban context, urban planning can create a more healthy and livable environment as well as reduce cooling energy consumption.

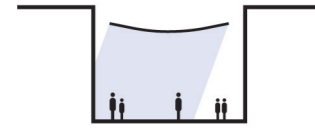
## A: PREVENT OVERHEATING: URBAN SCALE



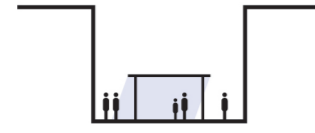
A.1. Increase vegetation between buildings for shading and evaporative cooling of the accessible open space.



A.2. Implement water bodies in between buildings for evaporative cooling of the accessible open space.



A.3. Add shading devices over streets with no vegetation for shading of the accessible open space.



A.4. Shade outdoor spaces where people are intended to spend time.



A.5. Use materiality and shape of buildings to reduce the amount of reflected solar radiation in public spaces.



A.6. Use materiality and shape of buildings to reduce amount of absorbed radiation

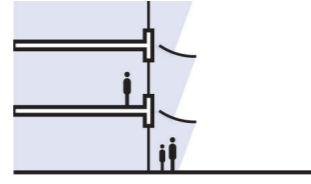
## B: PREVENT OVERHEATING: BUILDING SCALE



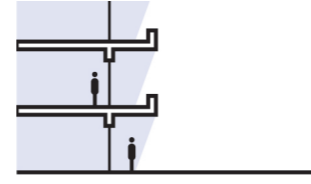
B.1. Rooftop vegetation for shading and evaporative cooling to prevent building masses from overheating.



B.2. Shaded rooftops prevent building masses from overheating.



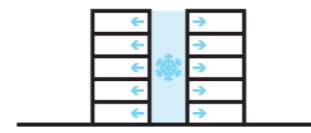
B.3. Shaded building openings prevent sun radiation from entering the buildings.



B.4. Set back building openings prevent sun radiation from entering the buildings.



B.5. Use building mass to absorb heat from the rooms.



B.6. Narrow courtyards store cold air from the night and cool the building during the day.

**METHODS TO PREVENT OVERHEATING:** Traditionally, buildings and urban spaces in hot regions were designed to reduce heat stress indoors and outdoors. Before modern technology could alter indoor climates, builders used the sites natural conditions as well as the buildings' and spaces' morphology to create comfortable living environments (Enteria, Santamouris and Eicker (eds), 2021).

Drawing inspiration from historic building techniques as well as utilizing possibilities of modern architecture can enhance living environments climatically as well as avoid health threats and increased energy demands, thus creating more ac-

cessible, affordable and livable urban environments, in buildings and public spaces. Both for building and urban design, the essential principles are evaporative cooling and making use of night time cooling, shading of spaces and building mass, reducing absorbed solar energy through reflective materials and the possibility to ventilate and exchange air if needed.

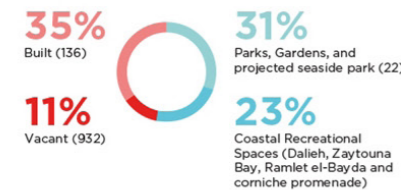
A number of measures involving vegetation, water bodies, temporary and permanent shading, the selection of materials and morphology as well as building cooling strategies are presented in Fig. 19.

FIG. 19: Strategies to counteract overheating of urban spaces and buildings.



Map A  
**Publicly Owned Parcels and Open Sites Used by the Public in Municipal Beirut**

Publicly owned parcels and open sites used by the public in municipal Beirut make up **9%** of its surface area, divided as follows:



- Beirut River
  - Coastal Recreational Space
  - Vacant (932)
  - Built (136)
  - Park / Garden (21)
  - Projected Seaside Park\*
- \*planned public park created after land reclamation by SOLIDERE

This map is compiled from: (1) a list of parks and gardens acquired from CDR, (2) a list of publicly owned parcels from 2004 (including parcels owned by the municipality and by public institutions) acquired from URBI, (3) a 2018-dated list of municipal parcels acquired from the municipality of Beirut, and (4) data based on the BED. The information shown in the map still requires fieldwork verification.

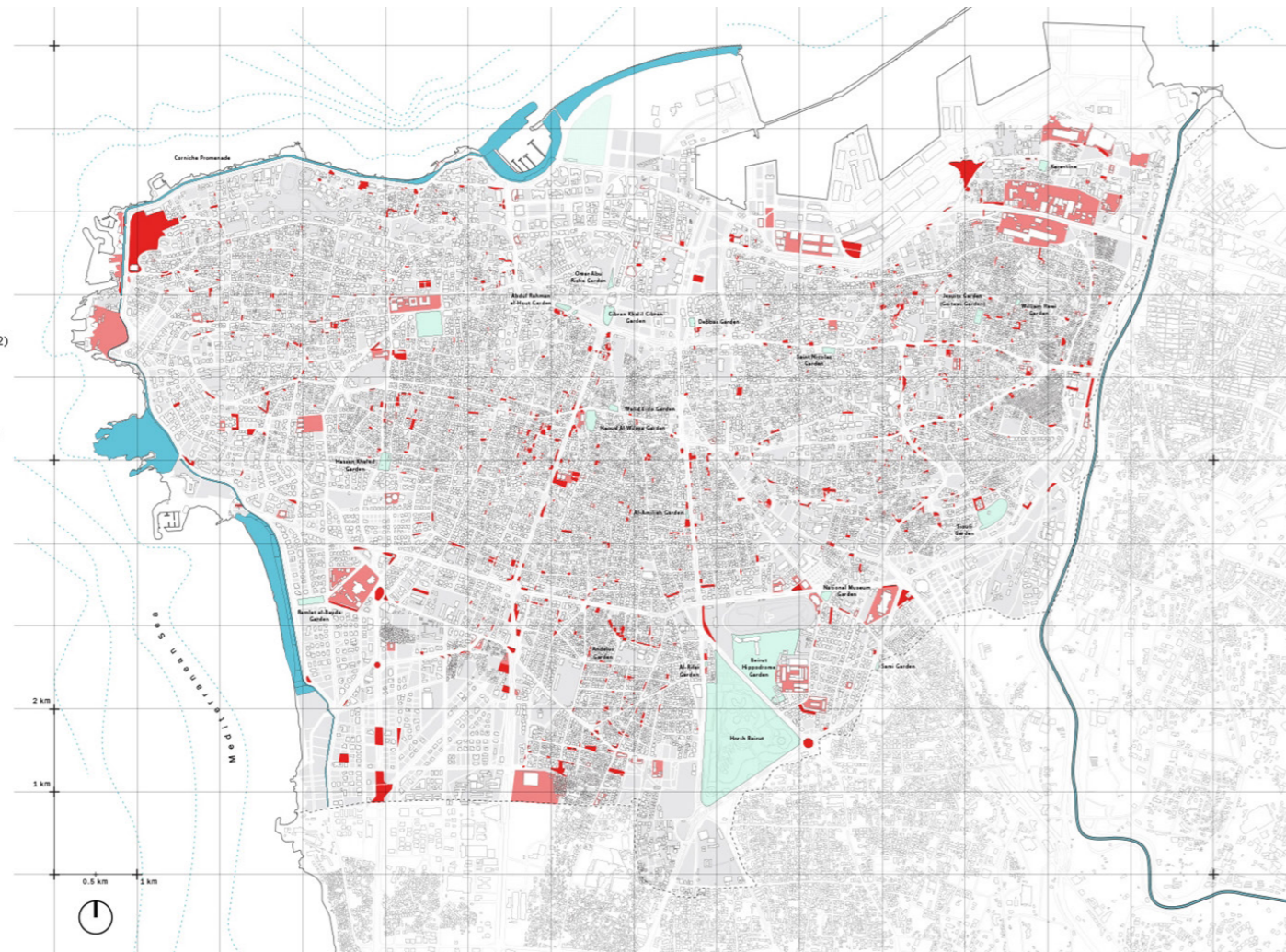


FIG. 20: Publicly Owned Parcels and Open Sites Used by the Public in Municipal Beirut (image from Beirut Urban Lab, 2020).

**PUBLIC SPACE AND THE WATERFRONT**

**PUBLICLY ACCESSIBLE GREEN SPACES:** The dense urban texture of Beirut indicates a lack of open spaces, especially publicly accessible open spaces. A mapping, conducted and published in 2020 by the Beirut Urban Lab, a research space at the American University in Beirut, has identified only 21 public green spaces which results in less than 1 m<sup>2</sup> green space per inhabitant (Fig. 20). The WHO's recommendation is a minimum of 9m<sup>2</sup> per individual. The UN detects an additional lack of playgrounds, beaches, sports areas and parks (UN Habitat Lebanon, 2021). The Beirut Urban Lab suggests the preservation and development of vacant, unbuildable lots as an opportunity to reactivate public life in Beirut.

**PUBLICLY ACCESSIBLE WATERFRONT:** The amount of accessible waterfront is likewise small. According to the Beirut Urban Lab's mapping, municipal Beirut has only two spots where people can directly access the water. These are the cliffs in Raouche, close to the Pigeon Rocks and the beach Ramlet Al Baida, which is partly privatized. The waterfront promenade along the coastline and the marina are public spaces close to the water, but a direct access of the water is only occasionally possible.

Historically there has been privatized access to the water along the northern coastline which indicates that the water is suitable for several water related activities. However, intended public access to the water is a rarity in today's Beirut.



FIG. 21: Activities at the waterfront near the port, 1900s (oldbeirut, 2014).

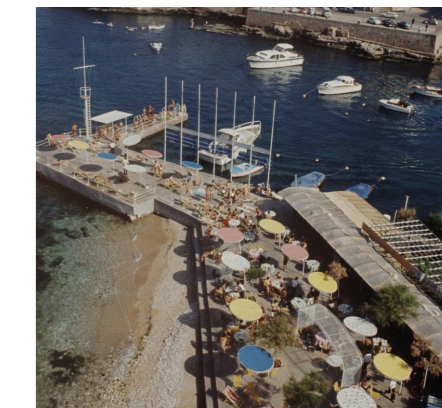


FIG. 23: Water activities at the St. George's Hotel, 1960s (oldbeirut, 2014).



FIG. 22: Water activities at St. George's Bay, 1960s, today marina (oldbeirut, 2012).



FIG. 24: Activities at the waterfront along the Coniche, 2022 (own photo).



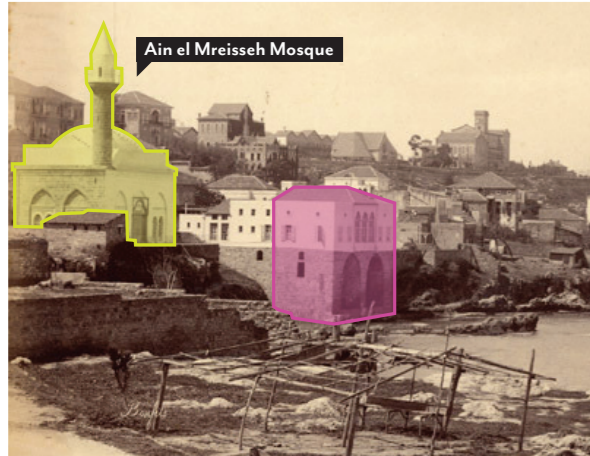


FIG. 25: Corniche 1890s (oldbeirut, 2014).



FIG. 26: Corniche 1890s (oldbeirut, 2014).



FIG. 27: Corniche 1920s (oldbeirut, 2014).



FIG. 28: Corniche 1970s (oldbeirut, 2014).

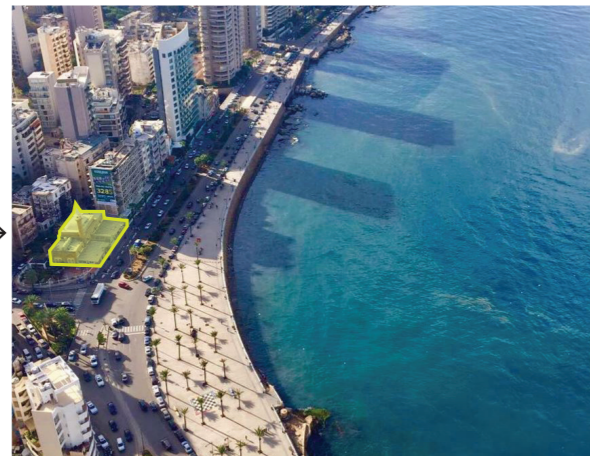


FIG. 29: Corniche 2017 (rabihsaade, 2017).



FIG. 30: Corniche 2022 (own photo).

**THE CORNICHE:** Municipal Beirut's western and northern shoreline is marked by the Corniche, a continuous promenade with occasional access to the water. By identifying the Ain el Mreisseh Mosque together with surrounding buildings in historical images dating back to the 1890s, we can trace back the development of the Corniche and how it changed Beirut's relation to the water (Fig. 25-30).

A first transformation can be seen between the 1920s and 1970s, the time of Beirut's development to a tourist destination. The shoreline has changed from natural cliffs and houses along the water to a shaded promenade. Today the promenade still exists, but seemingly has lost much of the quality it was supposed to add to the city. A multi-lane road with worn down to barely recognizable pedestrian crossings separates the city from

the water. The palm trees that replaced the former vegetation are providing not enough shadow to protect from the sun and create a comfortable environment. Today's promenade seems to be overall inaccessible and uninviting (Fig. 30+31). Yet, for some people living in Beirut the Corniche remains an attractive destination as activities are taking place and the spots with direct access to the water are being occupied by people (Fig. 32).



FIG. 31: Schematic section of the Corniche near the Ain el Mreisseh Mosque (based on dimensions measured in Google Earth Pro).



FIG. 32: Interactions with the water along the Corniche (own photo).



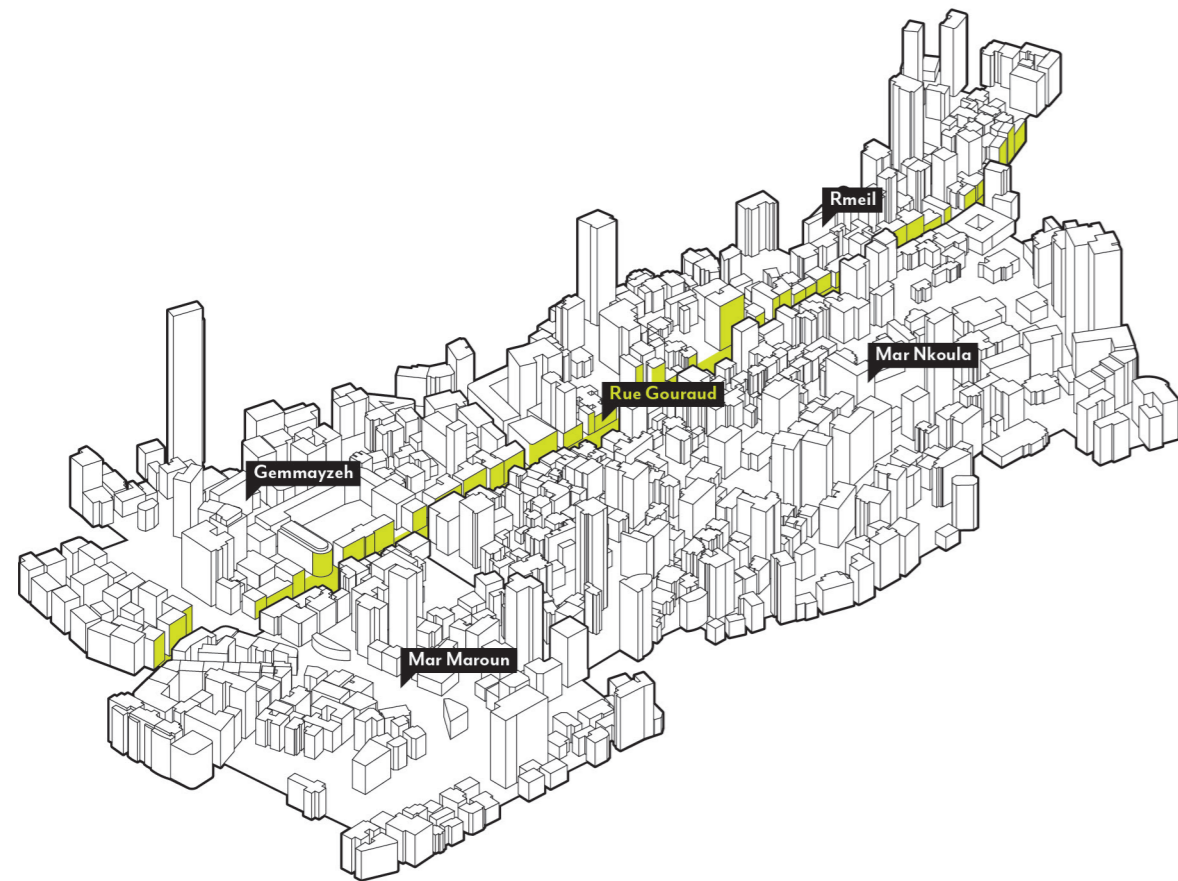


FIG. 35: Isometric view on the Rue Gouraud and its neighborhoods (based on a 3D model provided by the municipality).

