

# MASTERPLAN PROPOSAL FOR THE PORT-CITY OF BEIRUT

BEIRUT, LEBANON



**POLITENICO DI TORINO**  
Architecture and the Sustainable Design

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# ABSTRACT

In a post-explosion period this thesis investigates the port of Beirut and its surrounding area through an urban metabolic approach, reaching a resulting masterplan proposal for the rehabilitation and expansion of the port, taking into account the impact the port can have on the rest of the city and identifying various opportunities for innovation.



The definition and characteristics of a port city have changed along the years, but always marked an area, that at the very least, benefits from the economic activity around its port. This has created a relationship between city and port, one that reflects the state and condition of prosperity in the area, and could very well determine its fate.

The relationship between the port and the city of Beirut has passed through many milestones and events that continue to reshape both port and city, leading to major impacts on the entire country of Lebanon, as well as the neighbouring region.

The port of Beirut has first been mentioned in the 15th century, during the pharaohnic and phoenician era, when it had started to send and receive ships from cities across the mediterranean.

During the Roman era, the economic impact of the port lead to further urbanisation of the city, making it a hub for trade between the East and the West, a role that would be put in emphasis during the crusader wars, thanks to the port's location in the middle of the ancient world's map.

The port in its current state would be established in the late 19th century, and would see great success during the mid 1960's until 1975, a period that saw the demise of the neighbouring competing ports, mainly the one in Haifa, caused by the Israeli invasion of Palestine, leading to Beirut receiving most of the bulk in trading ships, being the largest port on the eastern coast of the mediterranean.

1975 would be an infamously historic date for the whole country, marking the beginning of the civil war that would last 15 years and would damage the whole economy of the country along with the activity of the port.

The rebuilding process would start in the early 1990's, and the port would benefit from the reconstruction of the Beirut central district due to its proximity, in a period that saw huge investments, under the management of a privately owned company "SOLIDERE", shaping the city of Beirut post-war.

In 2004 the private Beirut Container Terminal Consortium took over the container terminal operations and expanded the terminal quay to 1100 sqm and upgraded it to host 16 ship to shore gantry cranes, as well as extensive on shore container handling equipment. This had positive impact on the traffic that grew from 945 143 TEUs in 2008 to 1 229 081 TEUs in 2019.

The most recent event was the most impactful on the port-city relationship, on August 4th 2020, an explosion occurred in the port, killing 204 people and causing billions in damage. Though the damage was massive, the container terminal had received minimum damage and was operating again 10 days after the explosion.

The post-explosion period inevitably carries many heavy tasks that need to be achieved in order to re-establish broken links between city and port as well as it has the necessity to innovate in different sectors to create new links and channels of flows that are concerned in this port-city relationship.

Though there is the need to act quick and create a sustainable, efficient port and port management, so that no chance of hosting new ships is missed, there is also the need to reflect and seek out new opportunities to connect foreland and hinterland, doing so by recognizing the different flows that come in to play, from waste, goods, biota, people, energy and even freshwater, these flows channeling in and out of the city are inevitably in part, corely connected to the port and thus should be considered in future masterplans that would be envisioned for the port and its surrounding area.

According to C.Kennedy and fellow researchers, urban metabolism can be defined as “the sum total of the technical and socio-economic process that occur in cities, resulting in growth, production of energy and elimination of waste”, more importantly it allows us to analyse cities as living organisms, with a variety of flows that though are different, still are inevitably intertwined in the functioning of a city in a global sense.

Using this approach to analyse the city of Beirut gives us the possibility to represent different flows in a single scene in order to understand how and where they overlap, as well as identifying opportunities for future development and expansions.

The port is a major element that comes into play in the city's metabolism, mostly for the goods coming in and out of it but also its impact on the biota, energy and people both in the immediate surrounding of the port as well as the larger global context.



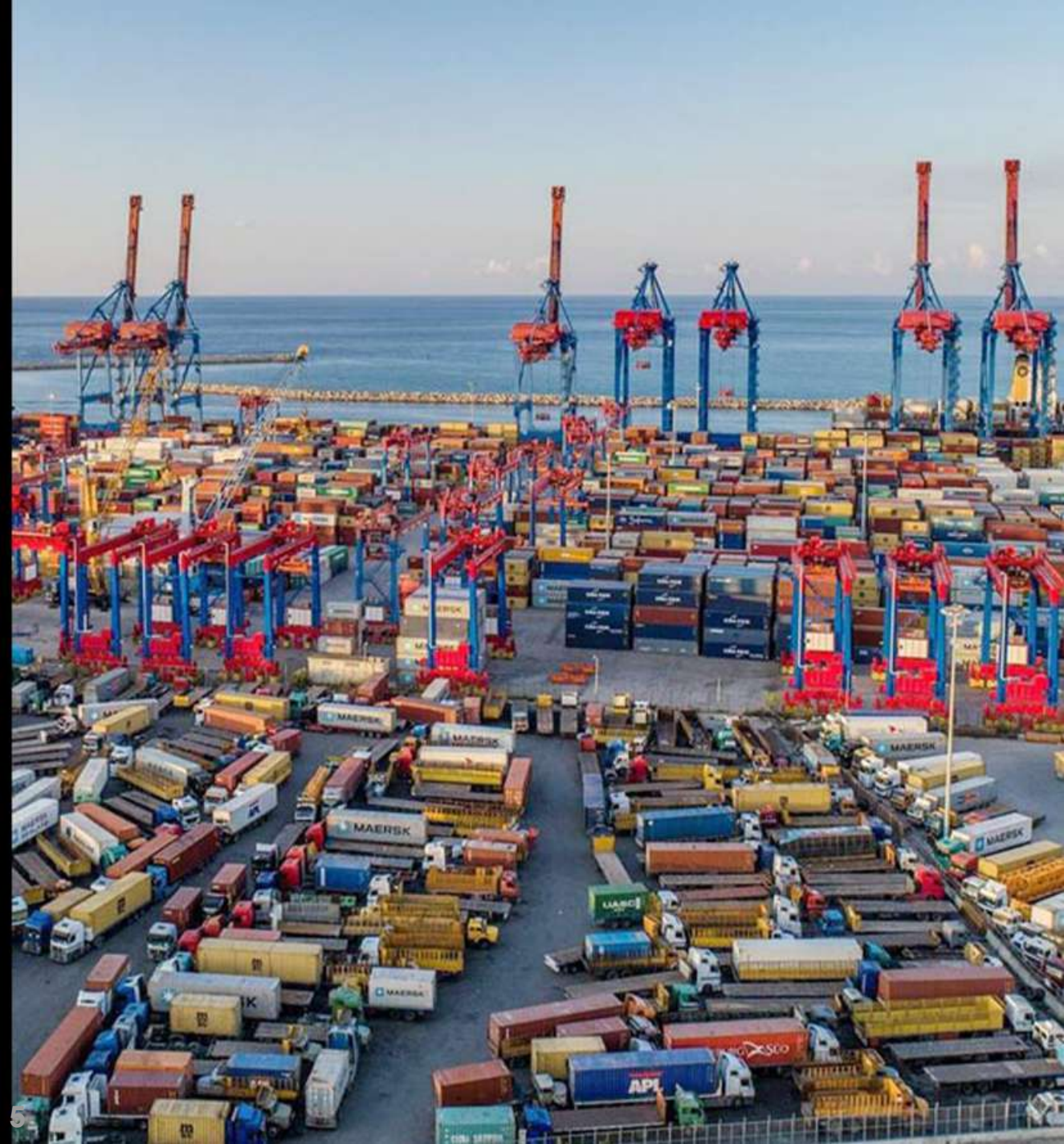
## GOODS:

The Port of Beirut accounts to 72% of the total imports and 78% of total exports of goods across the sea, with a container terminal of an annual throughput of approximately 1.23 million TEU, 7 million tons of goods, yearly. It also acts as a transshipment hub for MSC and CMA-CGM, the second and third largest container shipment companies in the world. Its location has also made it the main port of Syria, through the Beirut-Damascus road, linking it to cities further east.

Furthermore, being the only port with a container terminal in Lebanon, goods transportation from the port to the several destination hubs across the country has a huge impact on already overused coastal highways and the Beirut-Damascus highway, as well as on the eastern entrance of the capital towards the intersection of the highways.

Due to shipping trends leading to larger ships the port has had recent plans to extend its container terminal in order to keep up with the neighbouring competitiveness, but it planned to do so by filling the adjacent basin to the current container terminal to the west which would lead to further goods densification inside the city to be transported across the country.

Without denying the importance of good trades related to the port for the local economy and the need for its competitiveness, isn't there a way in upgrading the current container terminal and yet evade the traffic increase it would produce? And is there not an opportunity to solve the problem of transport trucks going across the country by using the sea as a way to move North-South? Not to exclude the opportunities it would create across the country's sea shore.