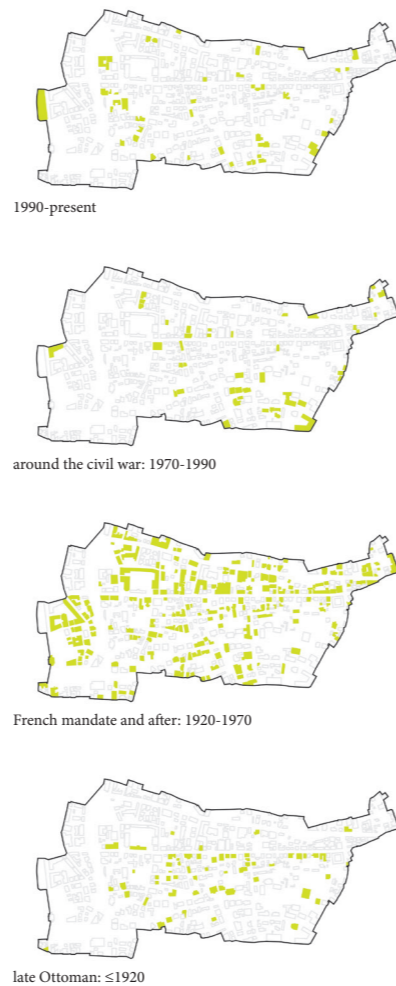


FIG. 34: Building periods of the neighborhoods (based on data from Beirut Recovery Map).

## CASE STUDIES

**RUE GOURAUD:** The neighborhood along the southern border of the port contains the street Rue Gouraud. The mainly residential buildings have commercial uses in their ground floors along the entire street and offer numerous restaurants, cafes, bars and shops which allow for a frequent use by several target groups during the day and night (Fig. 38). The street is framed by the four sectors Gemmayzeh, Rmeil, Mar Maroun and Mar Nkoula which show a high degree of build structures from the time of the French Mandate and after, as well as many buildings from the late Ottoman period - especially along the Rue Gouraud, which gives the

street its historic character (Fig. 34+36+37). The urban fabric is densely filled with buildings of three to five floors and with a height between 10 and 15 meters. Only newer developments exceed this height but only a few of those are located directly along the Rue Gouraud.

Additionally, some sections of the streets are framed by greenery, which helps shading the sidewalks in the steep summer sun (Fig. 39). The space for cars is limited which allows relatively safe pedestrian movement. This creates a pleasant street that is experienced in the human scale.



FIG. 35: Schematic section of the Rue Gouraud.



FIG. 36: Rue Gouraud in the 1920s (oldbeirut, 2018).

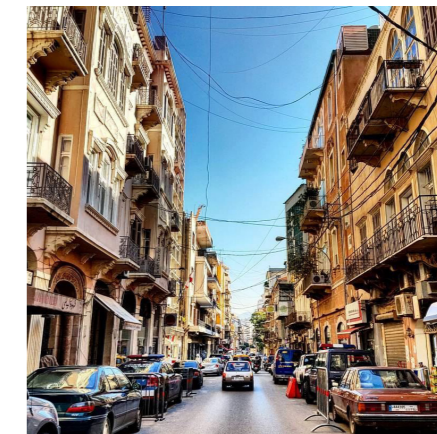


FIG. 37: Rue Gouraud around 2017 (digitalyeti, 2017).

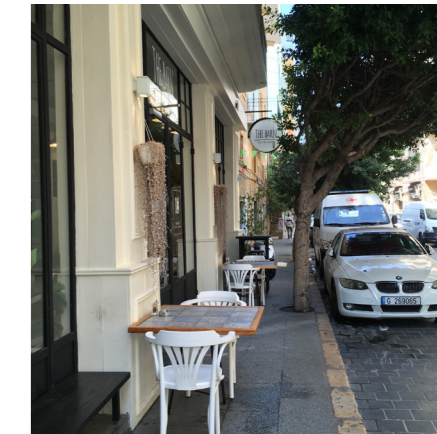


FIG. 38: One of many small restaurants (own photo).



FIG. 39: Dense vegetation (own photo).

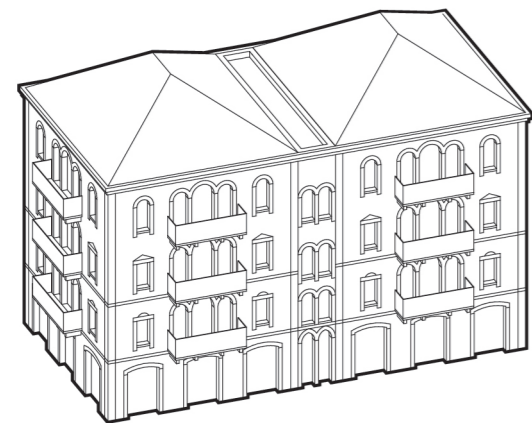


FIG. 40: Schematic model of a "commercial" late Ottoman Beirut house (before 1920).

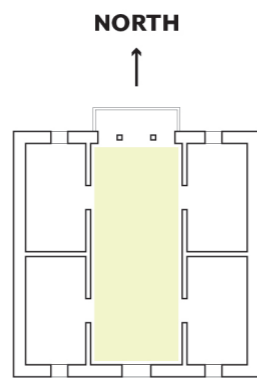


FIG. 41: Schematic floorplan of a Lebanese Liwan house with three centered arches towards north.

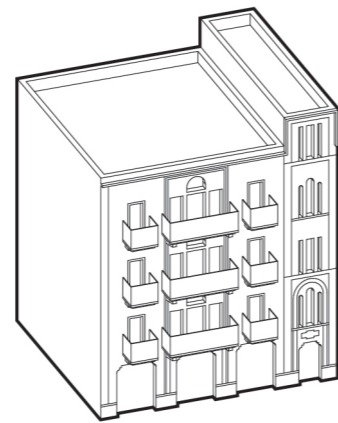


FIG. 42: Schematic model of a house during the French mandate showing European influences (1920-1930).

**THE LATE OTTOMAN BEIRUTI HOUSE:**

One of the most prominent housing types along the Rue Gouraud is a cubic house with a 12x12 to 15x15 square footprint (Fig. 40). This type can be dated from the late Ottoman period, during the second half of the 19th century up until the French mandate 1923.

This type shows common structural and ornamental elements of the Beirut houses of that time that are rooted in traditional Lebanese farm houses as well as influenced by Islamic and western (venetian) architecture. Such elements include the three centered arches and the balconies as well the pyramid tiled roof (Beirut Heritage Initiative, 2021). The typical orientation of Lebanese Liwan

houses towards the north is missing (Fig. 41). A sign that climatic considerations had to give way to increasing urbanization of Beirut. The attached staircase and the commercially used ground level with up to three residential floors hint that these buildings along the Rue Gouraud were build after the reform of the Ottoman empire towards modernization.

The appearance of this type is replicated by several houses from the decades after the French mandate (1923-1946) but modified with European motives such as rectangular wall openings and French balconies. It can still be recognized as an inspiration for the most recent buildings of the street (Fig. 42).



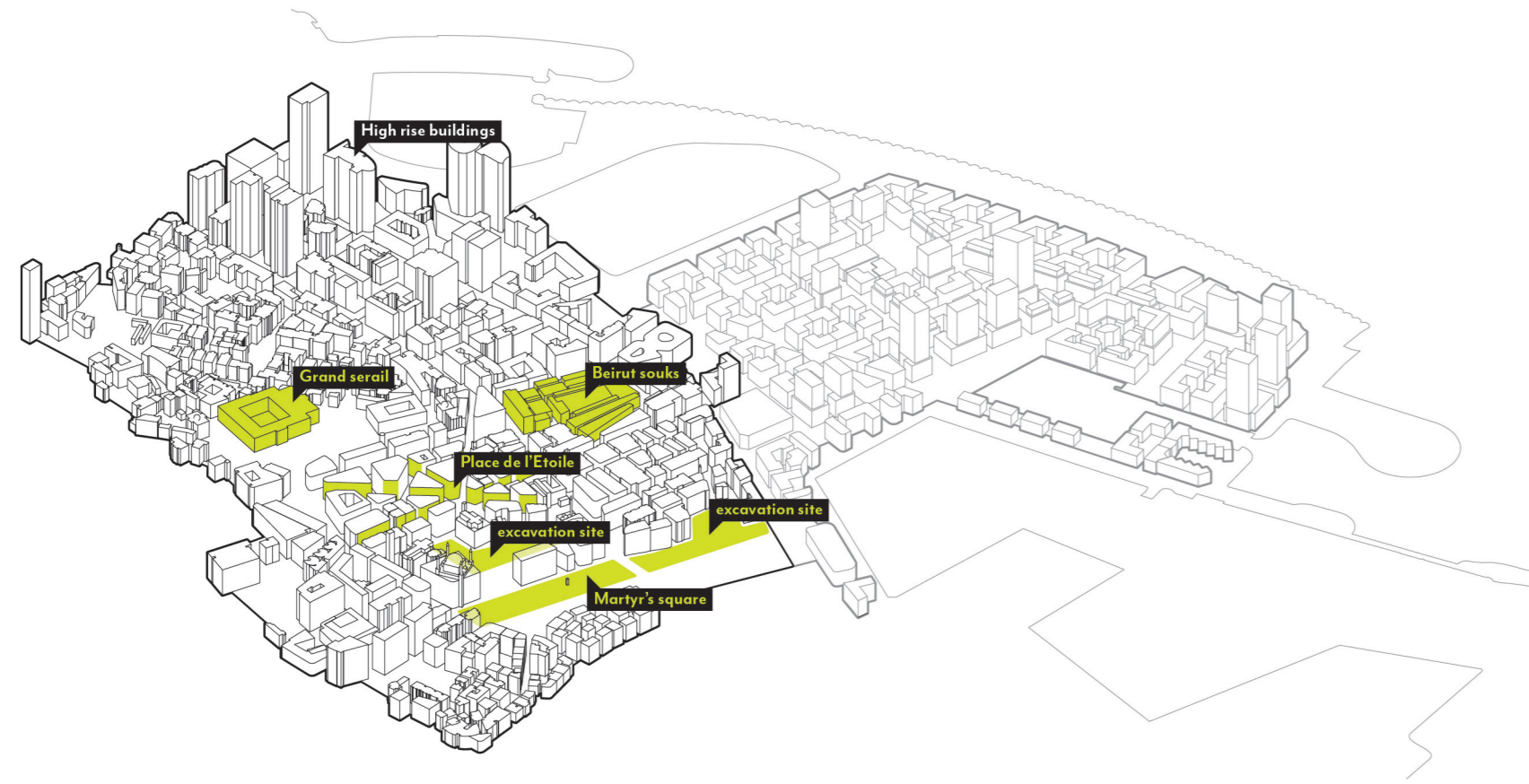


FIG. 45: Isometric view on the Central Business District (based on a 3D model provided by the municipality).

**CENTRAL BUSINESS DISTRICT (CBD):** The historic center of Beirut showed traces from several time periods and civilizations, dating back more than 5.000 years ago (Hassan, Resen, 2018). During the 20th century it developed into the Central Business district, housing offices, international banks, hotels and government ministries.

After the severe damage from the civil war (1975-1990), leaving the infrastructure, the historic center and about 900 heritage buildings destroyed (Hassan, Resen, 2018), the CBD undertook a radical modernization. The lack of governmental institutions to conduct a redevelopment led to the founding of the private company Solidere that was commissioned to develop the city center.

The redevelopment that followed primarily economic interests generated an isolated

central city that barely connects to the surrounding neighborhoods (Marot, Yazigi, 2012). A ring road with diameters between 20 and 50 meters cuts off most pedestrian connections to the neighboring areas and created an insular city center that lacks mental and physical accessibility. The treatment of historically relevant sites and architecture is often criticized as superficial and the traditional markets (souks) have been replaced by a modern shopping mall.

While much attention was given in the design of commercially used public spaces such as the Nejmeh Square, little attention was given to others such as the historically important Martyrs Square.

During the site visit in September 2022, parts of the CBD were closed to the public and guarded by the military.



FIG. 44: Redeveloped city center after the civil war (based on Solidere's masterplan).



FIG. 45: Nejmeh square (own photo).



FIG. 46: Glass-skyscrapers of the CBD (own photo).



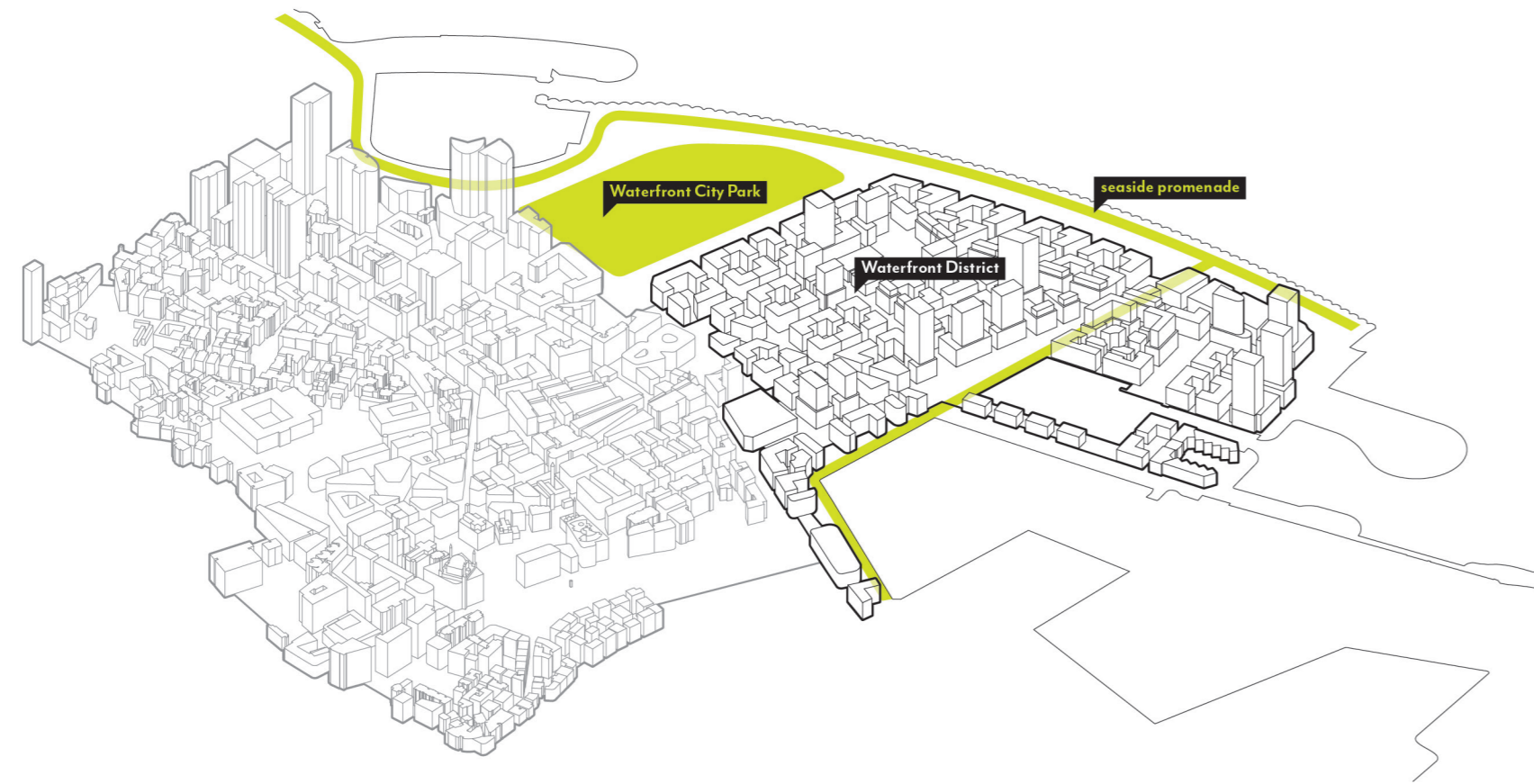


FIG. 47: Isometric view on the Waterfront district (based on Solidere's masterplan).

**WATERFRONT DISTRICT:** The Waterfront district is the latest urban development project of larger scales in Beirut. It proposes a new city district on a landfill that is attached to the central business district and overlooks the port to its east. The developers propose a large scaled block structure on a grid with street dimensions of up to 30 meters and a building height of approximately the same dimension, with a number of skyscrapers spread over the site (Fig. 50).

The three main public spaces are the city park, the extension of Beirut's seaside promenade and a commercial street stretching centrally along the north-south axis and connecting to the shopping hotspot Beirut Souks in the CBD.

Although these public spaces could attract citizens from other areas in the city, the peninsular-like design with two luxury marinas and that only connects to the more exclusive areas of the CBD suggest that the proposal is likely to mostly benefit a high income clientele.

The multi-lane road surrounding the area, similar to the ring around the CBD make pedestrian access difficult. Especially an easy pedestrian accessibility of the public spaces is not given (Fig. 48+49).



FIG. 48: Publicly accessible areas (white) including streets.



FIG. 49: Streets, thickness indicates hierarchy.



FIG. 50: Visualization from the development consultant Visionaire.