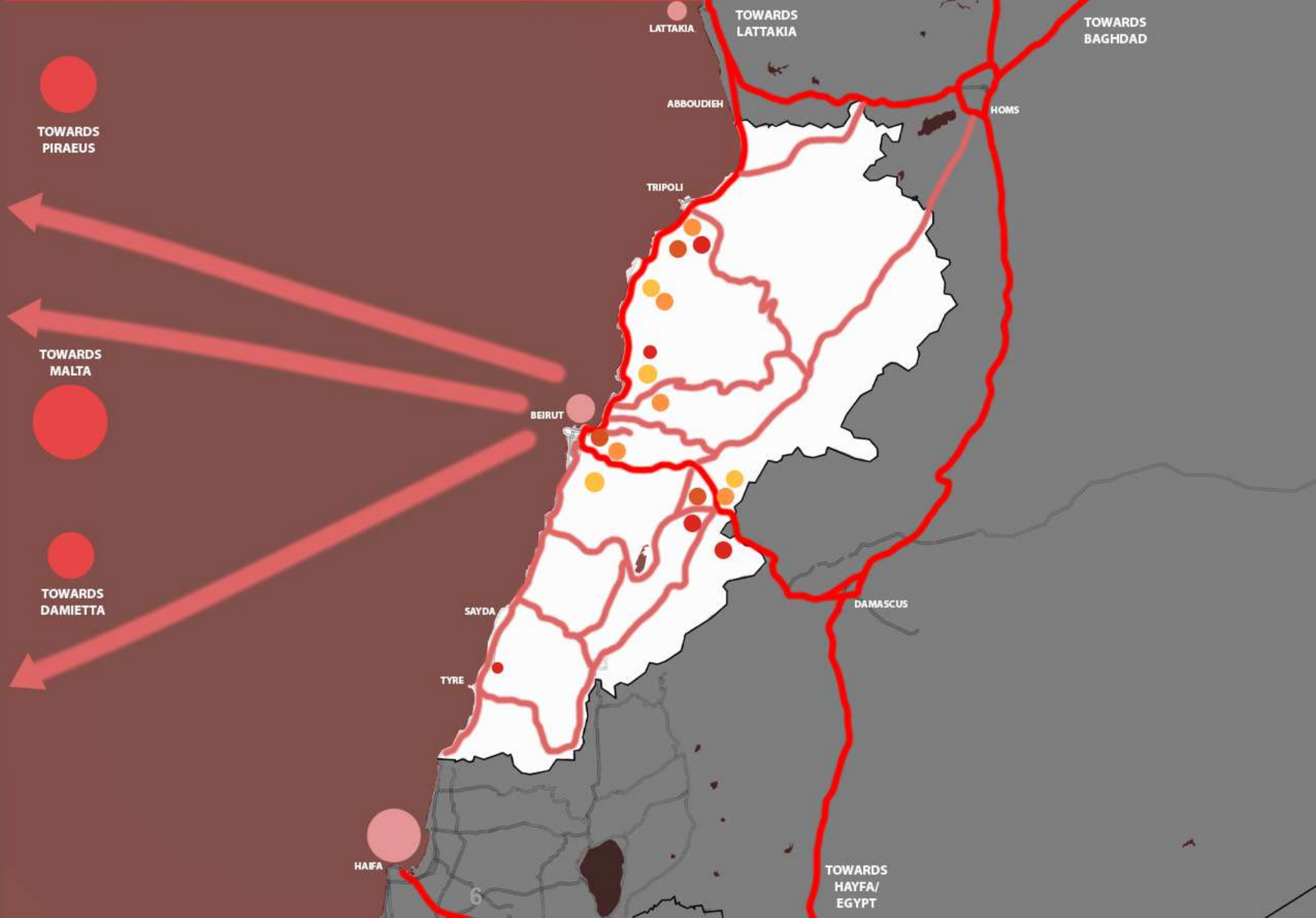




# GOODS:

## LEGEND:

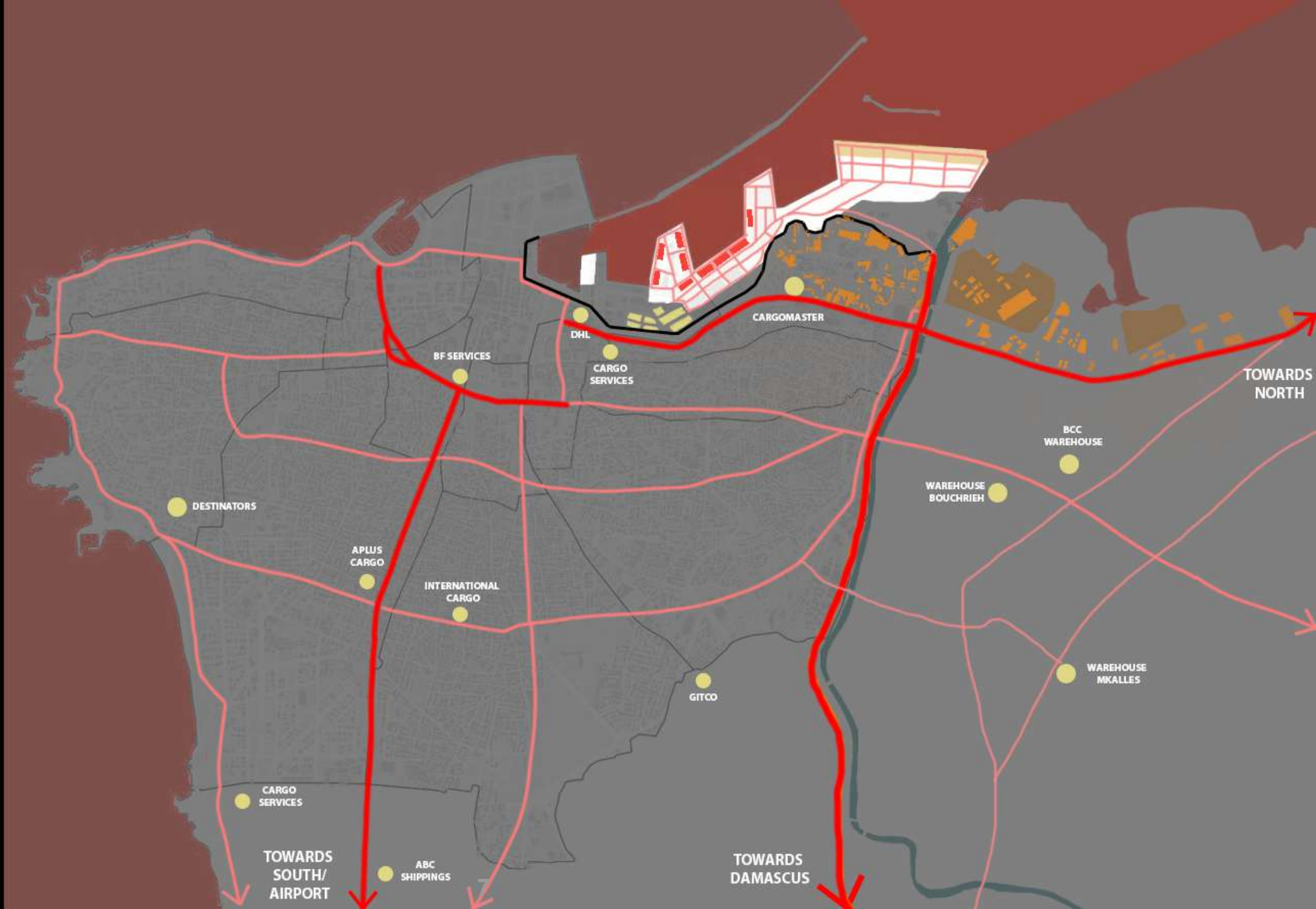
- SHIP ROUTES
- CONTAINER TERMINAL
- CONTAINER HUB
- MOTORWAY INTENSITY
- INDUSTRIAL MANUFACTURING
- CONSTRUCTION FACTORIES
- AGRICULTURAL FARMS
- FOODSTUFFS AND BEVERAGES



# GOODS:

## LEGEND:

- SHIP INTENSITY
- OPEN AIR STORAGE
- STORAGE HANGAR
- MOTORWAY INTENSITY
- IMPORT EXPORT RELATED BUSSINESS
- INDUSTRY RELATED TO PORT
- OIL/GAS INDUSTRY
- CONTAINER TERMINAL





# WASTE:

The waste crisis is nothing new to Lebanon a country that produces more than 2 million tons of waste a year.

In Lebanon the municipally sorted waste (MSW) is composed of 16% paper, 11.5% plastic, 5.5% Metal, 3.5% glass and 52.5% organic waste. 15% of which are composted, 8% recycled, 48% landfilled and 29% openly dumped.

This excludes the unofficial dumpsites outside of greater Beirut, and the illegal burnings happening across the country.

In Lebanon there are 3 main operational landfills in Sayda, Naameh and Zahle, with the bourj Hammoud landfill being recently reopened to receive waste after the explosion on August 4.

In Beirut and Mount Lebanon, the waste from residential neighbourhoods is collected by the municipality which allocate a private company to run the operation, the current one being Ramco.

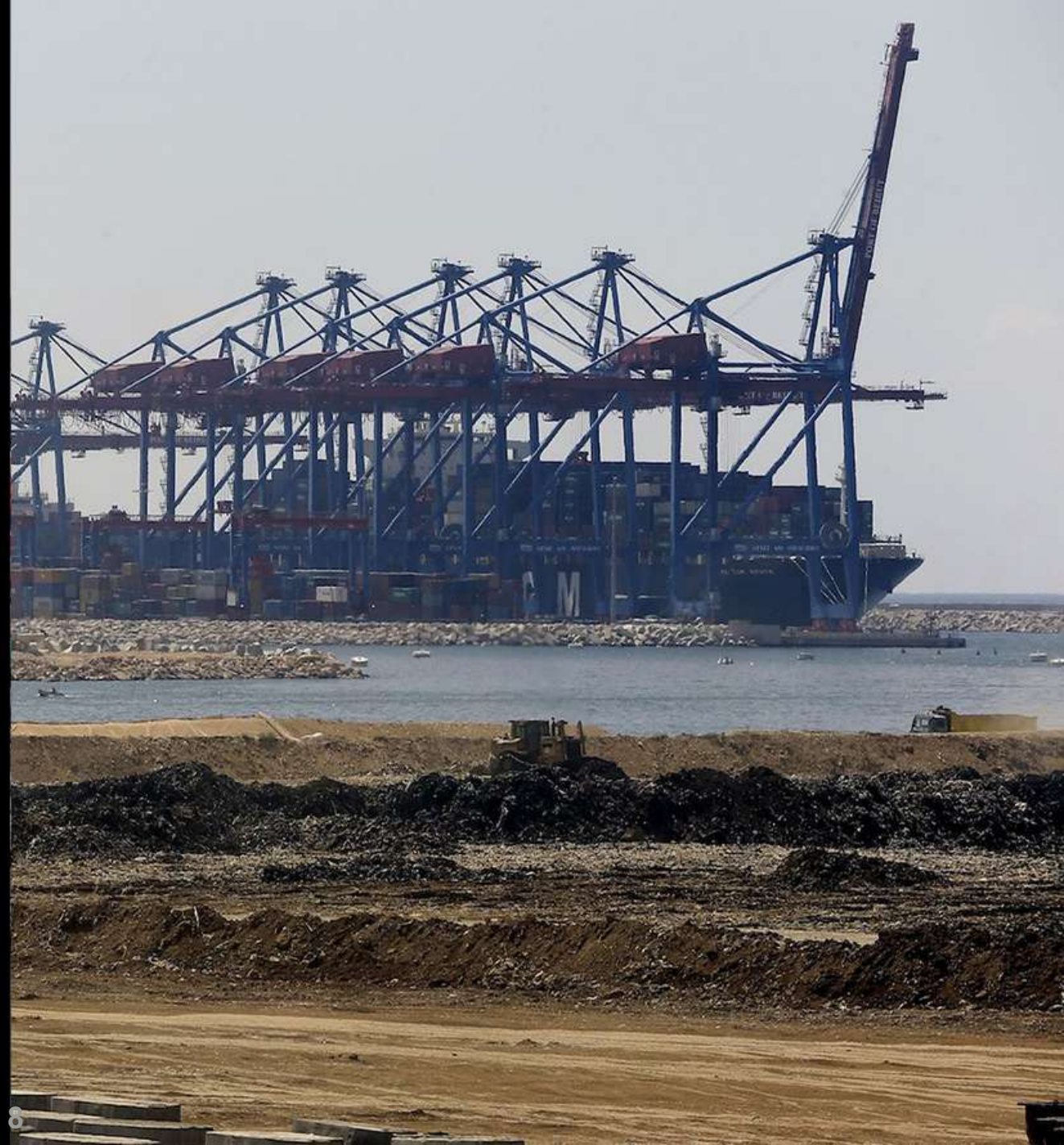
Although 80% of the MSW is recycable, only 8 to 10 % is being recycled, with the help of local NGOs. Most recently, a legislative law allowing the mixing of waste from slaughterhouses to hospital toxic waste, to industrial manufacturing waste all mixed with waste collected from residential neighbourhoods.

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Furthermore, the reopening of the landfill in Bourj Hammoud causes a serious threat to the health of the people living in neighbouring areas, and this due to the controvertial location of the landfill on the sea coast in the middle of residential areas of Beirut and Bourj Hammoud.

Also, aside from the permanent sanitary waste dumping in the Beirut river, occasional toxic wastes from hospitals and industries are dumped

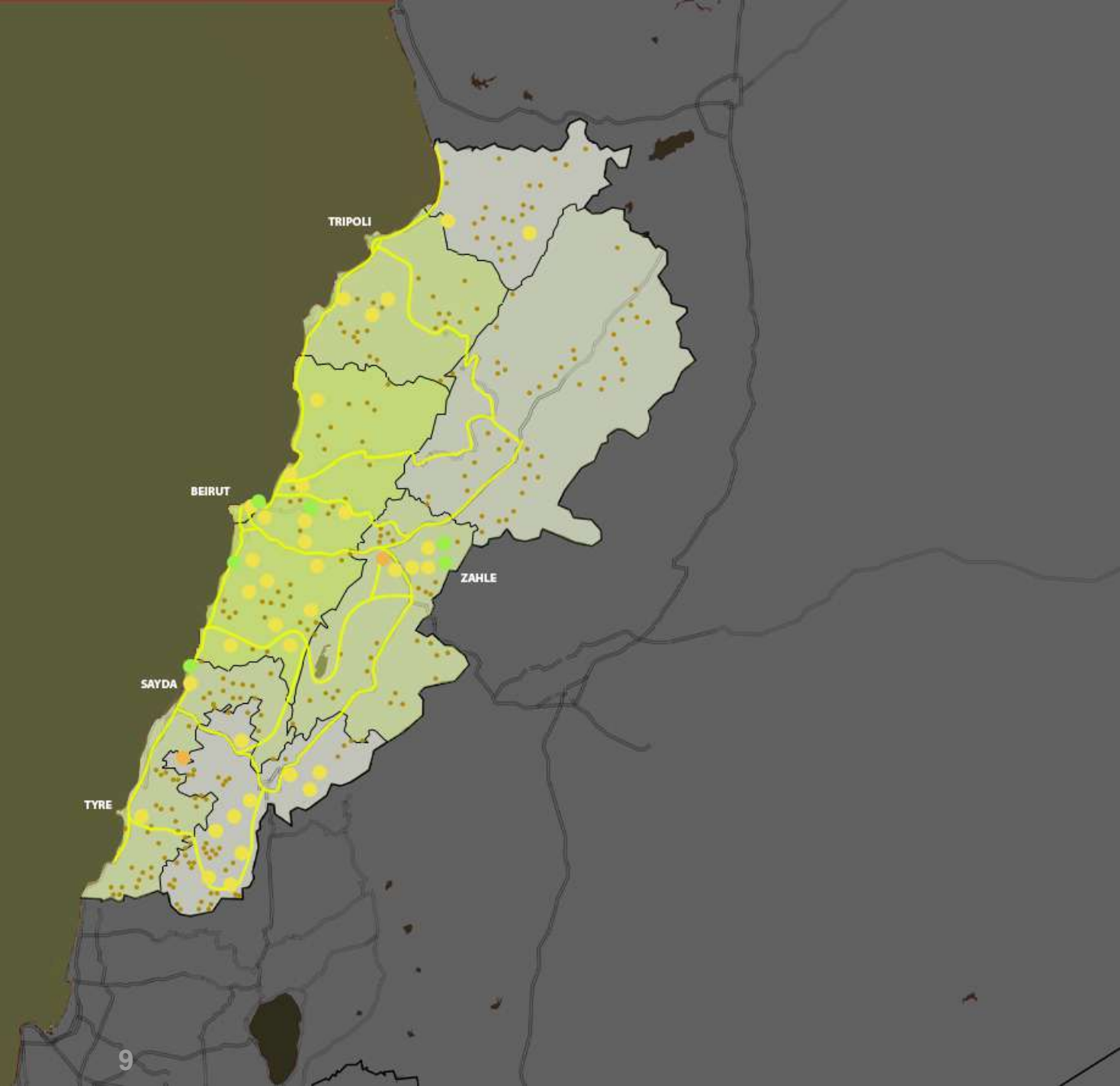
Other than the obvious strategies to promote recycling due to the immense amount of dumped recycables, what are ways that could deal with the crisis while keeping in mind the impact on the health of the local population and nature?



# WASTE:

## LEGEND:

- TOTAL WASTE PERCENTAGE
- TRUCK ROUTES
- SORTING/COMPOSTING FACILITY
- SANITARY/LANDFILL
- THERMAL TREATMENT PLANT
- UNOFFICIAL DUMPSITES





# WASTE:

## LEGEND:

● LANDFILL (currently not operational)

STENCH IMPACT:

● 0-500m

● 500-1200m

● 1200-2000m

— COLLECTION ROADS

— TOWARDS COLLECTION SPOTS

— RIVER (occasional toxic wastes)

— RECYCLING FROM 0 TO 20%

● PLASTIC RECYCLING INDUSTRY

..... PLASTIC COLLECTION ROUTE

..... PAPER COLLECTION ROUTE

..... COMPOSTE COLLECTION ROUTE

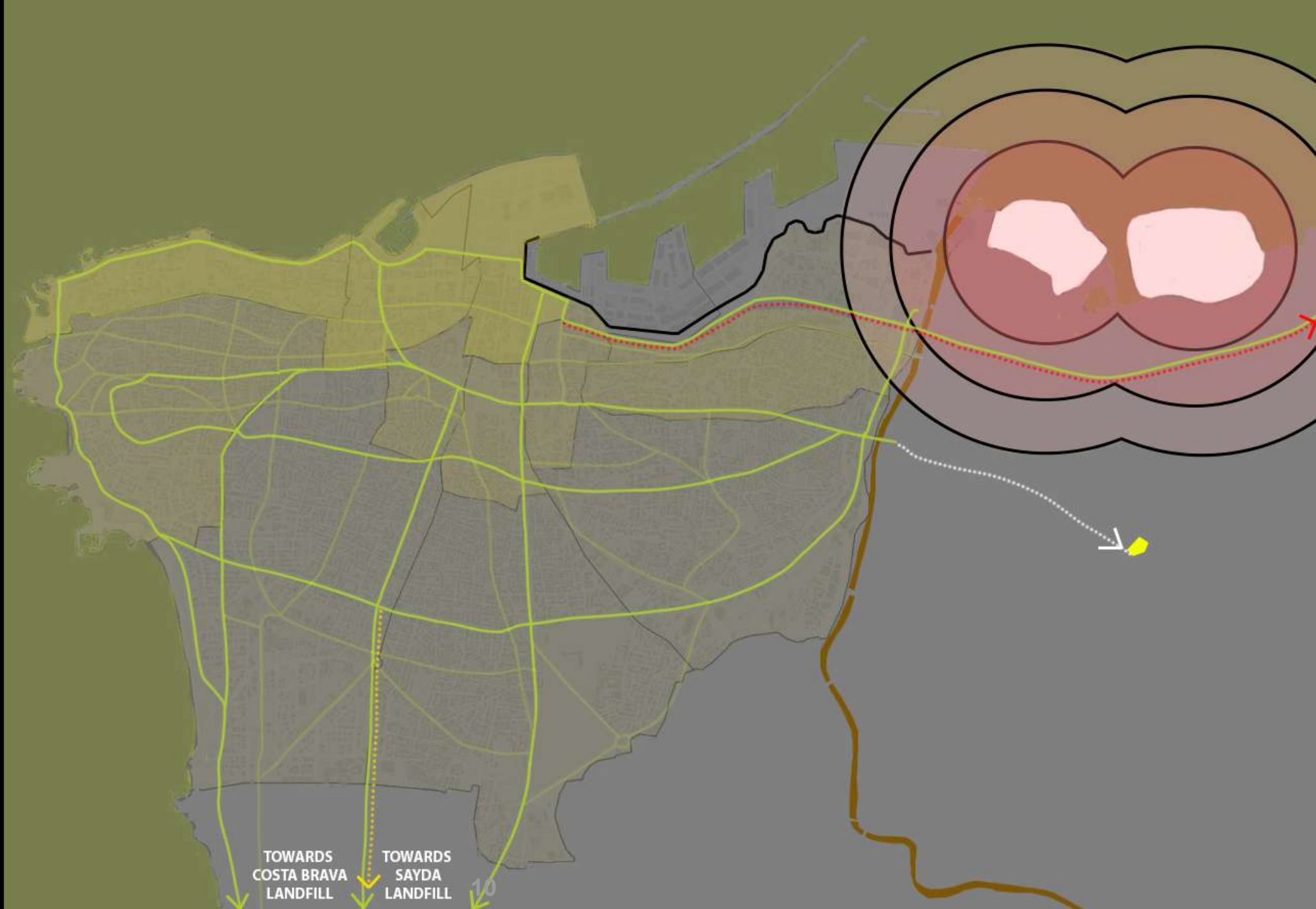


500 m

TOWARDS  
COSTA BRAVA  
LANDFILL

TOWARDS  
SAYDA  
LANDFILL

10





## PEOPLE:

The total population of Lebanon roughly amounts to 6.850 million, with more than 2.2 million being located in Beirut, other major cities include Tripoli, Batroun, Byblos to the north, Tyre, Sayda, Nabatieh to the south and Zahle and Baalbek in the east.

Most of the flow is centered around Beirut, with the only operational airport in the city, as well as being a hub for embassies and governmental institutions, with a big flow of people using the coastal highway to reach the capital on a daily basis.

Not having a functional train or means of public transportation, aside from public buses that are very poorly maintained, most of the population relies on privately owned cars as means of transportation.

In Beirut, due to the intensity of flow of cars, pedestrian activity has mostly disappeared, except from the main social hubs yet without dismissing the fact that even there the cars have covered the side of streets for parking.

Adding to this the spatial impact of the port which forms a long barrier separating people from the waterfront.

What if the port coprotagonist in the traffic congestion, by offering a new type of public transportation that operates on water, using the coast to parallel the north-south highway? And what if we could revitalise misused parts of the port to allow for people to regain public space on the waterfront linked to the port?