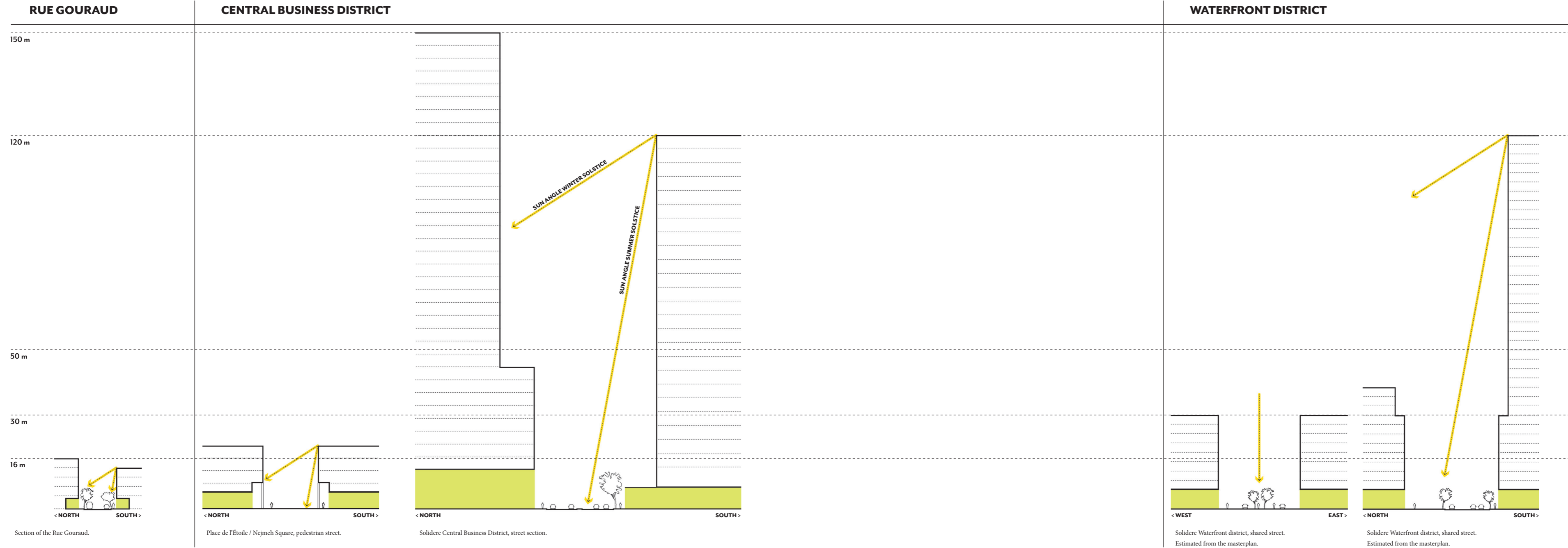


FIG. 51: Comparison of street sections from the Rue Gouraud, Central Business District and Waterfront District.

	RUE GOURAUD	CBD	WATERFRONT DISTR.	>> PORT DEVELOPMENT
<b>PEDESTRIAN ACCESSIBILITY</b>	- confrontation between pedestrians and motorized traffic due to shared accessibility and high amount of parking spaces. + relatively save pedestrian movement.	- car oriented design and priority. - insular design, multi-lane road cuts off connections to the city. - atypical structure and dimensions increase mental barrier.	- car oriented design and priority. - unfamiliar structure and dimensions increase mental barrier.	>> pedestrian priority. >> accessibility from the surroundings. >> Beirut-typical urban pattern.
<b>ARCHITECTURAL HERITAGE</b>	+ variety in scales, shapes and architecture. + documentation of the cities history with buildings dating back to the late Ottoman period.	- poor handling of architectural heritage and city history. - reduction of architectural heritage to few restored heritage buildings and excavation sites and superficial recreation of facades. - global architecture style instead of location rooted design.	- the masterplan doesn't suggest a diversity in architecture. - the suggested grid structure seems alien and out of place in its form and dimensions compared to the existing city patterns.	>> variety in scales, shapes and architecture. >> location specific urban design and architecture that connects to and roots in the cities building history.
<b>PUBLIC SPACE</b>	+ the Rue Gouraud acts as main public space. - few public space besides main street, but potential public spaces nearby.	+ attractive commercial spaces - reflective materials, morphology and lack of shading lead to increased radiation and heat accumulation, causing overheating of the public space. - sealed surfaces and little vegetation add to heat accumulation. - proportions in inhuman scales.	+ high amount of public space, especially green space (city park and seaside promenade). - poor accessibility of these spaces due to multi-lane roads surrounding them. - proportions in inhuman scales. - little shading by the urban form makes heat accumulation likely.	>> high amount of accessible public space. >> high amount of greenery. >> climate adapted urban design and architecture (shading, heat prevention, cooling,...). >> proportions in relation to human scales and pedestrian experience.
<b>ACTIVITY IN PUBLIC SPACES</b>	+ mix of retail, gastronomy, cultural institutions, housing and office spaces attracts different user groups and enables activity throughout the day.	- highly commercialized. - zoning leads to mono functionality of the spaces and shorter time windows of activity.	+ assumed mix of residential, commercial and office spaces would increase activity of public spaces. - no direct access to and activation of the waterfront (except marina).	>> activation and public accessibility of the waterfront. >> mixed use. >> "charge free" as well as commercial areas for the citizens.

FIG. 52: Conclusions from the analysis of the Rue Gouraud, CBD and Waterfront District (+ positive identified aspects; - negative identified aspects; >> goals for future development)

	CONNECTIVITY	MICROCLIMATE	ACCESSIBILITY
<b>URBAN SCALE</b>	>> building volumes dimensions based on the ports surroundings. >> street dimensions, hierarchy and plot sizes based on the ports surroundings. >> connect to relevant places and features around the port.	>> high amount of vegetation in between the buildings for shading and evaporative cooling. >> water bodies in between buildings for evaporative cooling of the open space. >> temporary street covers for shading in the hot seasons. >> shading of meeting points. >> consider the suns movement when dimensioning and shading open spaces. >> materiality that reduces the amount of reflected solar radiation in open spaces.	>> prioritize pedestrians to cars. >> ensure comfortable microclimate. >> active waterfront. >> quick access to the sea. >> connect to the city. >> avoid physical and mental barriers. >> use block structure and grown structure, which are the two most common in Beirut, to create a familiar pedestrian experience.
<b>BUILDING SCALE</b>	>> building design rooted in architectural heritage of different time periods. >> materiality that suits the city's character and benefits the microclimate.	>> rooftop vegetation and shading to prevent overheating of the building mass. >> shade openings to prevent sun radiation from entering the building. >> use set-backs for openings to prevent sun radiation from entering the building. >> use building mass for cooling. >> use narrow courtyards to store cool air for the day. >> consider sun movement when dimensioning and shading building openings.	

FIG. 53: Guidelines for the design of the port proposal.





FIG. 54: Overview plan showing the relevant connections to the city and the relocated port.

## PROPOSAL

The last chapter describes the design proposal that has been developed as a response to the previously presented research and analysis.



## MASTERPLAN

**MAIN PRINCIPLES:** At its current state, the port is cut off from the city by the highway Charles Helou. By relocating the port further to the east, industrial traffic associated with port businesses can be expected to reduce. Locating some of the remaining traffic in a tunnel offers the possibility to connect the port to the city and the attractive Rue Gouraud, as well as reduce noise pollution which increases the attractiveness and development potential of the port significantly. Strong north-south axes

then allow visual connections and fast and easy access to the water from the city. Along the water, the seaside promenade that already connects to the Corniche at Beirut's northern shoreline, will extend into the port. The largest of the three quays that has been the location of 2020's explosion, will be transformed in a memorial park as the heart of the new port. It's development should involve the citizens to enhance acceptance of and attachment to the new city extension.



FIG. 55: Aerial view on the port before re-development (based on Bing Maps and Google earth imagery).

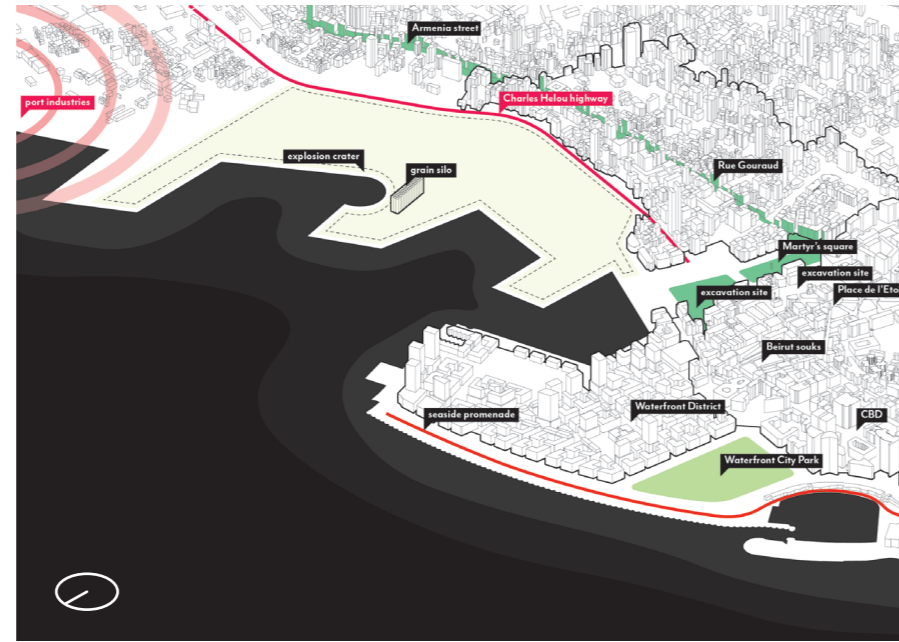


FIG. 56: Schematic view on the site and its near surroundings.

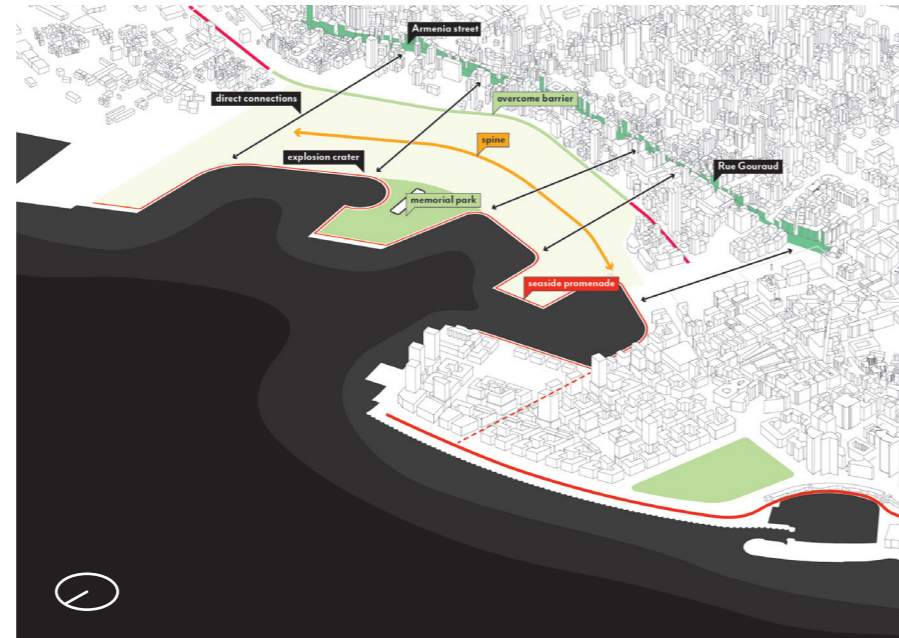


FIG. 57: The main public connections that are shaping the proposal.



The westernmost part of the port is exposed to noise emissions from the industrial port, which makes the outdoor spaces less attractive for residential uses and requires more noise resistant programs. The proposal suggests culture and nightlife oriented uses in the ground floors and offices and hotels in the top floors. Here, architectural measures can reduce the noise pollution. In all other areas of the site, residential blocks are spread from the current city's edge down to the waterfront which enhances connectivity between city and sea, where an attractive waterfront with low rise as well as high rise buildings can be formed. A new canal along the central spine enhances the microclimate of the public spaces, increases the potentially usable waterfront and brings the sea further into the city and closer to the people.

- attractive waterfront
- high rise
- mixed use blocks
- courtyard houses

FIG. 58: Isometric overview of the proposal.





FIG. 59: Masterplan (scale 1:9000)

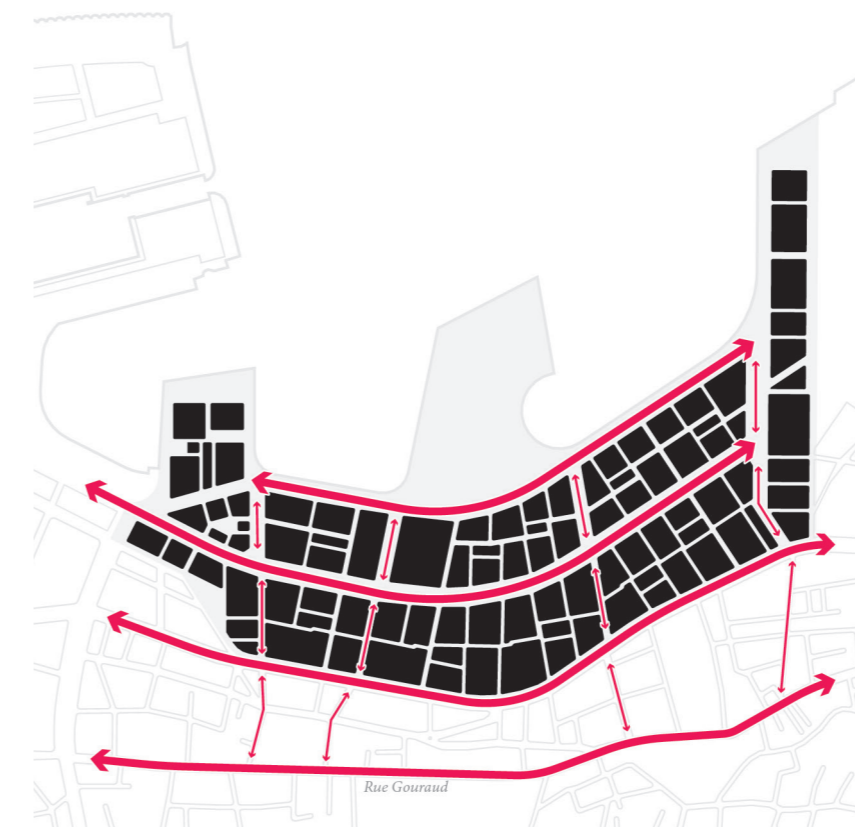


FIG. 60: Spatial organization of the proposal.

**SPATIAL ORGANIZATION:** The proposals layout is rooted in the structure of the city in the south of the port. It is dominated by clear east-west axes with public use that connect to the city center. North-south corridors connect these axes including the former highway and the Rue Gouraud / Armenia street and allow easy and fast pedestrian



FIG. 61: Main land use.

access to the waterfront. In the residential areas a dense pattern of shifted streets allows privacy. By resembling the existing cities structure in street and plot dimensions and hierarchy it increases the integrity of the new development and through favored pedestrian accessibility it invites visitors and avoids mental and physical barriers.

**LAND USE:** In terms of public use the proposal offers three main zones. A culturally and public oriented waterfront which prolongs the existing promenade, a commercial central spine that connects to the city center and a nightlife axis that connects the waterfront to the bar scene of the Armenia street.

The waterfront is intended to invite residents and visitors from all over the city and offers a number of public, cultural and free-of-charge programs. Visiting the waterfront should be attractive for everyone and not connected to financial matters. In contrast, the central spine has a more commercial character.



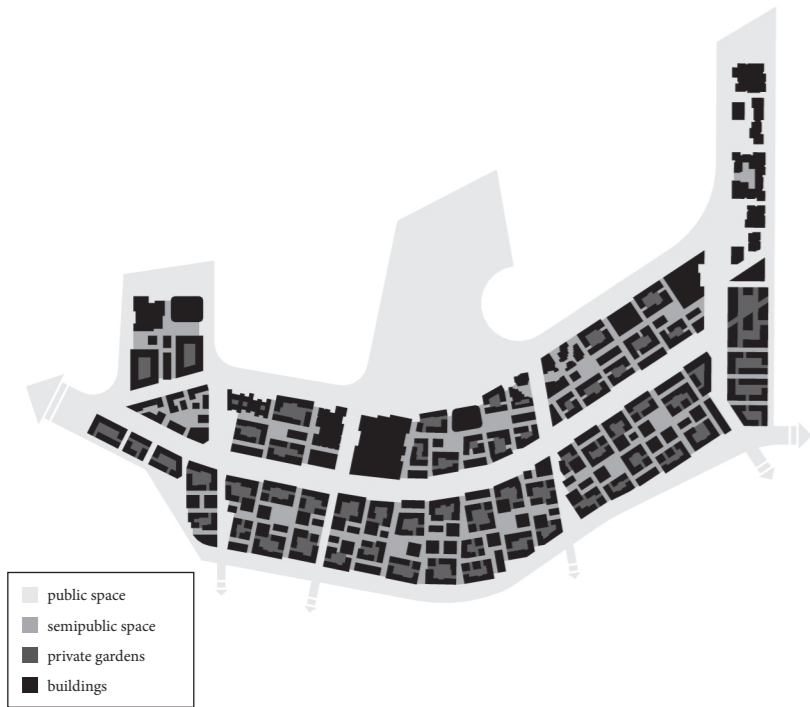


FIG. 62: Public (light grey) and protected (dark grey) open space.