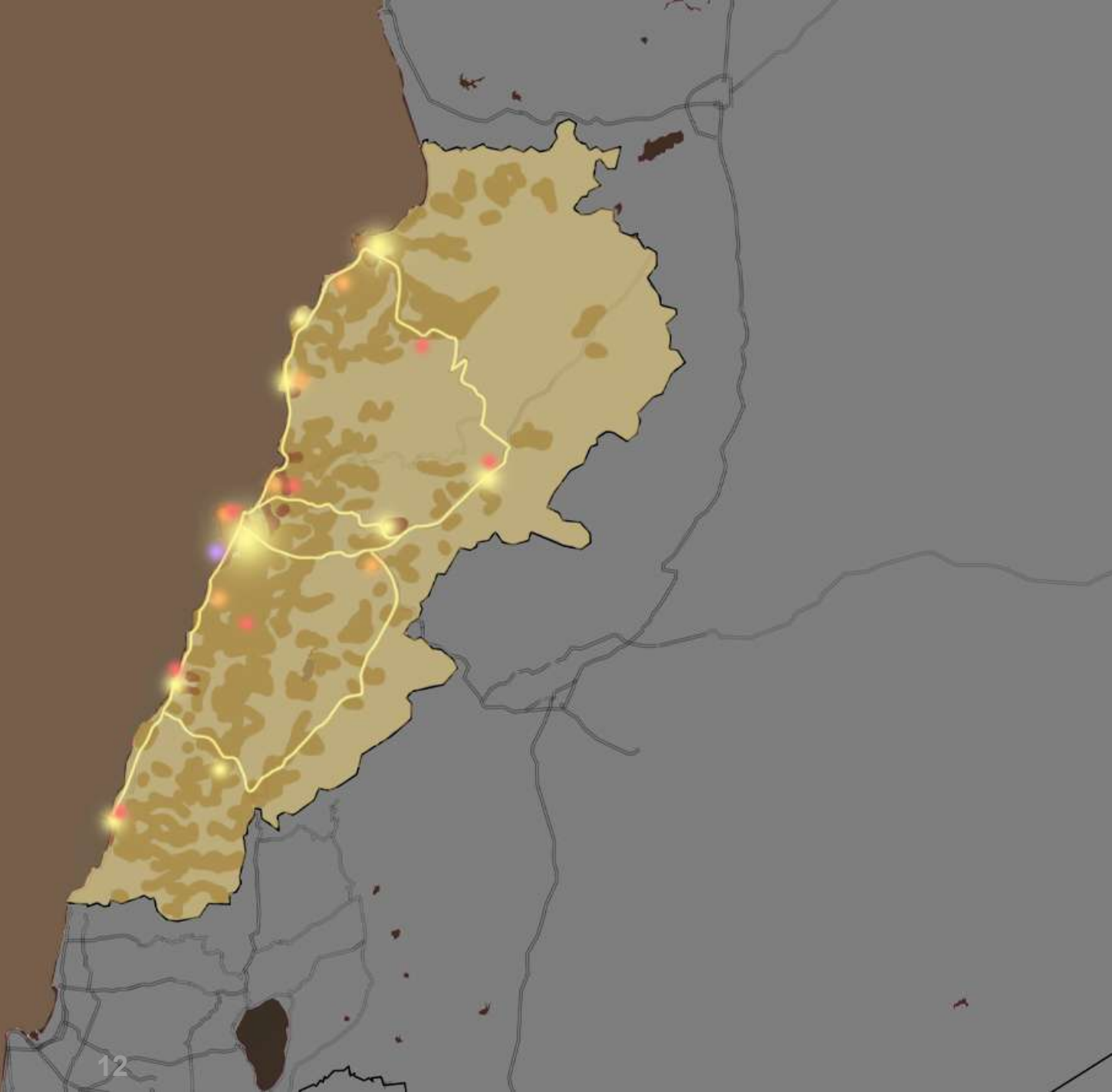
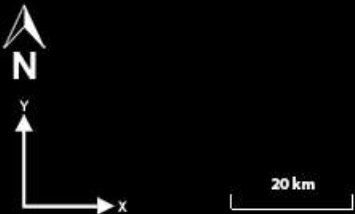
# PEOPLE:

## LEGEND:

DENSITY (PERSON/km2):

- <250
- 250-5000
- >5000

- SOCIAL HUBS
- TOURISM HUB
- AIRPORT
- UNIVERSITY/ OR HUB
- CONNECTIVE ROAD



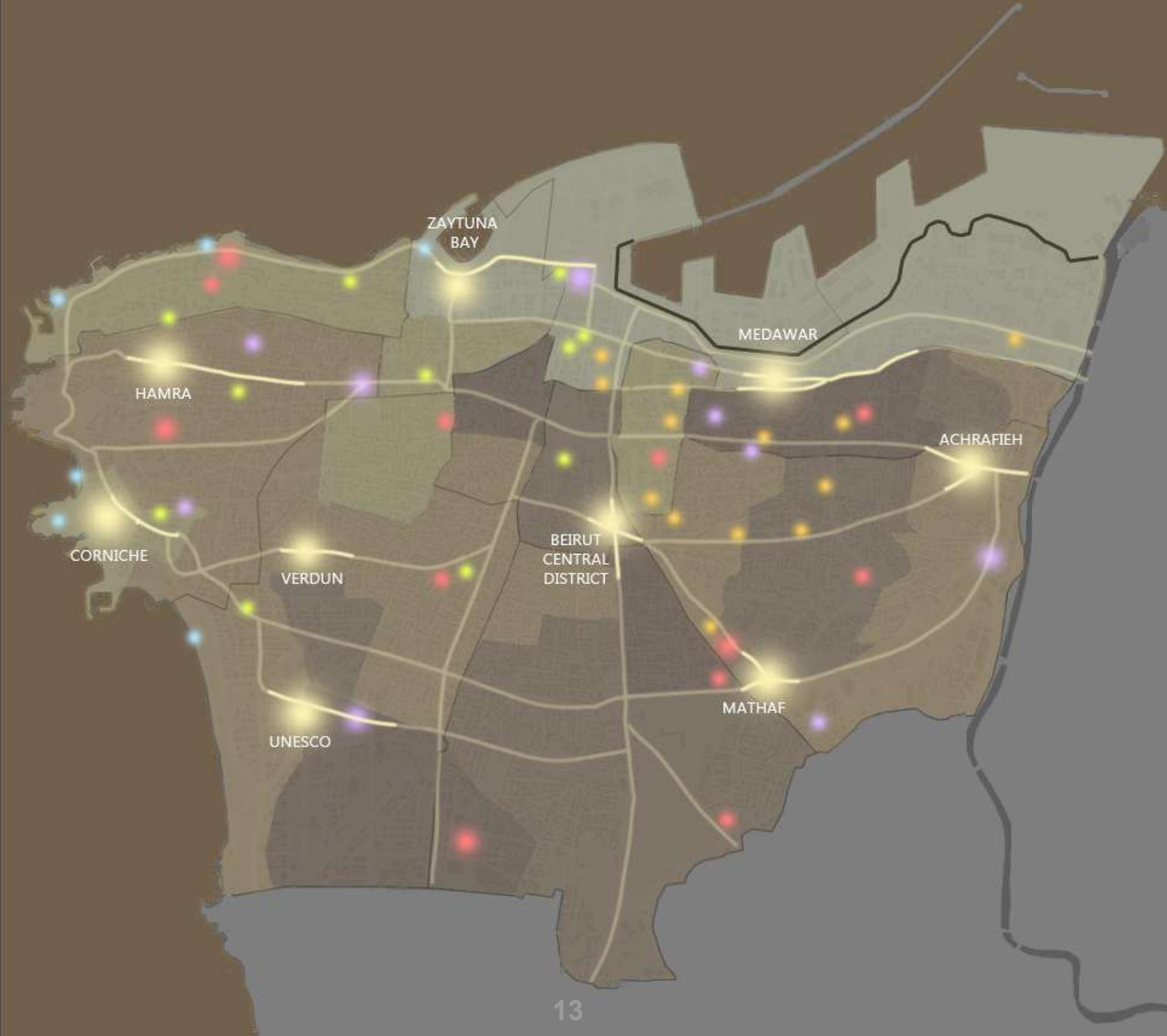
# PEOPLE:

## LEGEND:

DENSITY (PERSON/HECTAR):

- <100
- 100-200
- 200-300
- 300-400
- >500

- SOCIAL HUBS
- UNIVERSITY
- COMMERCE
- CHURCHES
- MOSQUES
- WATERFRONT PROMENADE
- HUB INTENSITY





## BIOTA:

Lebanon is a main route for birds travelling North South along the Mediterranean with many important bird areas declared, one of them occurring on the outskirts of Beirut, an area on the valleys of the Beirut river that has been left out by city planning and remained green, being used by migrating birds to rest.

The Beirut river plays a role as a main water pollutant for the sea, due to heavy pollution, causing the sea life to deteriorate along the coast.

Therefore, strategies should be implemented to deal with this crucial area of the city, of importance to human as well as bird and fish life, all rotating around the Beirut River.

Looking more closely at the capital, most of the biodiversity is located in the Horsh, the largest green space inside Beirut.

Although very low amount of formal green spaces accessible to the public causes a problem in an already heavily polluted city that also lacks of public space. we can find in areas, mainly in the part of the city south of the port, green spaces, where a variety of plants, from trees to bushes have taken life. These spaces are mostly considered left over spaces inside the city, from parking lots to alleyways.

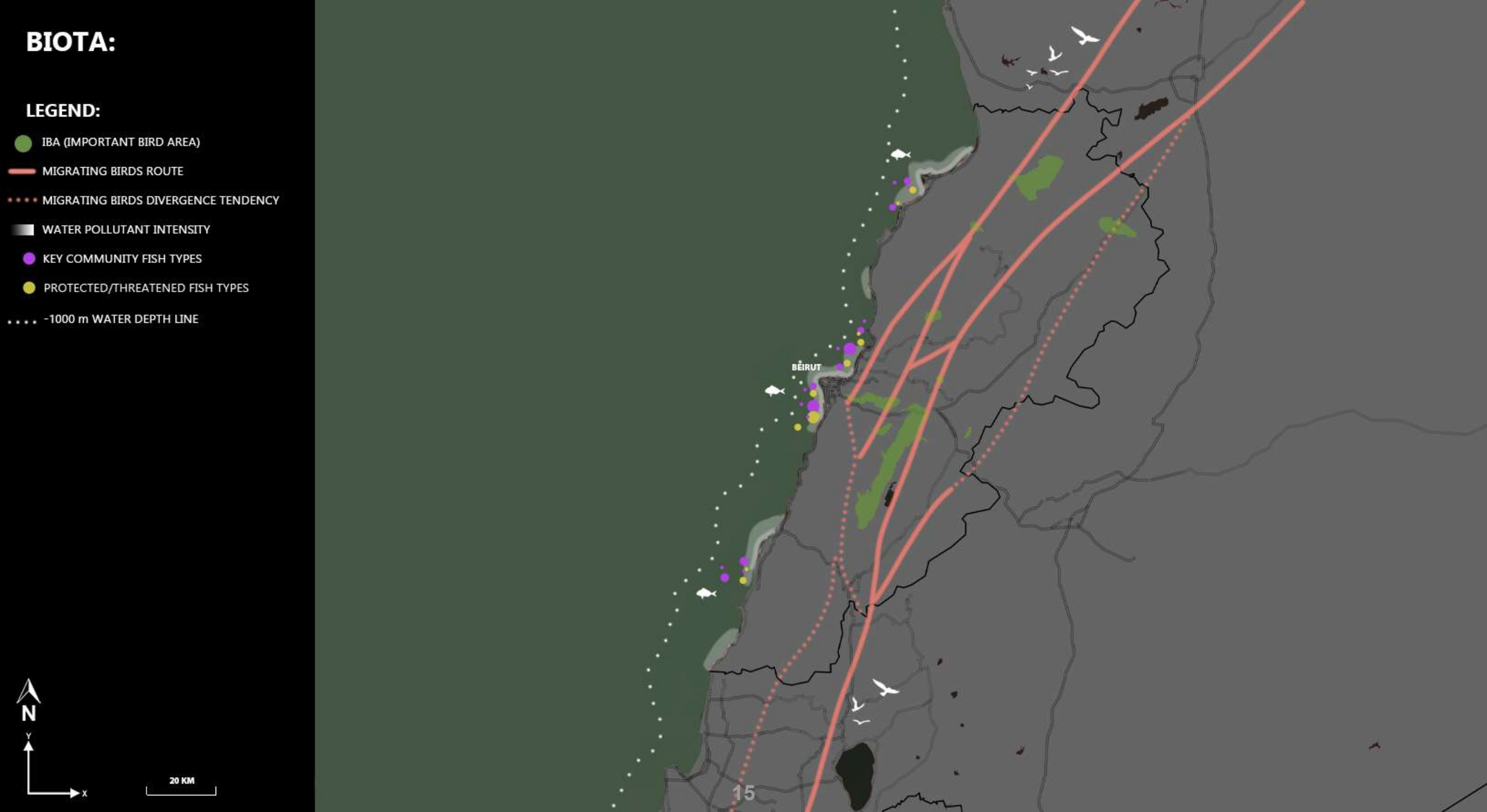
What can be done to allow for biodiversity to reflourish inside the sea, using the main green structure of the Horsh and the wild greenery along the city?



# BIOTA:

## LEGEND:

- IBA (IMPORTANT BIRD AREA)
- MIGRATING BIRDS ROUTE
- MIGRATING BIRDS DIVERGENCE TENDENCY
- WATER POLLUTANT INTENSITY
- KEY COMMUNITY FISH TYPES
- PROTECTED/THREATENED FISH TYPES
- 1000 m WATER DEPTH LINE



20 KM



# BIOTA:

## LEGEND:

- MUNICIPAL PARKS
- AGRICULTURAL SITE
- UNCONTROLLED GREENERY
- LOCAL BIRD HUB
- COASTAL BIRDS SITING
- MIGRATING BIRDS ROUTE
- WATER POLLUTANT INTENSITY





## ENERGY:

Lebanon has been facing energy shortages for decades, with power cuts happening even in the city due to insufficient capacity.

This lack of energy is due to having only 7 thermal powerplants, which produce 90% of the locally produced energy, are in poor state due to aging. This has led to the need to rely on imports mainly by ship from Turkey among other nations. But this all is not enough to solve the power shortages.

What is eye-catching is the high potential of solar and wind power energy, basic renewable resources that the country has failed to exploit with the wind resources remaining untapped.

Other resources are the notable geothermal locations with high potential in the North and South parts of the country, that could be crucial in solving the energy shortage in the country.

We also have the potential to exploit energy from wave motion along the coast, a plan that has been proposed before in the country but never realised.

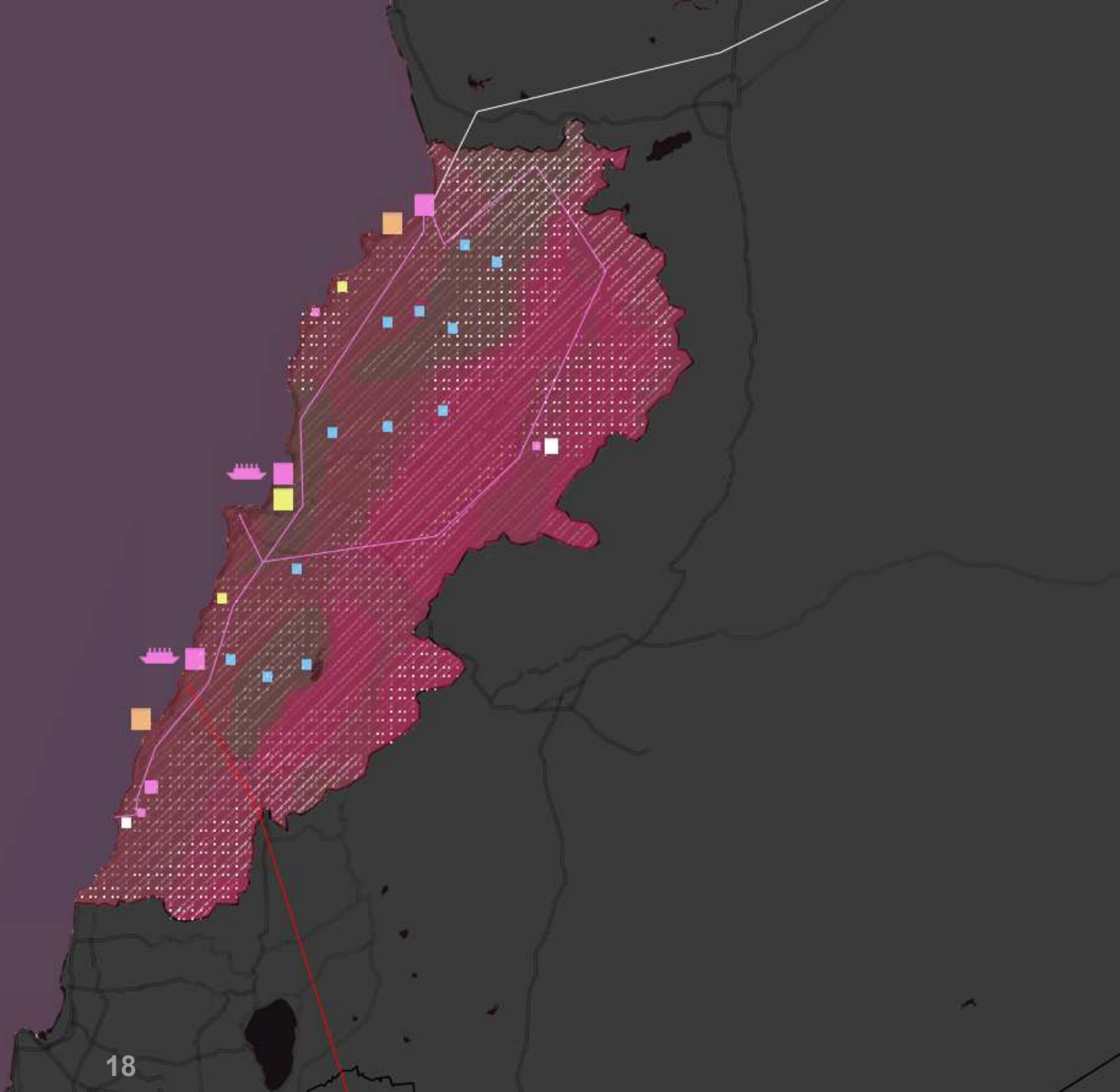
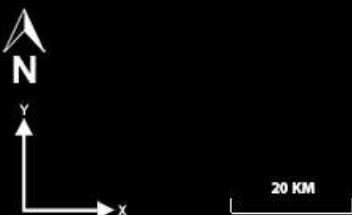
Strategies should cooperate on the national level, to exploit natural resources, from wind, solar, geothermal or wave motion and use them as plugins in an energy grid that would fulfill demands in sustainable manners.



# ENERGY:

## LEGEND:

- IRRADIATION INTENSITY
- GEOTHERMAL POTENTIAL HEAT
- OIL PIPELINE
- GAS PIPELINE
- MAIN ELECTRICITY GRID
- POWERSTATION
- CCGT
- GAS TURBINE
- HYDROPOWER
- STEAM TURBINE
- POWER SUPPLY SHIP
- WIND POTENTIAL

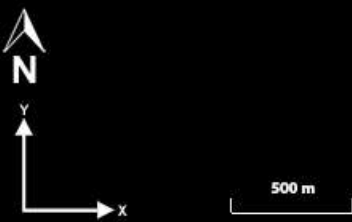
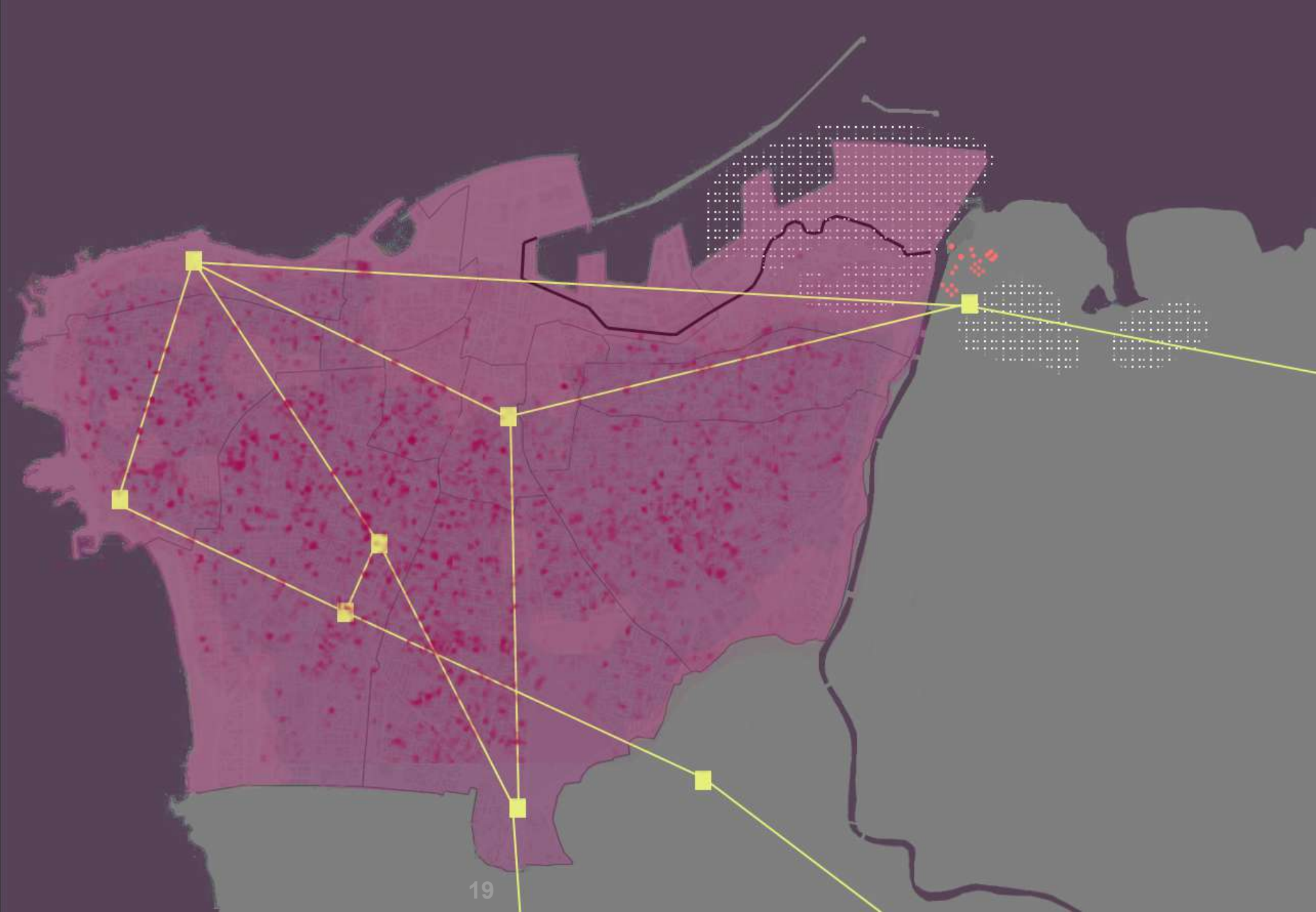




# ENERGY:

## LEGEND:

- IRRADIATION INTENSITY
- CO2 EMISSION
- ELECTRICITY LINE (UNDERGROUND)
- SUBSTATION
- OIL DISTRIBUTORS





## FRESH WATER:

In a country considered rich in water resources compared to neighbouring Syria and Jordan, providing clean water constantly to the citizens has surprisingly always been a challenge. With old water lines that lose most of the water in the ground and an under exploitation of snow waters that mostly reach sea in underground aquifers, the citizens have relied on buying freshwater from private companies and storing it in underground water wells.