FIG. 63: Residential mixed-use (black) and public/cultural functions along the waterfront (colored)



FIG. 64: Shading.



FIG. 65: Green spaces.

**PUBLIC AND PRIVATE:** To balance privacy for the residents with the active public spaces, a dense structure with narrow streets is suggested for the residential areas. This clearly sets them apart from the wide public spaces and creates a threshold to the protected spaces between the buildings.

The houses are accessed through a dense network of shared spaces for the residents with a central pedestrian street as main connection. Within the block structures, gardens provide intimate spaces that are shielded off from the busy commercial areas and can be directly accessed from the buildings.

**BUILDINGS:** While most of the plots offer a mix of housing, workspaces and commercial functions, some plots, especially along the waterfront, are reserved for public or cultural institutions. These plots also hold the tallest buildings of the proposal which allows a combination of public use on the ground levels and commercial use in the towers. This

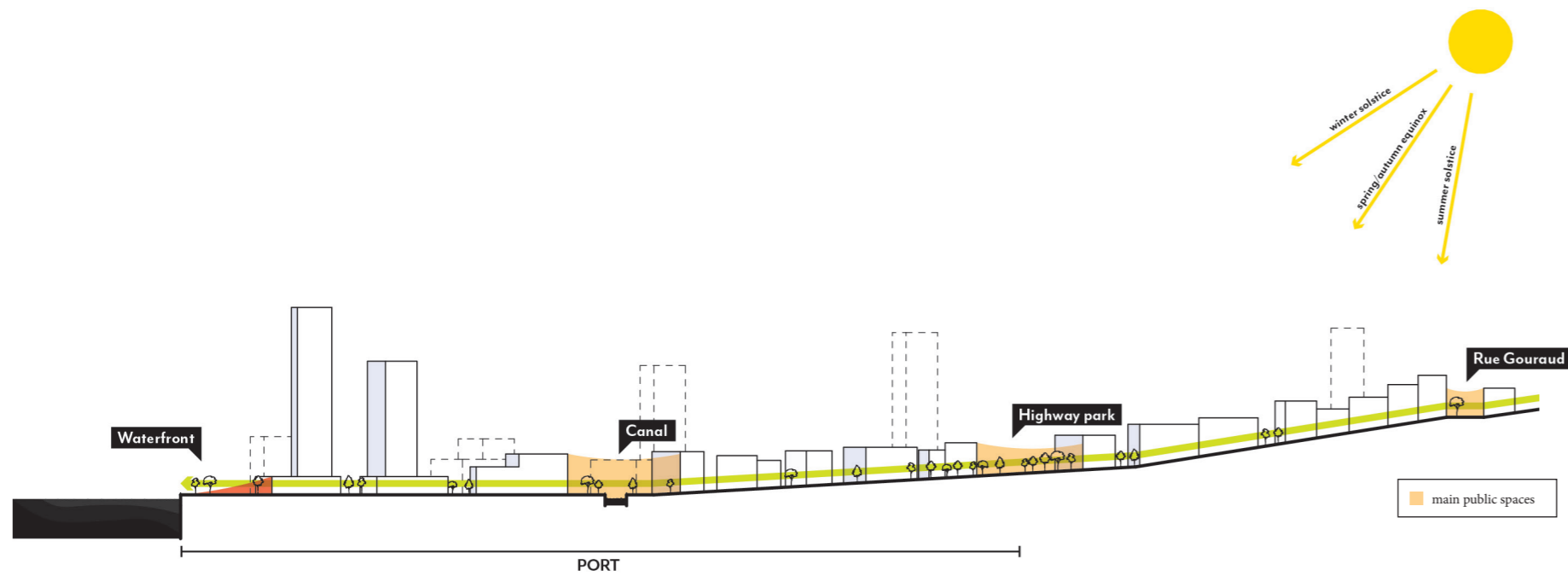
model attracts developers while encouraging them to invest in public spaces. Especially the eastern quay holds a large number of commercially, night life oriented spaces combined with high rise towers. A careful supervision and control by local authorities is advised to ensure that quality public spaces don't get compromised by private interests.

**SHADING:** The port is generously stocked with trees and temporary street shading for the hottest months to prevent heat accumulation in public spaces through shading and evaporative cooling. This creates more pleasant outdoor environments and temperatures to encourage visitors and residents to make use of the open spaces. The choice of trees should be based on the local climate and

flora and the degree of potential shading and cooling effect to achieve a high impact on the microclimate with minimal maintenance effort needed. Additionally, the vegetation is intended to also add to the visual quality of the open spaces so the variety and visual attractiveness should also play a role in the urban landscape.

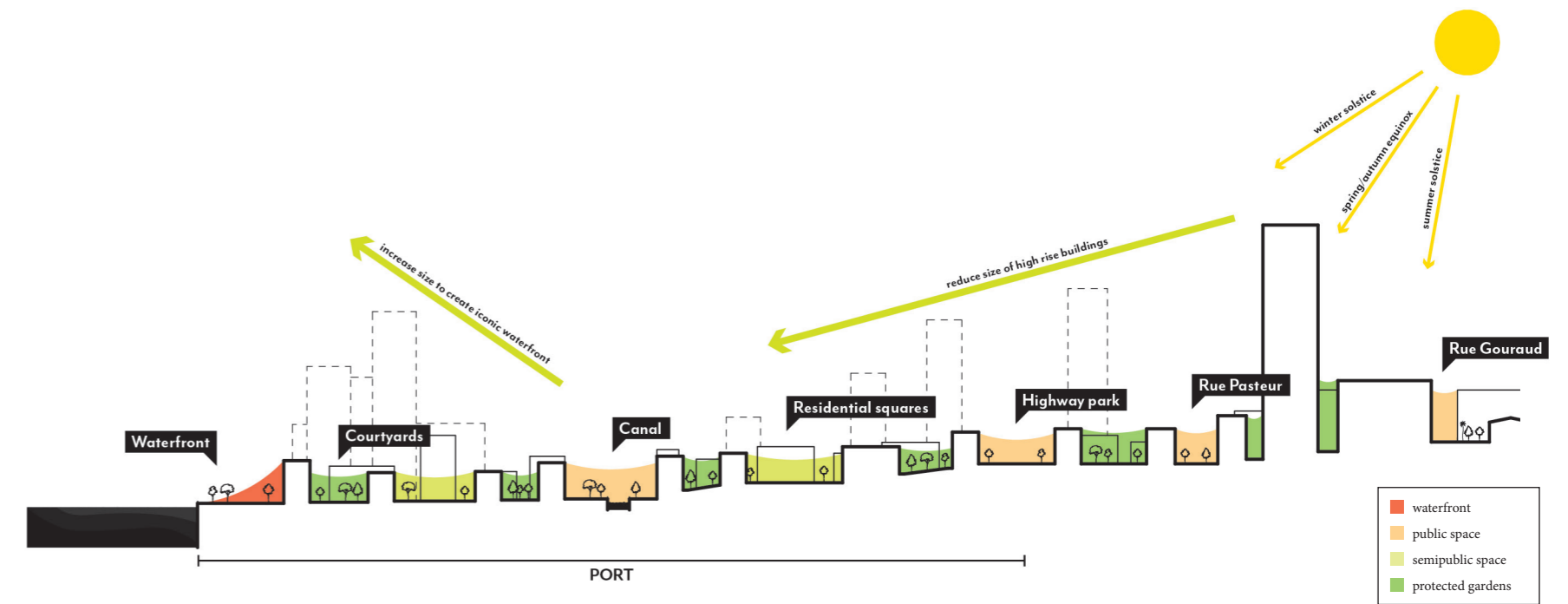
**VEGETATED SPACES:** The site offers many small scale green spaces along the streets as well as several main parks. The high amount of vegetated surfaces prevents overheating of open spaces by diverting solar radiation and supports cooling through evaporation. Additionally each housing block contains its own sheltered green space as a retreat for the residents.





**ACCESSIBILITY:** North-west connections allow direct visual contact with the sea and the main public spaces. These axes can reach the Rue Gouraud and Armenia street which improves the sites connectivity to the city and accessibility of the waterfront. These axes also work as main pedestrian connectors between the public spaces.

FIG. 66: Section (north-south) showing the connection of the sea and the city.



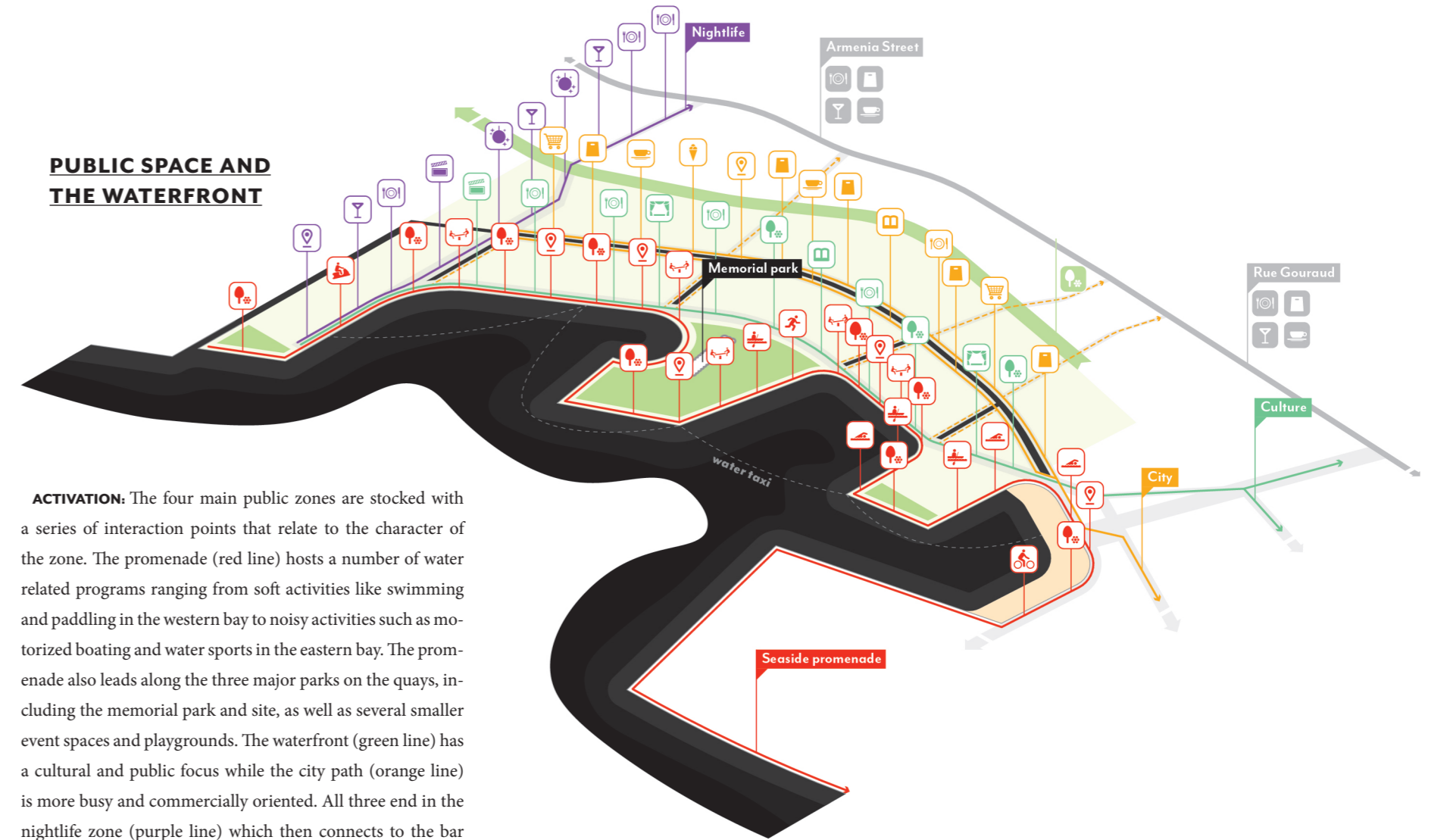
**CONNECTIVITY:** The proposal offers a mix of scales, similar to the neighborhoods around the port. Most of the buildings vary from four to six floors with higher buildings bordering public spaces and lower dimensions in residential areas. Occasional high rise buildings ensure architectural variety without densifying the area too much. However, their height decreases towards the proposals central axis to create spaces in human scales and to avoid

additional solar radiation reflected into the streets. Along the waterfront the scales rise to form an attractive elevation. Here, climatic impacts can be mitigated by the cooling effect of the sea. The proposal creates a similar urban experience as the city it is connecting to, thus enhancing its mental accessibility and the continuity of the existing neighborhoods towards the waterfront.

FIG. 67: Section (north-south) showing the height development of the proposal.



FIG. 68: Spatial organization of the proposal.



**ACTIVATION:** The four main public zones are stocked with a series of interaction points that relate to the character of the zone. The promenade (red line) hosts a number of water related programs ranging from soft activities like swimming and paddling in the western bay to noisy activities such as motorized boating and water sports in the eastern bay. The promenade also leads along the three major parks on the quays, including the memorial park and site, as well as several smaller event spaces and playgrounds. The waterfront (green line) has a cultural and public focus while the city path (orange line) is more busy and commercially oriented. All three end in the nightlife zone (purple line) which then connects to the bar scene at the Armenia street.

FIG. 69: Overview of the main public spaces and connections to the city.





FIG. 70: Detail plan of the city beach and seaside promenade (scale 1:2500).

**THE CITY BEACH:** While all three bays host water access and activities, the most protected and closest one to the city center will offer a public beach as a main attraction and entrance to the lively waterfront of the new port district. In a context of limited water access and as being only the second public beach in municipal Beirut, it is a statement against privatization of the waterfront. Together with the memorial park and promenade, it should be realized in the first development phase to open the site to the public early on.



FIG. 71: Visualization of the new beach near the city center with view into the port.



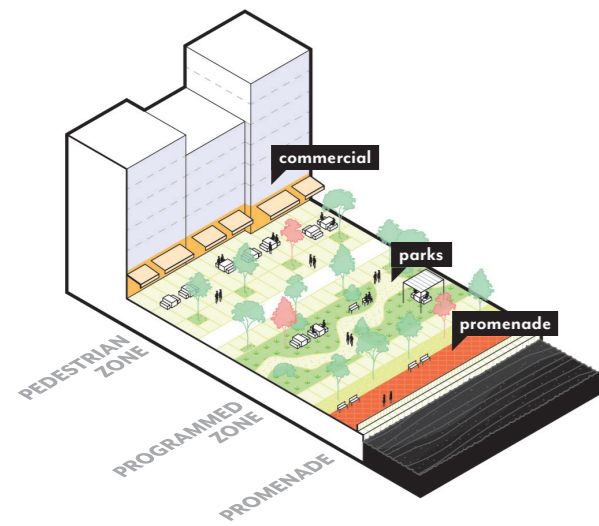


FIG. 72. First exemplary program for the waterfront.

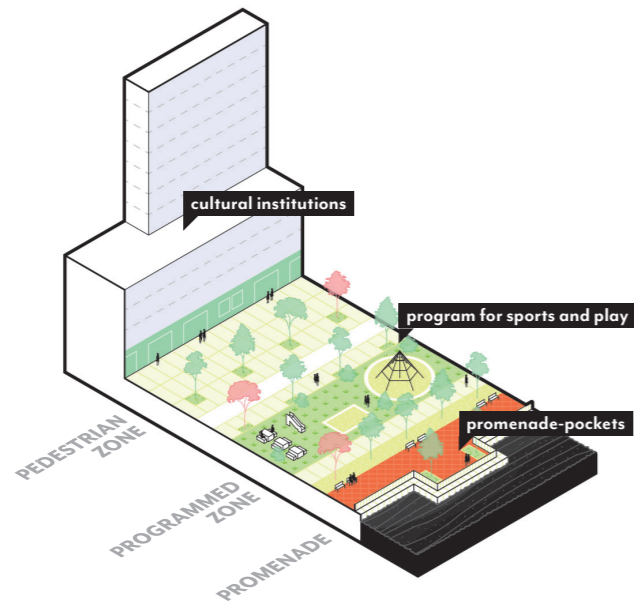


FIG. 73. Second exemplary program for the waterfront.

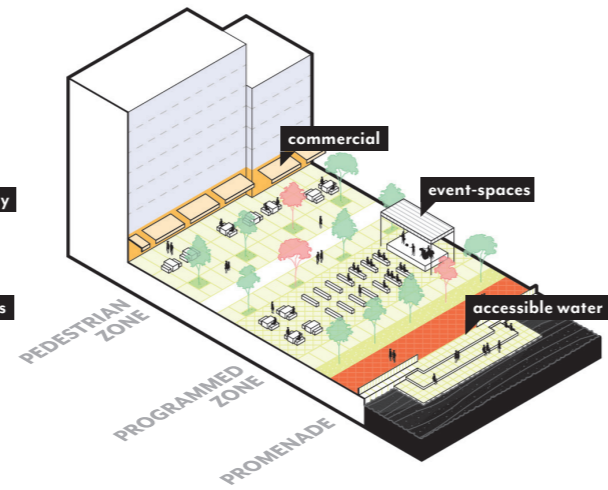


FIG. 74. Third exemplary program for the waterfront.