This has both resulted in less money to invest on more sustainable methods and made water bottling companies prolific, notably the ones that recover most of the fresh water from the Beirut river, one of the main factors for its demise.

High salination has also been found in underground water wells along the shoreline, due to high exploitation and sea water infiltrating the water lines, with over salination in months of summer, notably around intense urban sprawls in Beirut, Tyre and Tripoli.

Moreover, rainwater harvesting is of high potential in the country, where recent studies done by UNICEF showed that it could provide up to 70% of the total deficit.

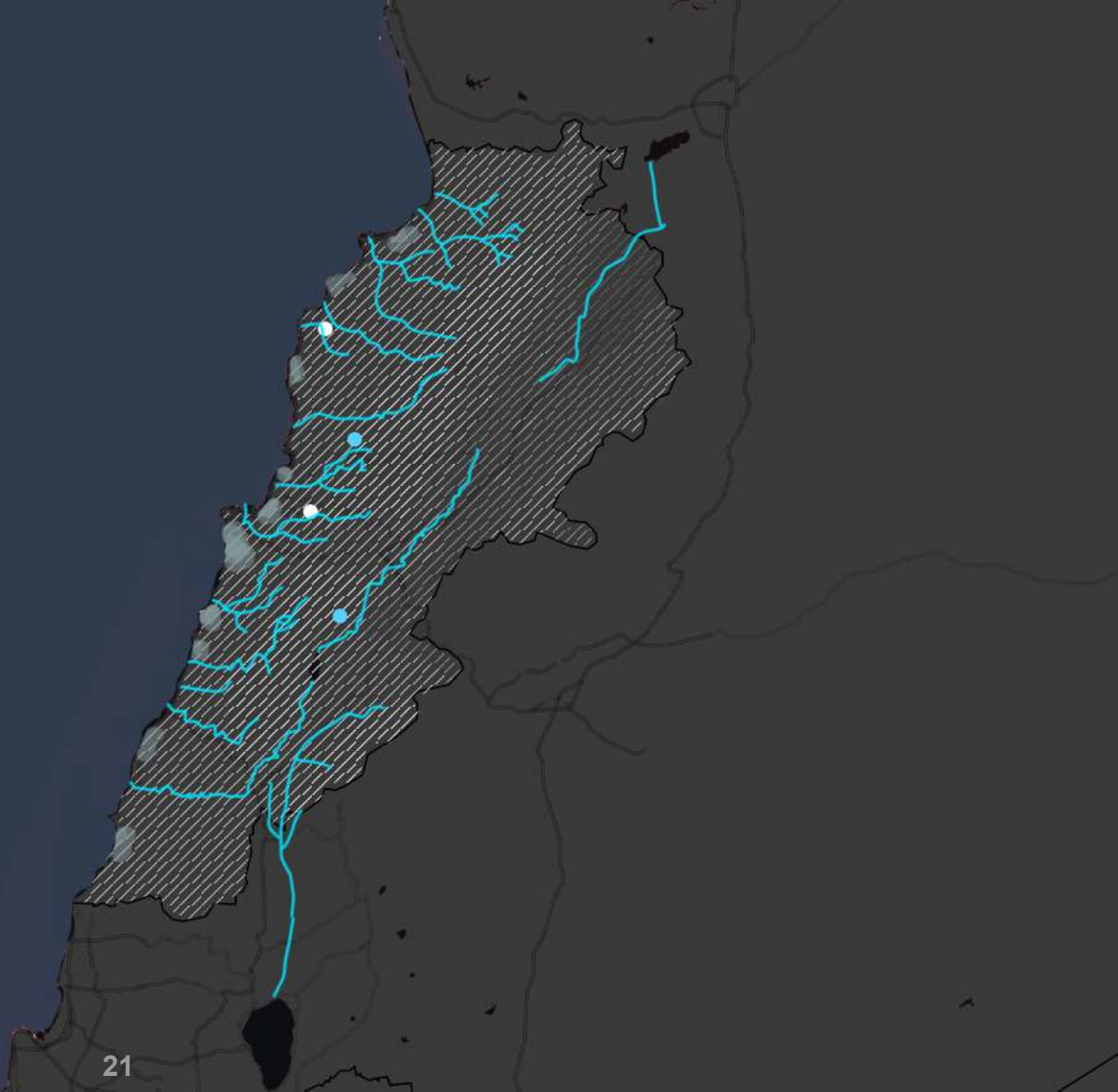
The main idea is to exploit rainwater potential and see what roles could be implemented in the port area to do so?



# FRESH WATER:

## LEGEND:

- /// ANNUAL PRECIPATATION INTENSITY
- CONSTRUCTED DAM
- DAM UNDERCONSTRUCTION
- RIVER
- SALINATION IN WELLS FROM SEA WATER

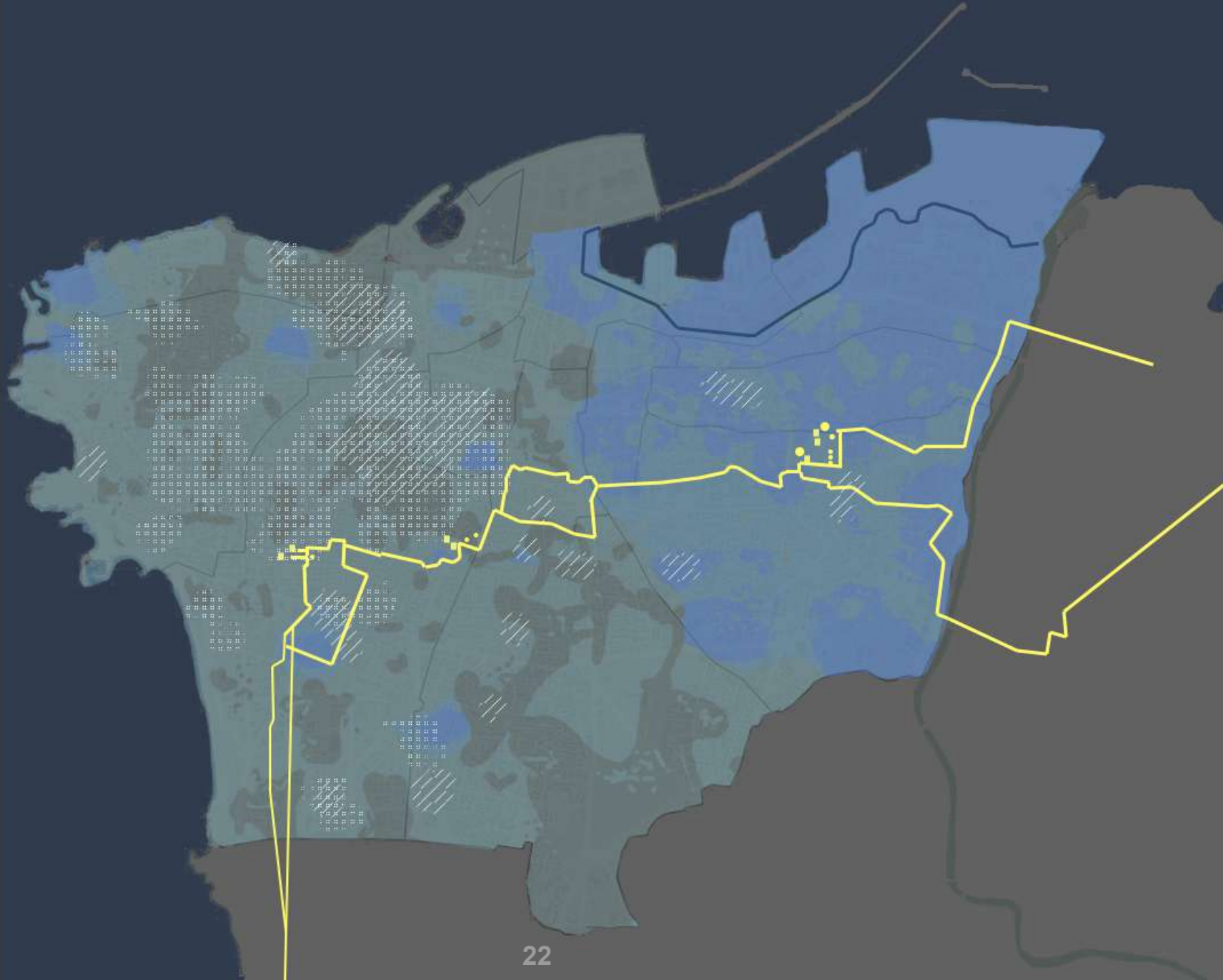




# FRESH WATER:

## LEGEND:

- MAIN WATER LINR
- RESERVOIRS
- PUMPS
- TAP WATER FREQUENCY
- /// E.COLI INFESTED
- ||||| HIGH SALINATION

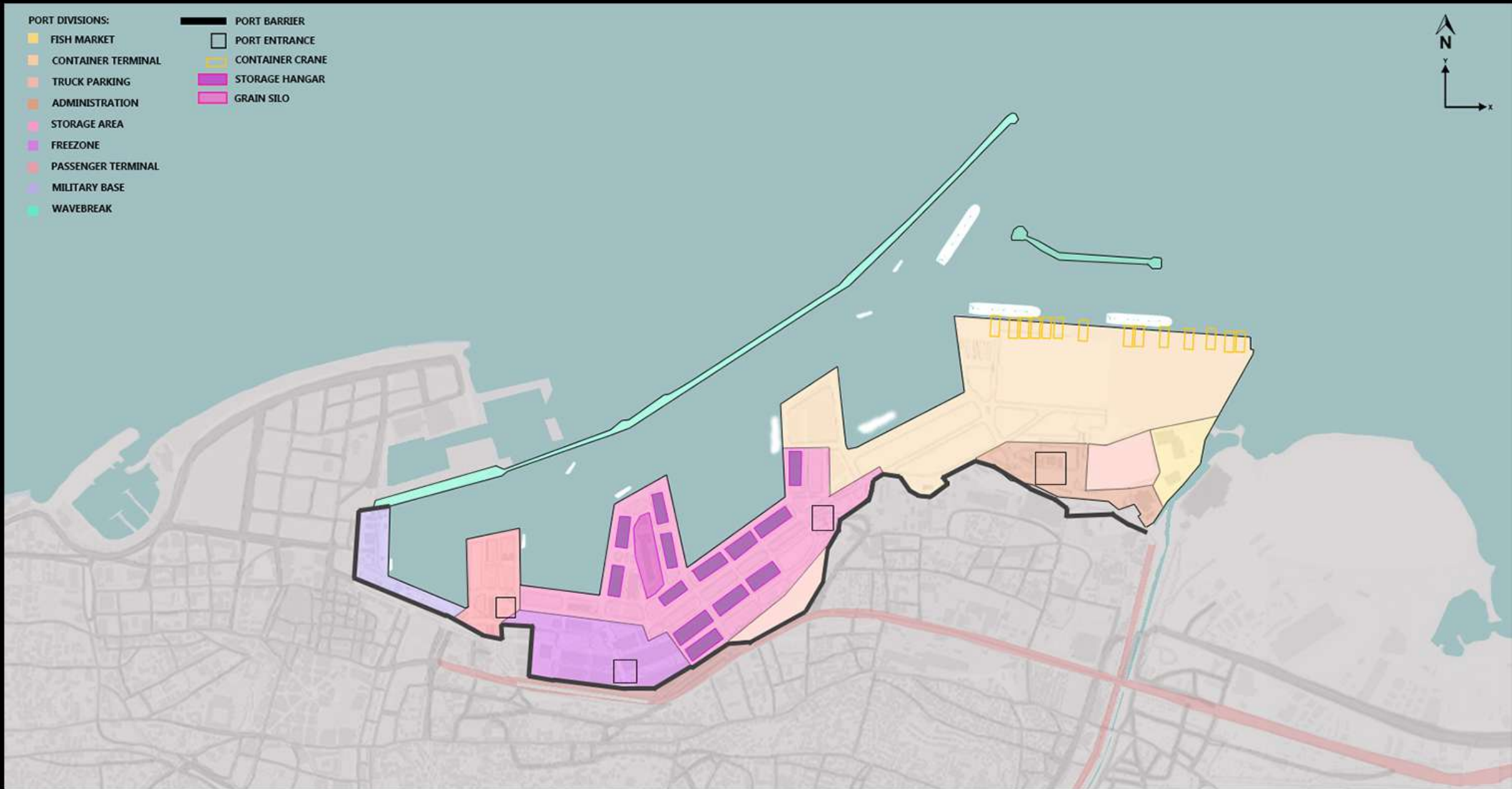


The port and the city have shapeshifted along the years, from the complete immersion of the port within the city's urban sprawl and landscape, slowly separating into two completely separate entities with very little interaction, due to the industrialisation of the port and the need for securing the part of the waterfront, designated for the port.

These two entities though are different in program and scape, still are inevitably linked due to the adjacency and spatial context they find themselves in. This spatial context, thus, is one that needs to be represented and taken account of, during the upcoming projects around the port and the port area.



# PORT CONTEXT



The largest and most efficient part of the port is the container terminal, on the eastern part, expansion plans are already envisioned for the terminal in order to ensure the port's competitiveness, in being able to host more "mega container ships" and trading fleets.

South of the container terminal lies the main port entrance adjacent to the truck parking lot and the administrative buildings that are oddly positioned and secluded from most of the port's activity. The truck parking lot is also problematic for lacking space, with trucks having to park in different areas on the port's periphery.

To the west of the container terminal is the second largest part of the port, the storage zone, that includes hangars and silos that are both inefficient in space usage as well as management, it is also the area where the explosion happened in August 2020.

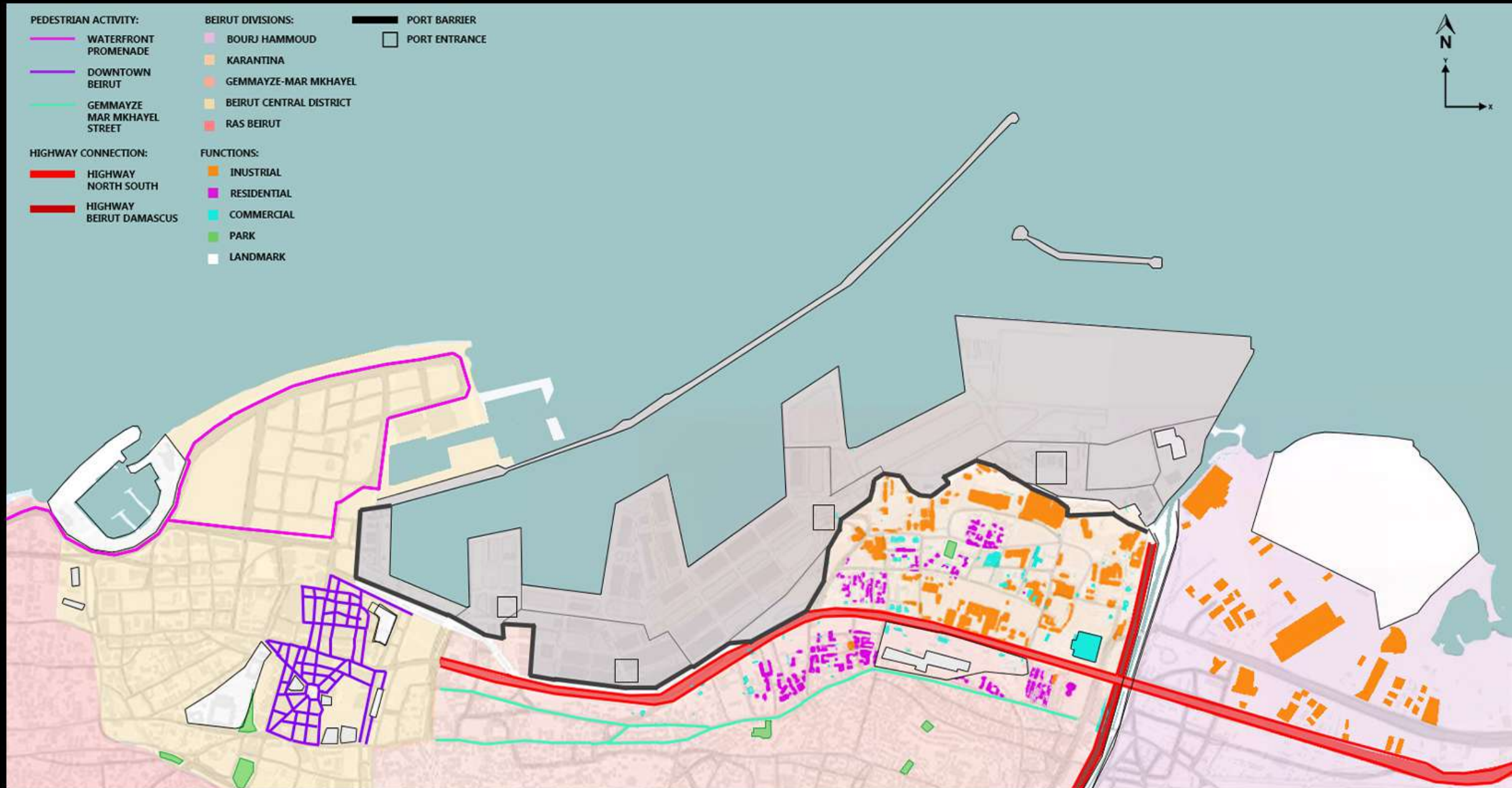
Although the area west of the storage zone is dedicated for the passenger terminal, the low amount of passenger boats coming in to the port lead to a large portion of the area to be used for handling of cars coming in and out of the port.

On the western part of the port is an area currently occupied by a temporary naval base with wall separations taking away even the sight of the waterfront from the public in the city center.

The port also includes two separate breakwaters that are built in a vernacular way and are in need of upgrading.



# SURROUNDING PORT CONTEXT



Though the port's linearity gives it contextual spatial connections with different parts of the city thus a variety of opportunities for interaction typologies, it still in its current form stands simply as a physical barrier, cutting away a large portion of the waterfront away from the public.

Starting off at the Beirut river and its estuary to the East of the port, as well as the neighbouring waste landfill, this area is a problematic one, due to the heavy damages of the ecological system and the disastrous sewage water running inside the river channel dumping in the sea.

Then to the west of the river, the port neighbours the area of Karantina, and although there is interaction between the industry North of Karantina and the port, the rest of the area still seems secluded from the port and lacks investments in infrastructure.

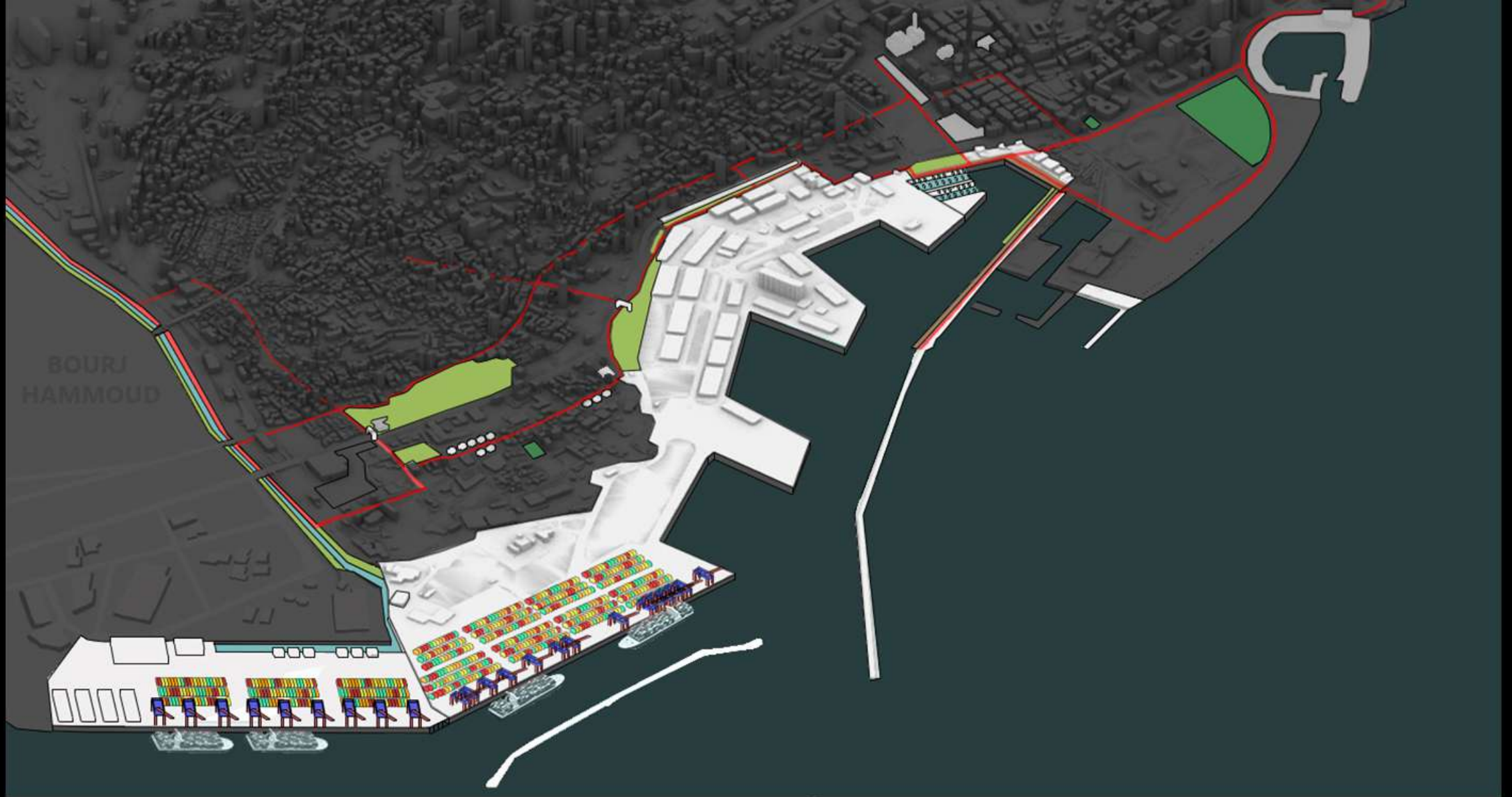
The highway then parallels the port, emphasising the barrier between city and sea, separating the residential area in Medawar from the port.