PROMENADE

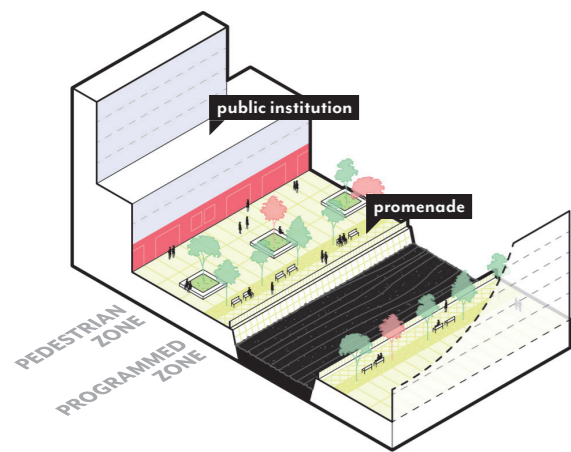


FIG. 75. First exemplary program for the canal.

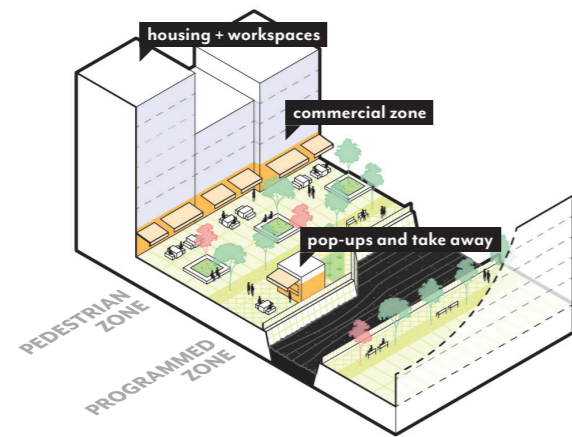


FIG. 76. Second exemplary program for the canal.

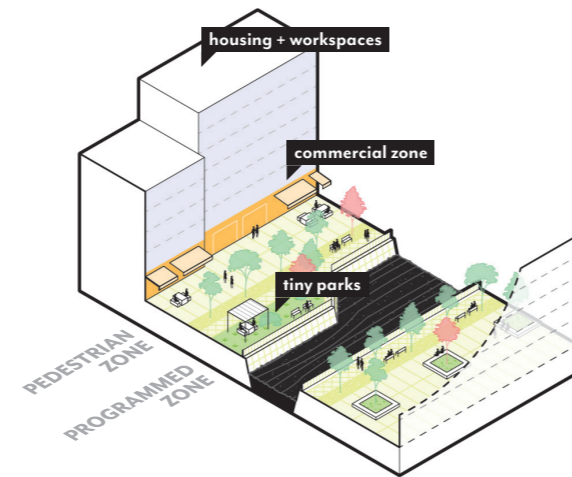


FIG. 77. Third exemplary program for the canal.

CANAL

**THE SEASIDE PROMENADE:** Developing the port offers the opportunity to react to the lack of public accessibility and usability of the sea in Beirut. The proposed spaces along the waterfront are based on Beirut's Corniche but in contrast to its road dominated design and the lack of variety in pedestrian spaces, the proposal suggests a zoning system with pedestrian focus. Car access is restricted for private traffic which reduces the necessary street dimensions and leaves more accessible pedestrian space.

The buildings' edges form a pedestrian zone that is served by the commercial and public ground floors. The second zone contains additional program such as parks, playgrounds, sports facilities, event spaces or commercial spaces. The last zone is the promenade which is complemented by occasional pockets and stairs that make the water directly accessible for visitors (Fig. 72-74).

The program of the spaces and buildings along the waterfront is aiming to attract citizens from all over Beirut and create a space to linger by offering many restaurants and public facilities or cultural institutions. The zoning system of the open space enables a variety in usability of the seafront which sets it apart from the existing promenade in Beirut.

**THE CANAL:** Introducing a canal as waterbody to the public space doesn't only add to the visual appeal but benefits the microclimate through evaporative cooling. The public axis connecting the city center in the east to western area of the proposal is especially threatened by overheating since it is not only exposed to solar radiation at noon but also captures the low sun in the early and late hours of the day which makes a large water surface desirable.

Additionally, generously spread trees add to the evaporative cooling of the water bodies as well as offering protection from the sun and shading of the paved ground which is at high risk to heat up during the day.

The program of the buildings is a mix of commercial spaces on the ground level with housing or workspaces on the upper floors. Some plots are reserved for public functions and local amenities for the residents, such as educational, cultural or communal facilities.

The central spine is characterized by shops and small scale food providers such as cafes, pop up restaurants and take away restaurants to create a space of movement that contrasts with the waterfront that aims to be a space to linger (Fig. 75-77).





FIG. 78: Detail plan of the seaside promenade (scale 1:2500).



FIG. 79: Visualization of the seaside promenade.



## NEIGHBORHOOD AND HOUSING

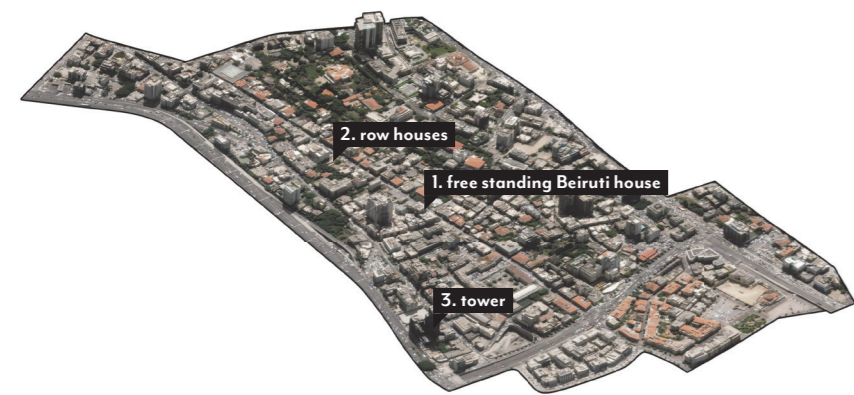


FIG. 80: General overview of the variety in scales and building types around the Rue Gouraud.

**DEFINING THE URBAN STRUCTURE:** The neighborhoods around the Rue Gouraud in the south of the port are characterized by a rich mix of building types and scales as a result of the areas consistent growth during the 20th century. This creates a diverse environment with characteristics from the late Ottoman period, the French Mandate as well as the modern styles of a globalized city. Although the contrasts are extreme in some places, most of the area is pedestrian friendly with small to medium sized buildings,

humane street dimensions and occasional vegetation. The identified qualities of this area have been used to develop the character of the proposal for the port district. The proposed building types are rooted in three simplified forms that have been found in the study area: the tower, the row houses and the free standing Beirut central hall house (Fig. 81). These types have been translated into the typologies for the port district (Fig. 82) and rearranged in block structures with central green spaces (Fig. 83).

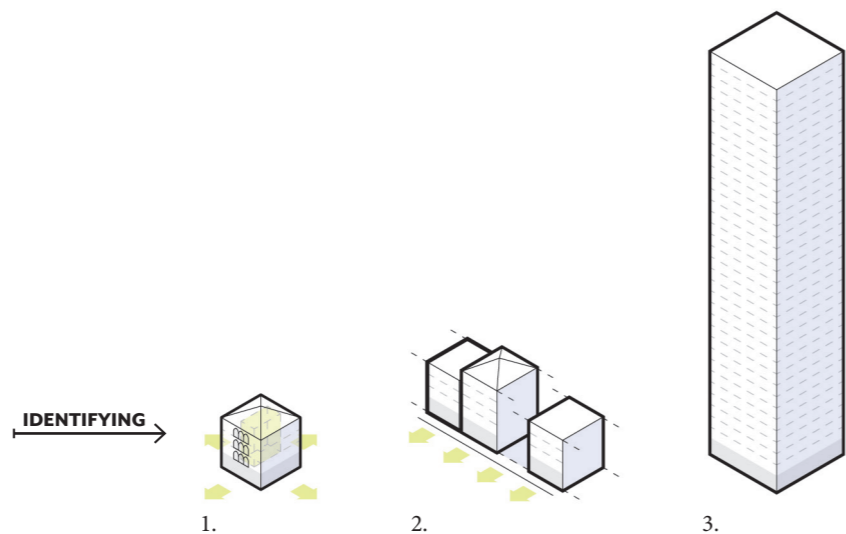


FIG. 81: Identified building types around the Rue Gouraud:

1. Variations of the typical Beirut central hall house with up to four free standing facades.
2. Houses in partly incomplete rows with free standing facades facing the street and the backsides.
3. Skyscrapers and towers as parts of rows or free standing.

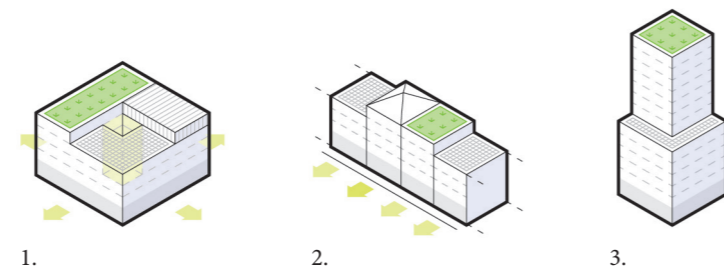


FIG. 82: Proposed building types of the new port district:

1. Free standing courtyard houses with several housing units, based on the central hall house.
2. Rows of houses with free standing facades to the street and the backside.
3. Medium sized towers as parts of rows or free standing.

TRANSLATING

REARRANGING

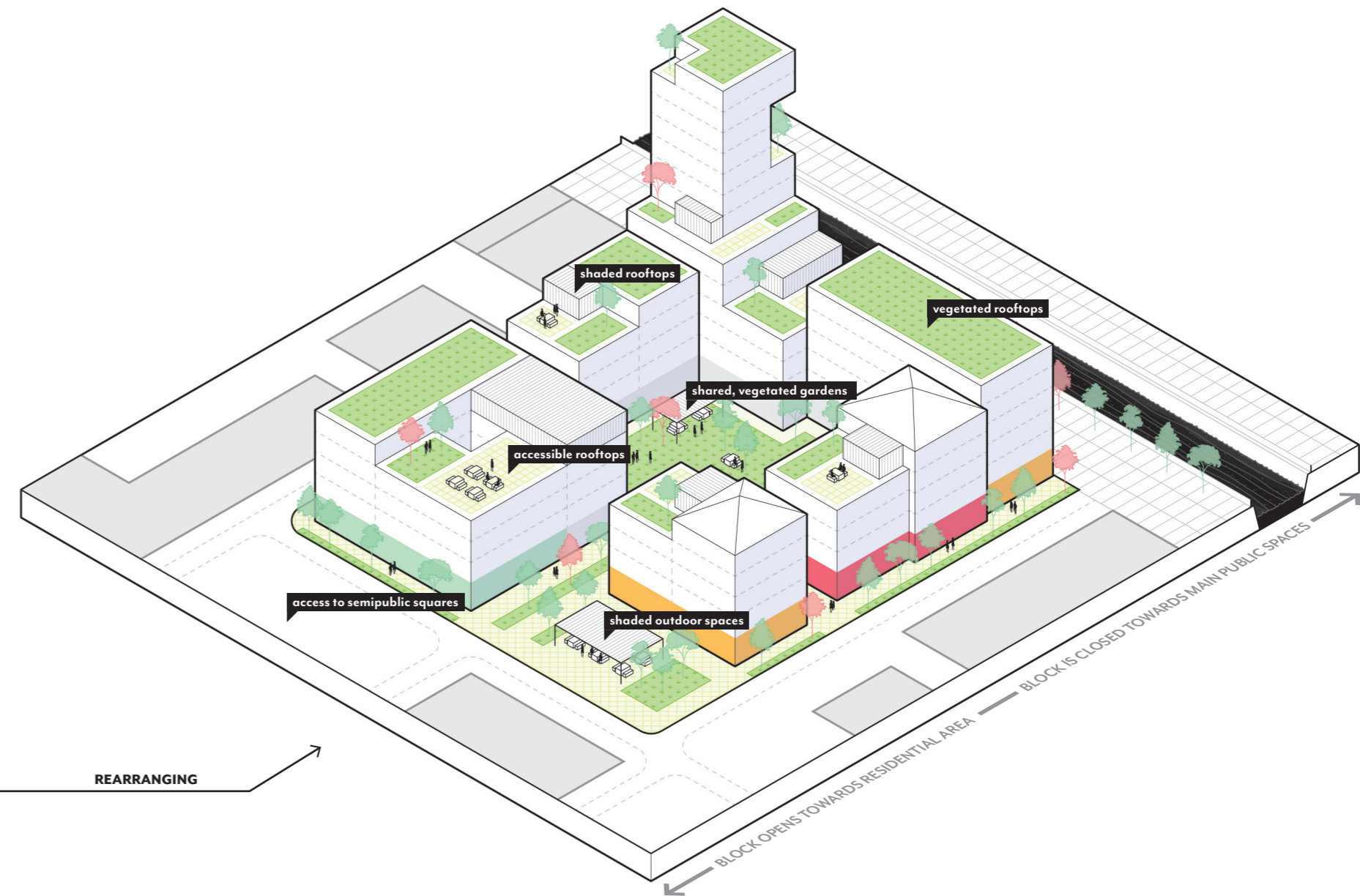


FIG. 83: Proposed residential block.





FIG. 84: Detail plan of a mixed-use residential area (scale 1:2500).

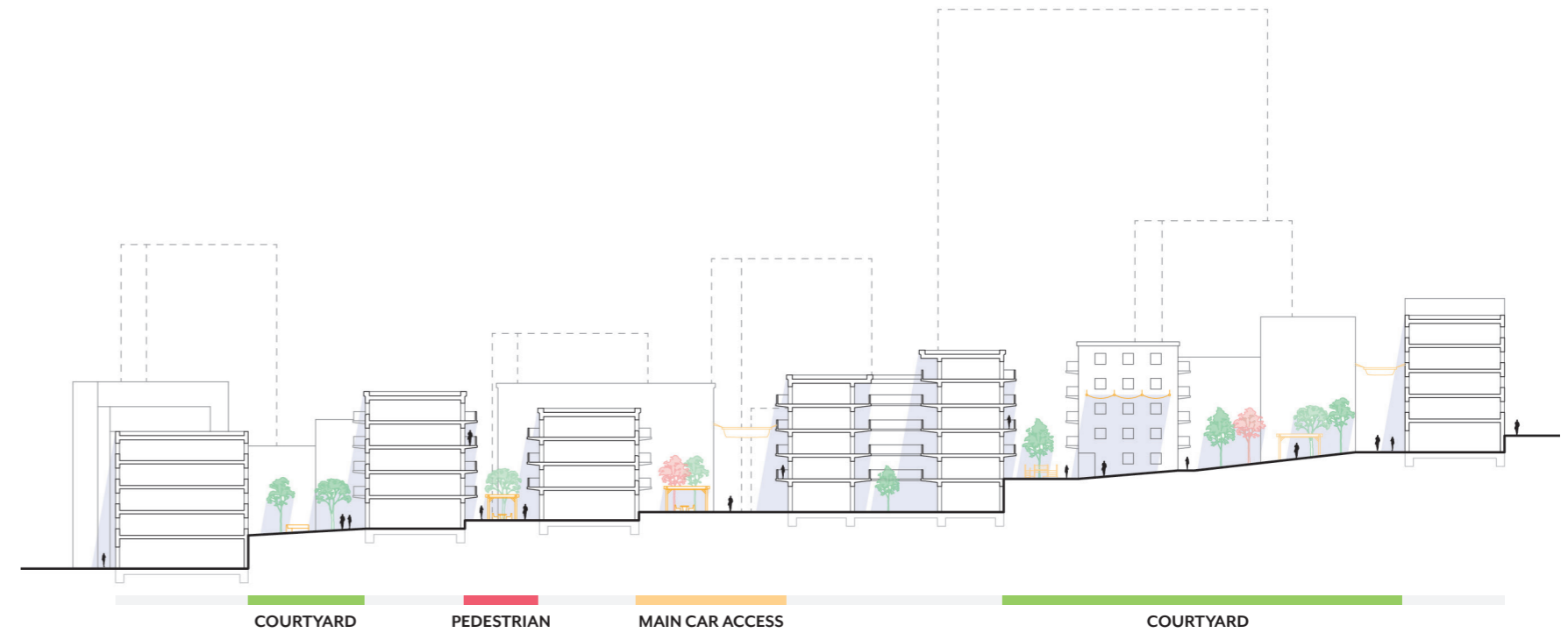


FIG. 85: Section A-A of a residential neighborhood (north-south, scale 1:1000).

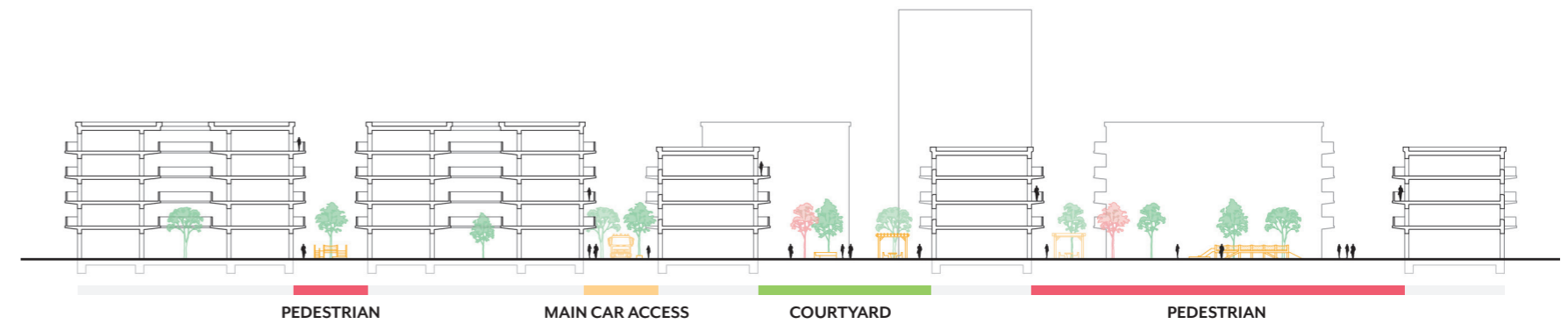


FIG. 86: Section B-B of a residential neighborhood (east-west, scale 1:1000).



**WALKABILITY:** In the residential areas car access is restricted to a few connecting roads and underground parking facilities. This reduces traffic and enables quality outdoor spaces for the residents. The blocks form a closed edge towards the busy public spaces of the port but open towards the neighborhoods to create a network of private and semipublic spaces with playgrounds or meeting points. A high amount of greenery maintains a pleasant outdoor climate over the year and temporary street shading offer additional cooling in the hottest months.

**MIXED USE:** The ground levels of the buildings host a mix of housing, community functions and -spaces as well as small neighborhood cafes, restaurants and local amenities. The upper levels are mainly used for housing with commercial- and workspaces along the main public spaces.



FIG. 87: Visualization of a street with restricted car access and shared spaces for the residents in an early afternoon at the end of March.

**SHARED SPACES:** The arrangement of the buildings creates shaded in-between spaces that are protected from the sun even in the hot summer. These shared spaces offer attractive street furniture and playgrounds to encourage the residents to spend more time outside.

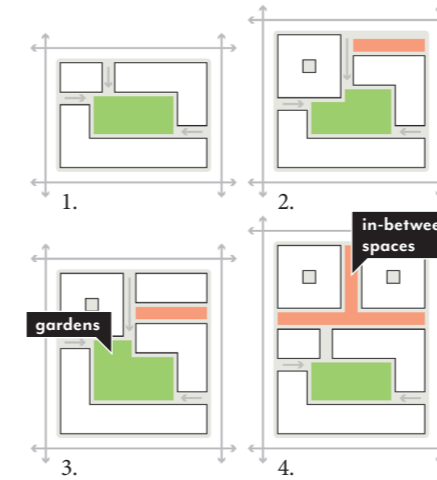


FIG. 88: Four building arrangements on varying plot sizes, generating shared outdoor spaces.

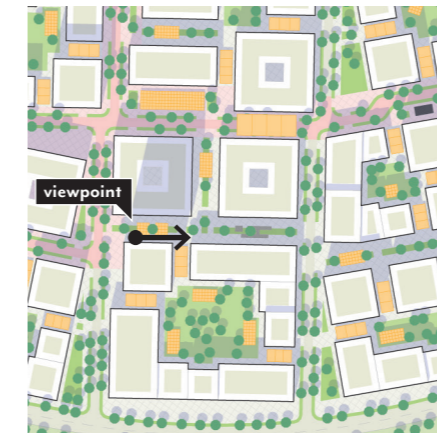


FIG. 89: Visualization of a pedestrian street with a small playground at noon in mid-July.



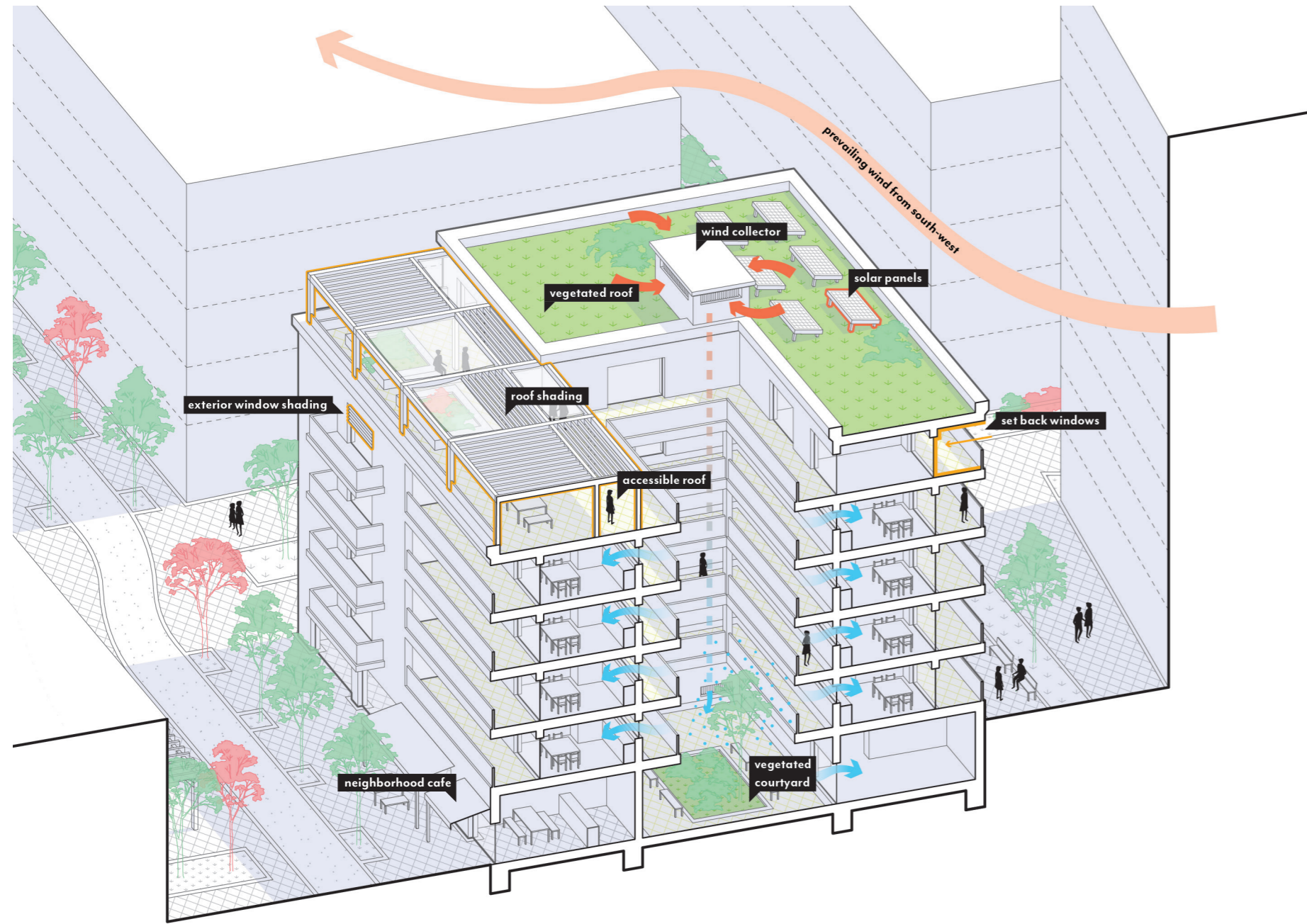


FIG. 90: Exemplary section of a residential building with climatic adaptations, rooted in the traditional Beirut architecture.

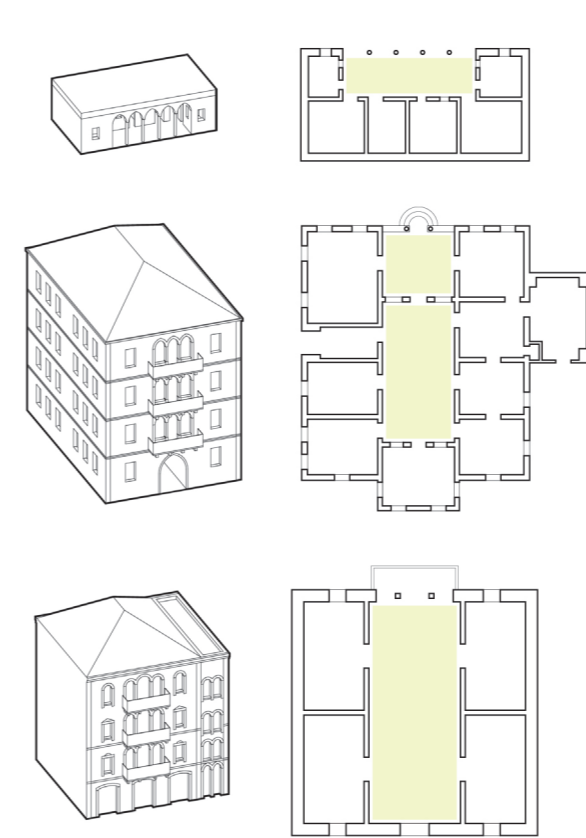


FIG. 91: Schematic variations of traditional Lebanese and Beirut houses with a central hall.

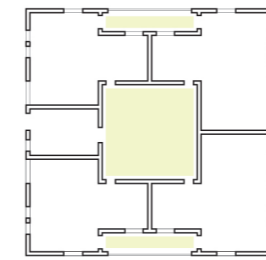


FIG. 92: Schematic floorplan of the proposed courtyard typology.

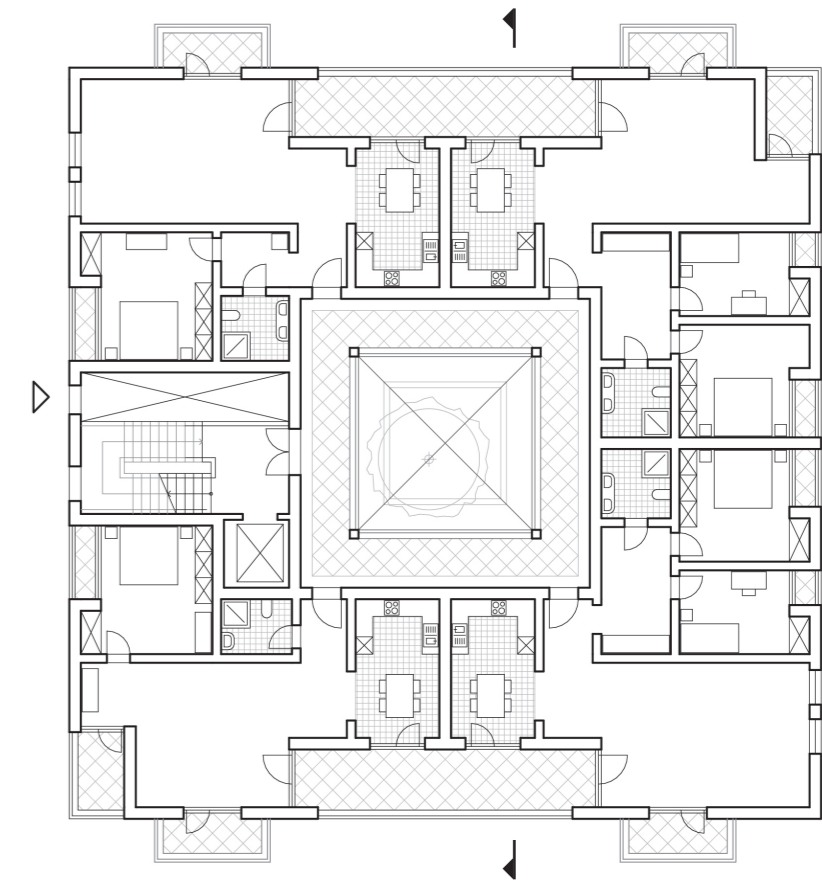


FIG. 93: Exemplary floorplan for a residential building with climatic adaptations, rooted in the traditional Beirut architecture.

**THE COURTYARD HOUSE:** As a reaction to fainting architectural heritage and to counteract heat stress, the proposal suggests a courtyard house typology that translates the central hall of traditional Lebanese houses into a shared courtyard as a social space and cool air storage for the hot days. The building combines up to four housing units in the floorplan to reduce exterior wall surfaces that are exposed to solar radiation. Windows are pushed in, shaded by extensive balconies of the floors above or can be covered with

exterior sun protectors, which prevents solar radiation from entering the building. Wind collectors catch and cool down air that is then used to ventilate the building after the stored cold night air of the courtyard has been used up. Vegetation or water elements in the courtyard offer additional cooling through evaporation and enhance its visual quality. The accessible roof as an additional social space is partly vegetated and partly shaded, to prevent the building from heating up in the sun.



**IV** APPENDIX



## **REFLECTION:**

**PROCESS SUMMARY:** During the process of the thesis, the response to the starting aim became more clear. The lack of public spaces and the heat accumulation in the summer can both be seen as a consequence of Beirut's rapid growth in the 20th century, that resulted in the high density of the city today. Additionally, the ongoing loss of an accessible and usable waterfront is a threat to the urban quality. As a response to these three issues, the proposal focuses mainly on mitigating heat accumulation and creating a comfortable and healthy microclimate, emphasizes the necessity of accessible and usable public space, and strengthens the connectivity of the city to the sea. With these main objectives the masterplan has been developed. Mid-process, it became also clear that the ongoing urban development of the port has a purely economical interest, and considering its attractive location next to the city center, will most likely follow the development of the CBD

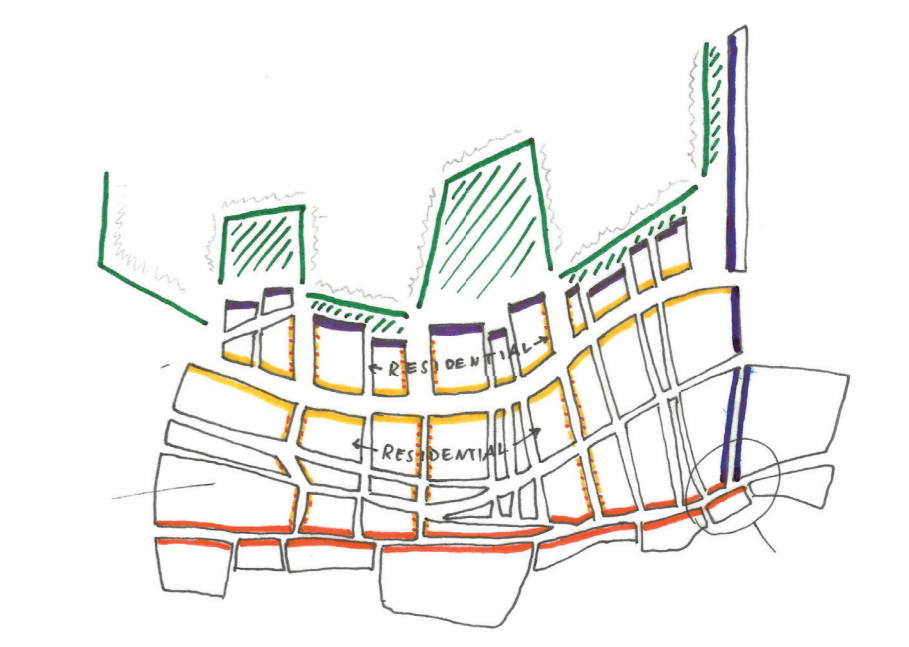
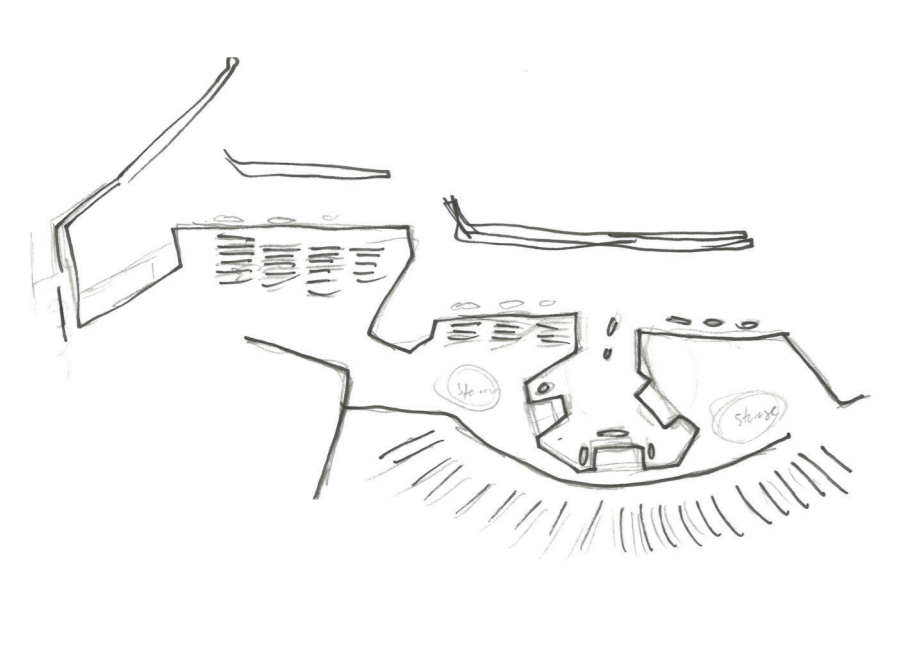
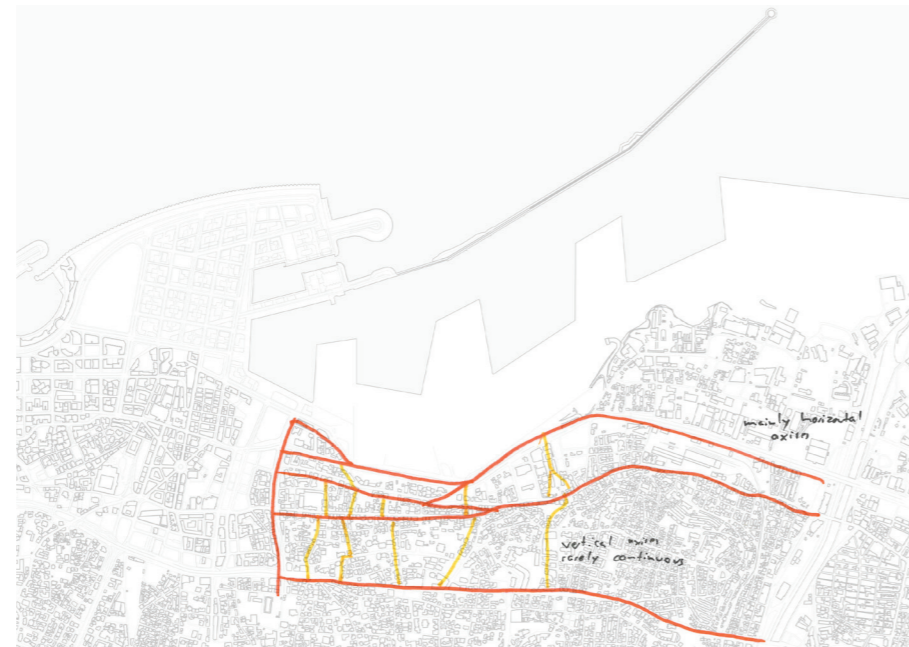
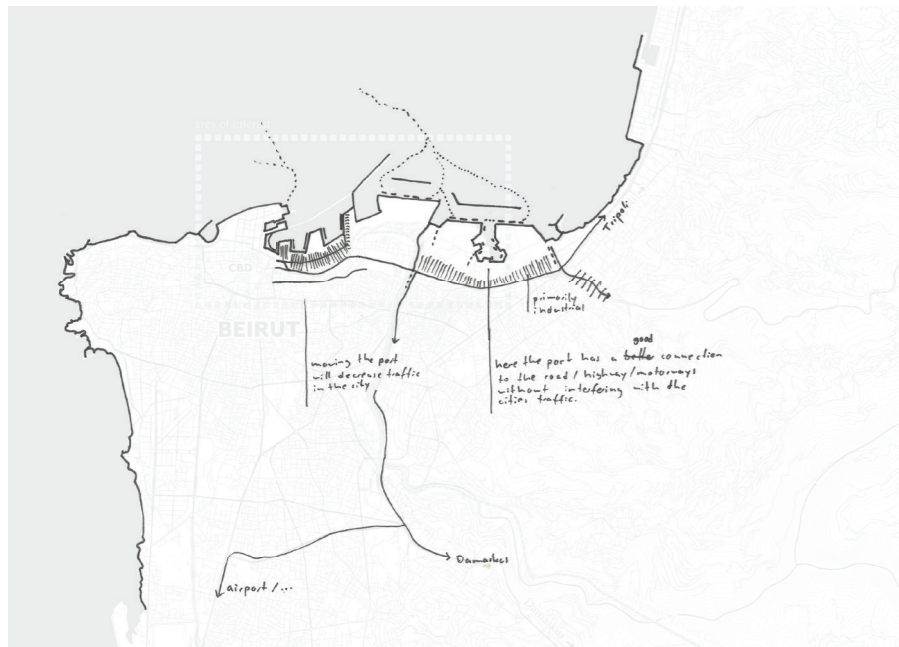
and Waterfront district as an insular, luxurious district for the wealthy elite of the city. With this disillusioning realization and the ambition to still create a proposal for the port that contributes to a healthy future environment for the citizens of Beirut, the design process aimed to offer a realistic masterplan that combines developers and the public's interests. The proposal presents a high density while using open spaces efficiently through reducing car access, creating attractive streets through vegetation, pocket parks, neighborhood centers and pedestrian connections. It offers plots for high rise and commercial buildings, and makes the plots along the waterfront attractive for developers, while at the same time creating a healthy microclimate and maintaining primarily low scales for a human centered experience.

With this approach I am hoping to have a positive impact on the ongoing discussion about the development of the port.

**REFLECTION:** In this thesis I was lucky to find much relevant information from international and local sources, so I gained a broad understanding for the city's recent history and current situation in terms of the urban environment. But most of the sources had a very critical view on today's Beirut, focusing on the damage of its recent history and on the future recovery. Only few sources demonstrated how the people are dealing with their losses and how the life in Beirut looks like today. Looking at my thesis now, I can clearly see how this filtered information has influenced the proposal. The masterplan presents a future focused strategy of how the city can develop a healthy port district. And although I focused strongly on a public's in-

terest, the proposal doesn't respond to what the citizens of Beirut specifically need. It addresses general topics related to healthy urban development, but lacks a response to how the development can contribute to the city's recovery. Instead of a final masterplan, it could have presented a gradually evolving strategy that accompanies the city's recovery already from today. For this, a more in-depth research about the citizens' perspectives, opinions, needs and wishes would have been helpful. So I am concluding this thesis with the realization that the developed proposal is not a solution, but can be a starting point for a discussion about an evolving port development in dialogue and cooperation with the citizens of Beirut.





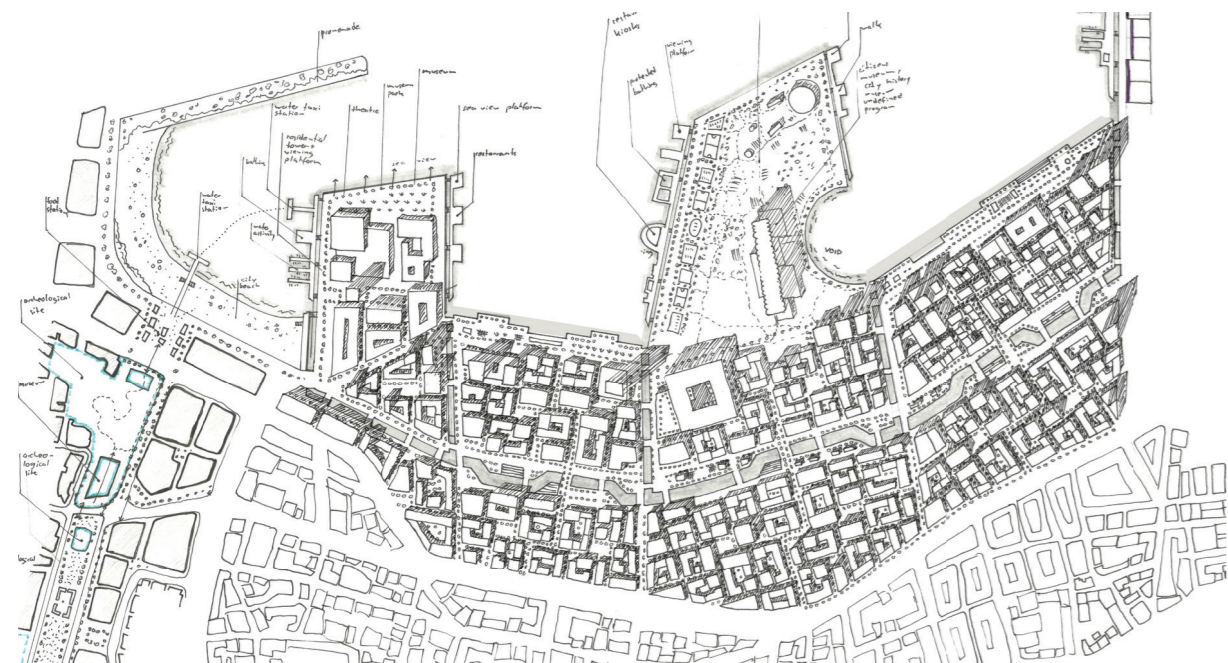
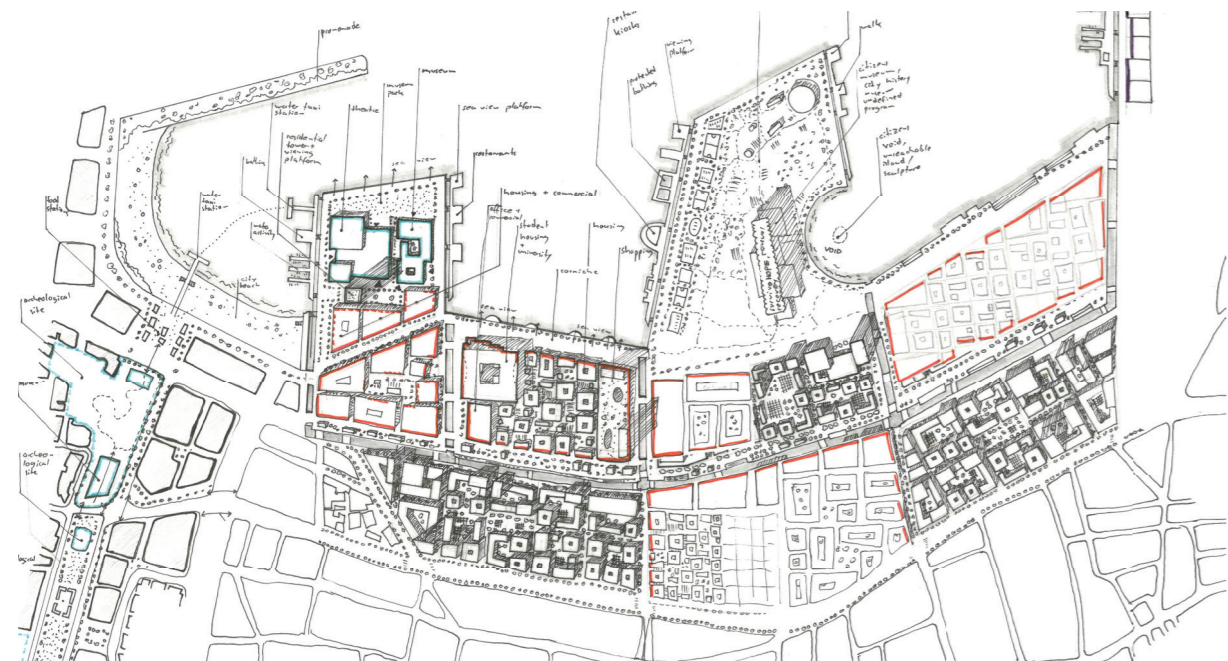
Relocation of the industrial port.

Main street pattern (top image) and extension on the port.

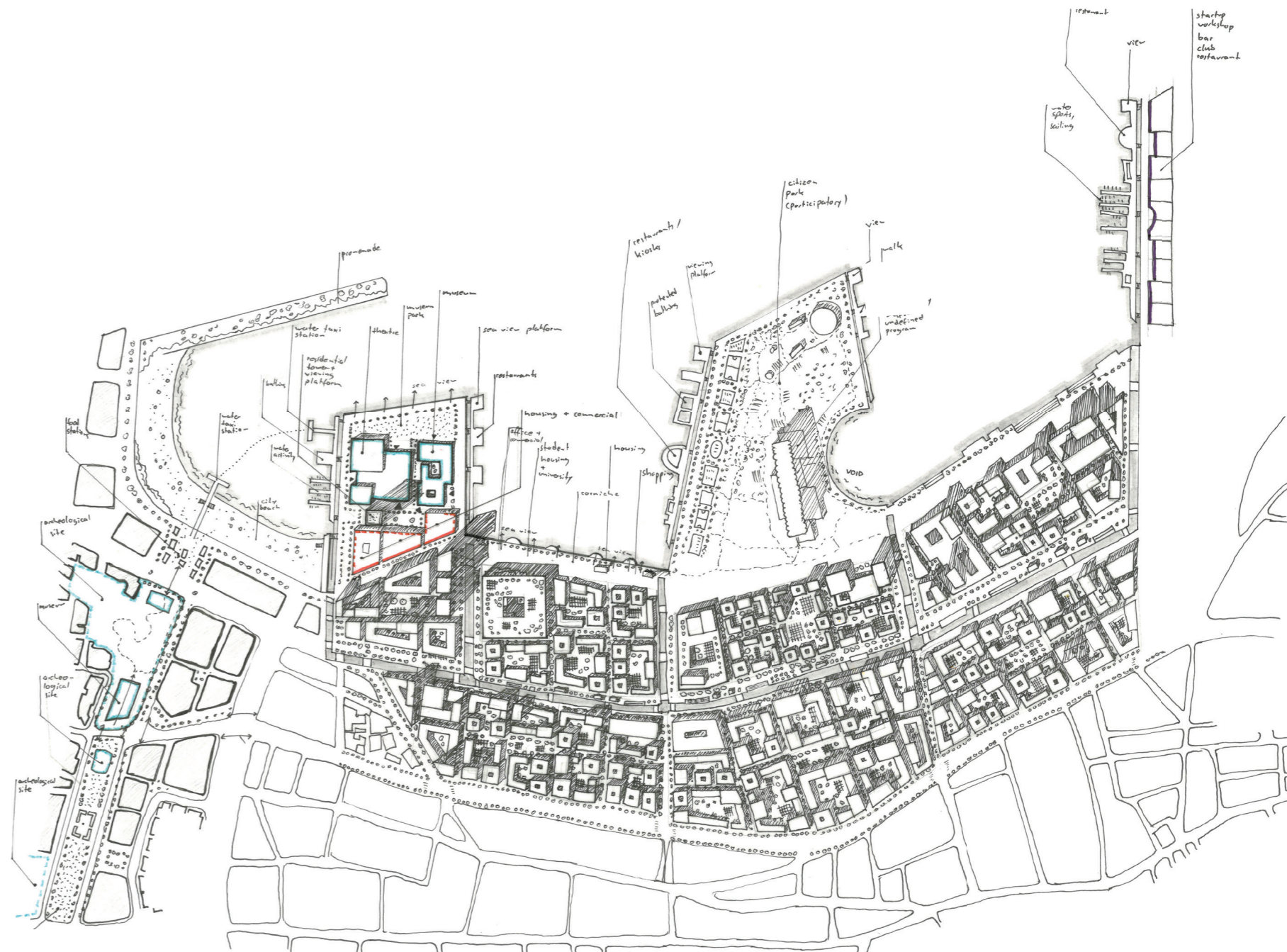
Masterplan structure drafts.

Grid study (top image) and program distribution.





Masterplan drafts.



Masterplan draft.



genzyme  
neighborhood  
with narrow  
streets and  
high contrasts  
in shape and heights

mix of  
housing  
and  
offices

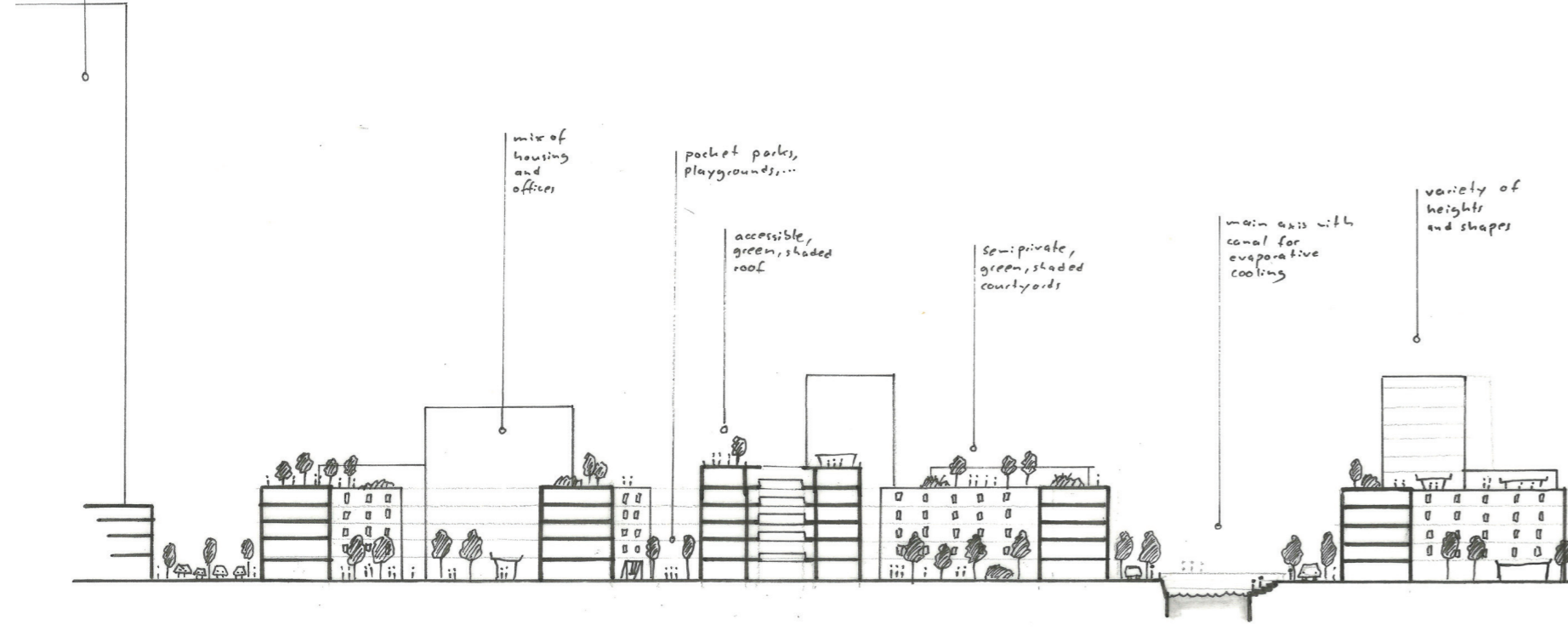
pocket parks,  
playgrounds,...

accessible,  
green, shaded  
roof

semi-private,  
green, shaded  
courtyards

main axis with  
canal for  
evaporative  
cooling

variety of  
heights  
and shapes

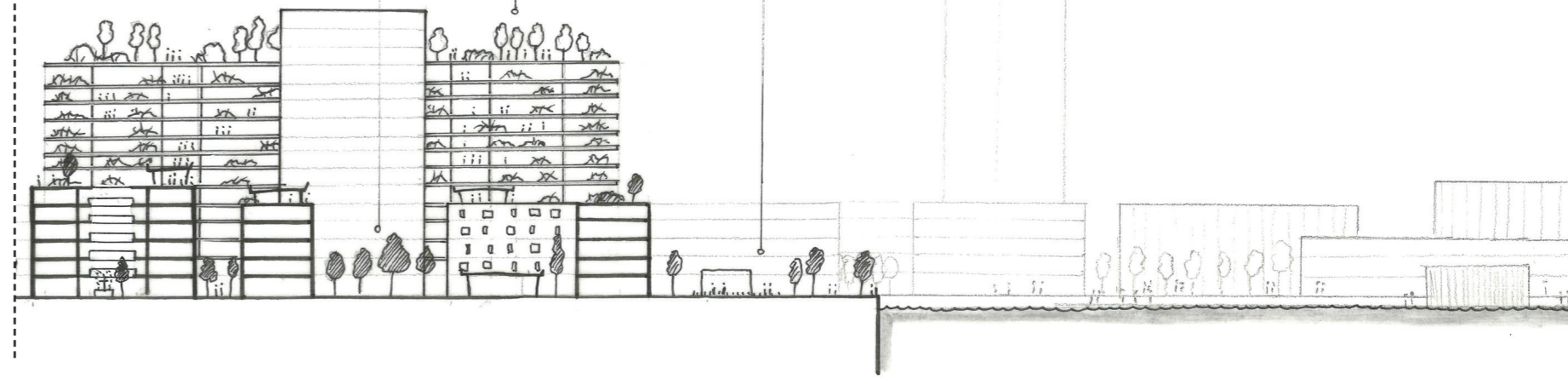


Draft section from the city to the water.

housing  
along  
waterfront

large parcels for  
projects with  
city-wide  
impact +  
iconic  
waterfront

promenade +  
public space  
along waterfront









## IMAGES

Cover page: Visualization of the design proposal, by the author

**Fig. 01: Aerial view on the port after the explosion:** Collage made by the author based on Bing Maps and Google earth imagery.

**Fig. 02: View on the port of Beirut at a state after the blast in August 2020:** Provided to the author by Inspireli Awards on: <https://www.inspireli.com/en/awards/beirut-documents> [Accessed 26 January 2022].

**Fig. 03: Impact of the Beirut Blast:** Beirut Recovery Map - Rice University. n.d. Beirut Recovery Map - Rice University. [online] Available at: <https://beirutrecovery.org/> [Accessed 26 January 2022].

**Fig. 04: Suggestion for the spatial development of the port: Option 1:** Haid, S. and Seyger, R., 2021. Joining forces for a new Beirut port area A strategic study, pp. 73-77. [ebook] Roland Berger. Available at: <https://www.rolandberger.com/en/Insights/Publications/Joining-forces-for-a-new-Beirut-port-area-A-strategic-study.html> [Accessed 26 January 2022].

**Fig. 05: Suggestion for the spatial development of the port: Option 2:** see Fig. 04.

**Fig. 06: Suggestion for the spatial development of the port: Option 3:** see Fig. 04

**Fig. 07: Map of the eastern Mediterranean sea:** Drawn by the author, based on: aid, S. and Seyger, R., 2021. Joining forces for a new Beirut port area A strategic study, p. 20. [ebook] Roland Berger. Available at: <https://www.rolandberger.com/en/Insights/Publications/Joining-forces-for-a-new-Beirut-port-area-A-strategic-study.html> [Accessed 26 January 2022].

**Fig. 08: Map of Beirut, its context and the port:** Drawn by the author, based on publicly accessible GIS data.

**Fig. 09: Zoom on the port and its context:** Drawn by the author, based on publicly accessible GIS data.

**Fig. 10: Main land use in municipal Beirut:** Drawn by the author, based on Google maps entries..

**Fig. 11: Public attractors in municipal Beirut:** Drawn by the author, based on publicly accessible GIS data.

**Fig. 12: Sprawl of the city over time:** Drawn by the author, based on: Ruppert, H. (1969) Beirut: Eine Westlich Geprägte Stadt des Orients. Gesellschaft: In Kommission bei Palm & Enke.

**Fig. 13: Overlay of different time periods:** Drawn by the author, based on: Toffel, L. and Vimercati, A., 2009. The French Mandate. Basel: ETH Studio Basel Contemporary City Institute.

**Fig. 14: Timeline from the late Ottoman period until today showing the main events that led to Beirut's modern landscape:** based on: UN Habitat Lebanon, 2021. Beirut City Profile 2021. [pdf] Beirut: UN Habitat Lebanon. Available at: <https://unhabitat.org/sites/default/files/2021/07/2021.07.19.pdf> [Accessed 12 February 2022]. and Ruppert, H. (1969) Beirut: Eine Westlich Geprägte Stadt des Orients. Gesellschaft: In Kommission bei Palm & Enke.

**Fig. 15: World map of Köppen-Geiger Climate Classification:** Modified by the author and based on: Koeppen-geiger.vu-wien.ac.at. 2022. World Maps of Köppen-Geiger climate classification. [online] Available at: <http://koeppen-geiger.vu-wien.ac.at/shifts.htm> [Accessed 15 February 2022].

**Fig. 16: Beirut zoning Regulation:** Mohsen, H., Raslan, R. and El-Bastawissi, L., 2020. The Impact of Changes in Beirut Urban Patterns on the Microclimate: A Review of Urban Policy and Building Regulations. Architecture and Planning Journal (APJ), [online] 25(1), p. 6. Available at: <https://digitalcommons.bau.edu.lb/api/vol25/iss1/2> [Accessed 14 February 2022].

**Fig. 17: Canyon average air temperature simulations across Beirut city on February 1st at 1200UTC:** Kaloustian, N., Bitar, H. and Diab, Y., 2016. Urban Heat Island and Urban Planning in Beirut. Procedia Engineering, 169, p. 75.

**Fig. 18: Canyon average air temperature simulations across Beirut city on July 1st at 1200UTC:** Kaloustian, N., Bitar, H. and Diab, Y., 2016. Urban Heat Island and Urban Planning in Beirut. Procedia Engineering, 169, p. 75.

**Fig. 19: Strategies to counteract overheating of urban spaces and buildings:** Drawn by the author

**Fig. 20: Publicly Owned Parcels and Open Sites Used by the Public in Municipal Beirut:** Beirut Urban Lab, 2020. Publicly Owned Parcels and Open Sites Used by the Public in Municipal Beirut. [image] Available at: <https://beiruturbanlab.com/en/Details/619> [Accessed 13 February 2022].

**Fig. 21: Activities at the waterfront near the port, 1900s:** Unknown, 2014. Beirut Port [1900s]. [image] Available at: <https://oldbeirut.com> [Accessed 3 February 2022].

**Fig. 22: Water activities at St. George's Bay, 1960s:** Unknown, 2012. Hotel St. George [1965] | Copyright Charles W. Cushman. [image] Available at: <https://oldbeirut.com> [Accessed 3 February 2022].

**Fig. 23: Water activities at the St. George's Hotel, 1960s:** Unknown, 2014. Ain El Mreysseh [1960s]. [image] Available at: <https://oldbeirut.com> [Accessed 3 February 2022].

**Fig. 24: Activities at the Waterfront along the Corniche, 2022:** own photo

**Fig. 25: Corniche 1890s:** Unknown, 2012. Ein El Mreisseh [1890]. [image] Available at: <https://oldbeirut.com> [Accessed 3 February 2022].

**Fig. 26: Corniche 1890s:** Unknown, 2012. Ain El Mreysseh [1896]. [image] Available at: <https://oldbeirut.com> [Accessed 3 February 2022].

**Fig. 27: Corniche 1920s:** Unknown, 2014. Beirut Seafront [1920s]. [image] Available at: <https://oldbeirut.com> [Accessed 3 February 2022].

**Fig. 28: Corniche 1970s:** Unknown, 2012. Beirut Corniche [1970s]. [image] Available at: <https://oldbeirut.com> [Accessed 3 February 2022].

**Fig. 29: Corniche 2017:** rabihsaade, 2017. Beirut seafront beirut corniche seafront sea lebanonshots ... (Beirut, Lebanon). [image] Available at: <https://www.lebanoninapicture.com/pictures/beirut-seafront-beirut-corniche-seafront-sea-lebanonsho> [Accessed 5 February 2022].

**Fig. 30: Corniche 2022:** own photo.

**Fig. 31: Schematic section of the corniche near the Ain el Mreisseh Mosque:** Drawn by the author, based on dimensions measured in Google Earth Pro.

**Fig. 32: Interactions with the water along the Corniche:** own photo

**Fig. 33: Isometric view on the Rue Gouraud and its neighborhoods:** Drawn by the author, based on a 3d model provided by the municipality.

**Fig. 34: Building periods of the neighborhoods:** Drawn by the author, based on data from: Beirut Recovery Map - Rice University. n.d. Beirut Recovery Map - Rice University. [online] Available at: <https://beirutrecovery.org/> [Accessed 26 January 2022].

**Fig. 35: Schematic section of the Rue Gouraud:** Drawn by the author, based on dimensions measured in Google Earth Pro.

**Fig. 36: Rue Gouraud in the 1920s:** Unknown, 2018. Gouraud Street [1920s]. [image] Available at: <https://oldbeirut.com> [Accessed 3 February 2022].

**Fig. 37: Rue Gouraud around 2017:** digitalyeti, 2017. Friday Dreaming wishiwasthere bigbluesky gemmayze scene citylife ... [2017]. [image] Available at: <https://www.lebanoninapicture.com/pictures/friday-dreaming-wishiwasthere-bigbluesky-gemmayze-scene> [Accessed 3 February 2022].

**Fig. 38: One of many restaurants along the Rue Gouraud:** own photo.

**Fig. 39: Dense vegetation along the Rue Gouraud:** own photo.

**Fig. 40: Schematic model of a "commercial" late Ottoman Beirut house:** Drawn by the author

**Fig. 41: Schematic floorplan of a Lebanese Liwan house with three centered arches towards north:** Drawn by the author

**Fig. 42: Schematic model of a house during the French mandate showing European influences (1920-1930):** Drawn by the author

**Fig. 43: Isometric view on the Central Business District:** Drawn by the author, based on a 3d model provided by the municipality and the masterplan for the Waterfront district.

**Fig. 44: Redeveloped city center after the civil war:** Drawn by the author based on documents published by Solidere

**Fig. 45: Nejme square:** own photo.

**Fig. 46: Glass-skyscrapers of the CBD:** own photo.

**Fig. 47: Isometric view on the Waterfront district:** Drawn by the author, based on a 3d model provided by the municipality and the master-plan for the Waterfront district.

**Fig. 48: Publicly accessible areas including streets:** Drawn by the author based on publicly accessible GIS data.

**Fig. 49: Streets, thickness indicates hierarchy:** Drawn by the author based on publicly accessible GIS data.

**Fig. 50: Visualization from the development consultant Visionaire:** visionaire.eu, n.d. [online] Available at: <http://www.visionnaire.eu/beirut-new-waterfront-district> [Accessed 20 April 2022]

**Fig. 51: Comparison of street sections from the Rue Gouraud, Central Business District and Waterfront District:** Drawn by the author based on measurements from Google Earth Pro.

**Fig. 52: Conclusions from the analysis of the Rue Gouraud, CBD and Waterfront District:** Made by the author

**Fig. 53: Guidelines for the design of the port proposal:** Made by the author

**Fig. 54: Overview plan showing the relevant connections to the city and the relocated port:** Drawn by the author

**Fig. 55: Aerial view on the port before re-development:** Collage based on Bing Maps and Google Earth Pro imagery.

**Fig. 56: Schematic view on the site and its near surroundings:** Drawn by the author based on a 3D model provided by the municipality.

**Fig. 57: The main public connections that are shaping the proposal:** Drawn by the author.

**Fig. 58: Isometric overview of the proposal:** Drawn by the author.

**Fig. 59: Masterplan (scale 1:9000):** Drawn by the author.

**Fig. 60: Spatial organization of the proposal:** Drawn by the author.

**Fig. 61: Main land use:** Drawn by the author.

**Fig. 62: Public and protected open space:** Drawn by the author.

**Fig. 63: Residential mixed use and public/cultural functions along the waterfront:** Drawn by the author.

**Fig. 64: Shading:** Drawn by the author.

**Fig. 65: Green spaces:** Drawn by the author.

**Fig. 66: Section (north-south) showing the connection of the sea and the city:** Drawn by the author.

**Fig. 67: Section (north-south) showing the height development of the proposal:** Drawn by the author.

**Fig. 68: Spatial organization of the proposal:** Drawn by the author.

**Fig. 69: Overview of the main public spaces and connections to the city:** Drawn by the author.

**Fig. 70: Detail plan of the city beach and seaside promenade (scale 1:2500):** Drawn by the author.

**Fig. 71: Visualization of the new beach near the city center with view into the port:** Drawn by the author.

**Fig. 72: First exemplary program for the waterfront:** Drawn by the author.

**Fig. 73: Second exemplary program for the waterfront:** Drawn by the author.

**Fig. 74: Third exemplary program for the waterfront:** Drawn by the author.

**Fig. 75: First exemplary program for the canal:** Drawn by the author.

**Fig. 76: Second exemplary program for the canal:** Drawn by the author.

**Fig. 77: Third exemplary program for the canal:** Drawn by the author.

**Fig. 78: Detail plan of the seaside promenade (scale 1:2500):** Drawn by the author.

**Fig. 79: Visualization of the seaside promenade:** Drawn by the author.

**Fig. 80: General overview of the variety in scales and building types around the Rue Gouraud:** Collage based on Google Earth Pro imagery.

**Fig. 81: Identified building types around the Rue Gouraud:** Drawn by the author.

**Fig. 82 Proposed building types of the new port district:** Drawn by the author.

**Fig. 83: Proposed block structure:** Drawn by the author.

**Fig. 84: Detail plan of a mixed-use residential area (scale 1:2500):** Drawn by the author.

**Fig. 85: Section A-A of a residential neighborhood (north-south, scale 1:1000):** Drawn by the author.

**Fig. 86: Section B-B of a residential neighborhood (east-west, scale 1:1000):** Drawn by the author.

**Fig. 87: Visualization of a street with restricted car access and shared spaces for the residents in an early afternoon at the end of March:** Drawn by the author.

**Fig. 88: Four building arrangements on varying plot sizes, generating shared outdoor spaces:** Drawn by the author.

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**Fig. 92: Schematic floorplan of the proposed courtyard house:** Drawn by the author.

**Fig. 93: Exemplary floorplan for a residential building with climatic adaptations, rooted in the traditional Beirut architecture:** Drawn by the author.



## LITERATURE

**Aouad, D. and Kaloustian, N., 2021.** *Sustainable Beirut City Planning Post August 2020 Port of Beirut Blast: Case Study of Karantina in Medawar District.* Sustainability, [online] 13(11), p.6442. Available at: <<https://doi.org/10.3390/su13116442>> [Accessed 27 January 2022].

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