The eastern side of the port neighbours Beirut's Central District, where the major touristic attractions as well as shops and religious hubs have no access to the nearby waterfront.





# MASTERPLAN



## MASTERPLAN

### GREEN BELT AND RIVER SYSTEM

Following the spatial organisation and the metabolic flows previously noted, two intertwining strategies have been proposed to be implemented in specific locations on transitional and interstitial spots along the port limits and the beirut river, respectively.

The first strategy is the creation of a green pedestrian belt along the limits of the port that would include different and strategic functions. The second is dealing with the beirut river as ultimately an indispensable piece of infrastructure in the city.





## **STRATEGY A**

### **GREEN PEDESTRIAN BELT AND REGENERATION OF CITY INFRASTRUCTURE**

This strategy aims on re-establishing the pedestrian activity along the waterfront and port periphery. This is done by the regeneration of specific infrastructures, transforming them into important nodes by introducing new functions in each.

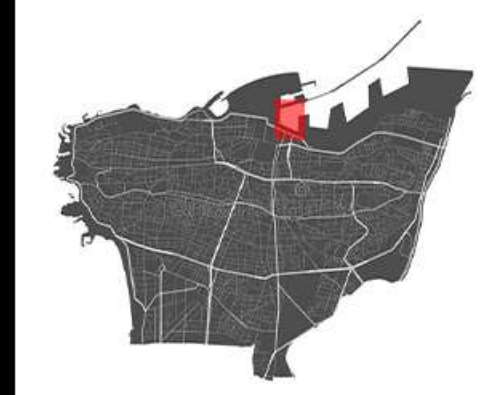
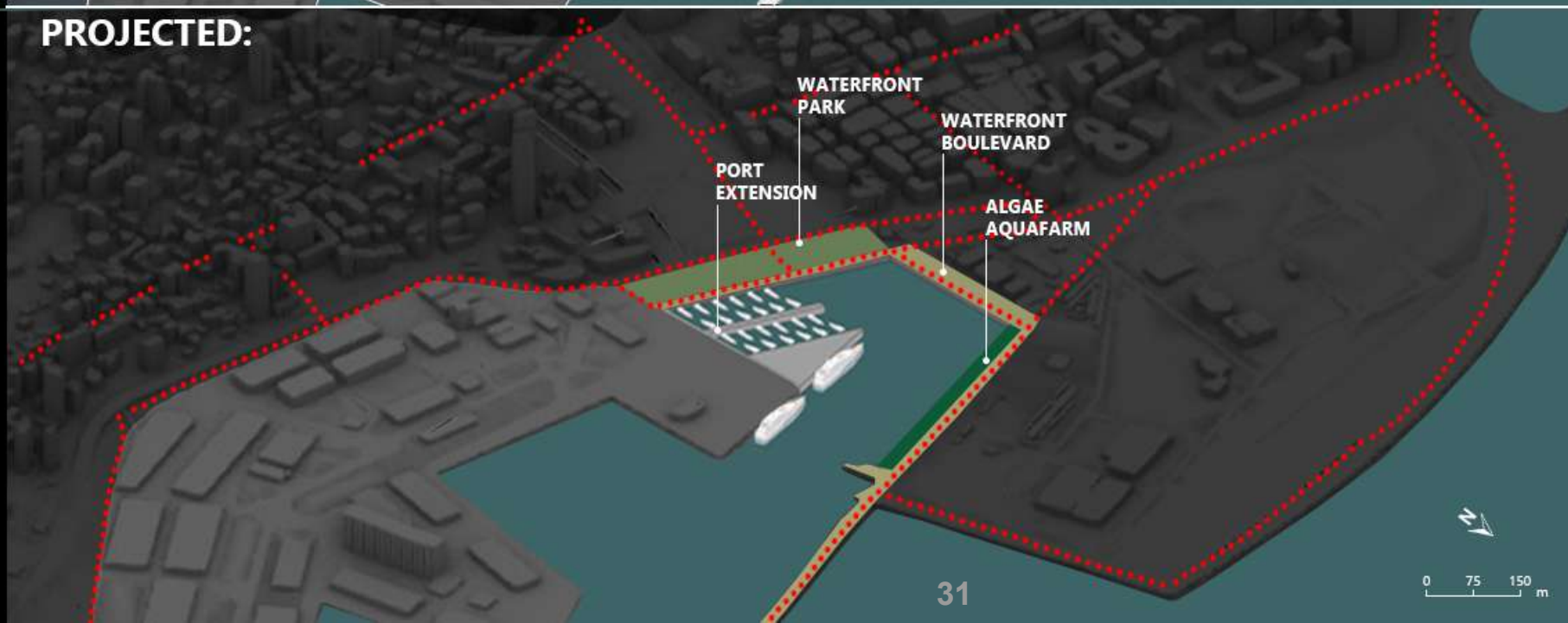
This belt would plug in to the present pedestrian connections along the western waterfront of the city and the streets in the Medawar area.

# STRATEGY A: BASIN 1

## CURRENT:



## PROJECTED:



The waterfront is a key element in a port city, therefore, its planned usage and functionality can play important roles in both ensuring efficiency and security for port operations as well as offering public and recreational spaces, strengthening the relationship between city, port and sea.

In this section of the port, the area around basin 1 is investigated. This area is located near the “heart of the city”, which includes martyr square, downtown Beirut and the Place de l'Etoile, the main touristic hubs in the city. It is also adjacent to the historical remains of the old port, that are in process of being uncovered. This makes the area of high importance to the inevitable expansion of the public domain towards the waterfront.

Currently the land is restricted due to the land being used for a temporary naval military base. The first step would be the relocation of this naval base as indicated in the masterplan, in order to free up the land for future development. Other steps and opportunities would be the creation of a waterfront boulevard and park, waterway transportation facilities and innovations in aquafarming.







Fig. 1.1: Basin 1 localisation and connections

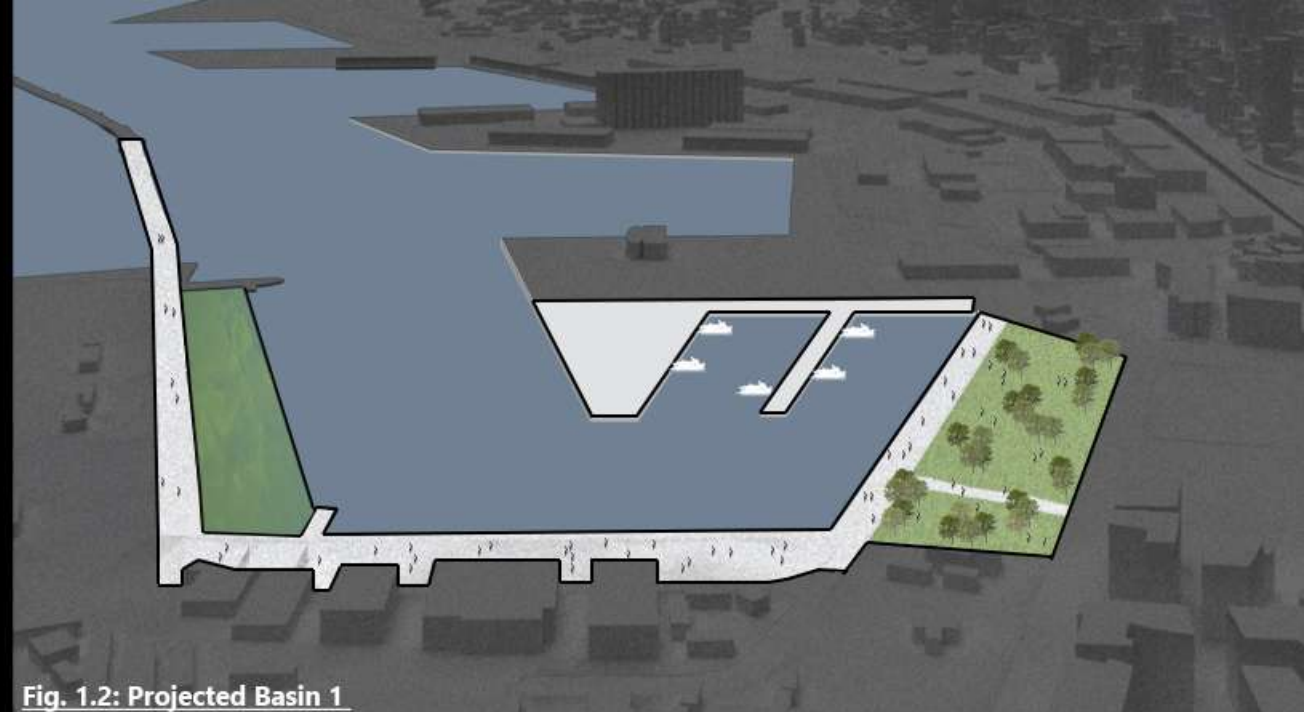


Fig. 1.2: Projected Basin 1

The first step would be to relocate the military base as shown in the map to the left, and removing the separation walls built around the plot. By doing so, links would be established with the waterfront promenade, the martyr's square and the neighbouring commercial areas.

Basin 1 would become a new landmark at the heart of the city and would demand new programs and additions to host a large diverse flow of people.

The waterfront park would be the only park in the surroundings, with an area of 5800 m<sup>2</sup>, designed at the intersection between the port, the sea and the city, this park would provide recreational spaces covered in vegetation with views on the basin and the port.

The waterfront boulevard would encircle the basin and link the port, the park, the algae aquafarming and would carry on along a small section of the breakwater, providing different viewpoints on the port to the public.

These additions would help enhance the pedestrian activity around the waterfront and thus will inevitably allow for new opportunities to arise in the commercial, cultural and recreational sectors in this area.



Supposedly, the symbolic heart of the city of Beirut, lies around the area of the current Martyr's square. This area, once the main hub of transportation in and out of the city as well as one of the main attractions for recreation and tourism, has lost its previous charm as well as function since the start of the 2000s.

Although historical ruins of the old port, religious edifices, institutional buildings as well as other cultural and touristic monuments are abundantly present in the area, no clear emphasis on this aspect or link is yet proposed.

Another important consideration to take is the proximity to the waterfront. This area and its landmarks are highly linked to the sea, yet this link has been erased with time, to the point that the area is restricted by a military base.

The aim of this introduction of a public boulevard and a park at this location is to reestablish this link between the public, the port and the sea by giving back the waterfront to the people, as well as highlighting the importance of the neighbouring monuments, by attracting both tourists and residents to the area.



Fig. 1.3: Boulevard views on the port

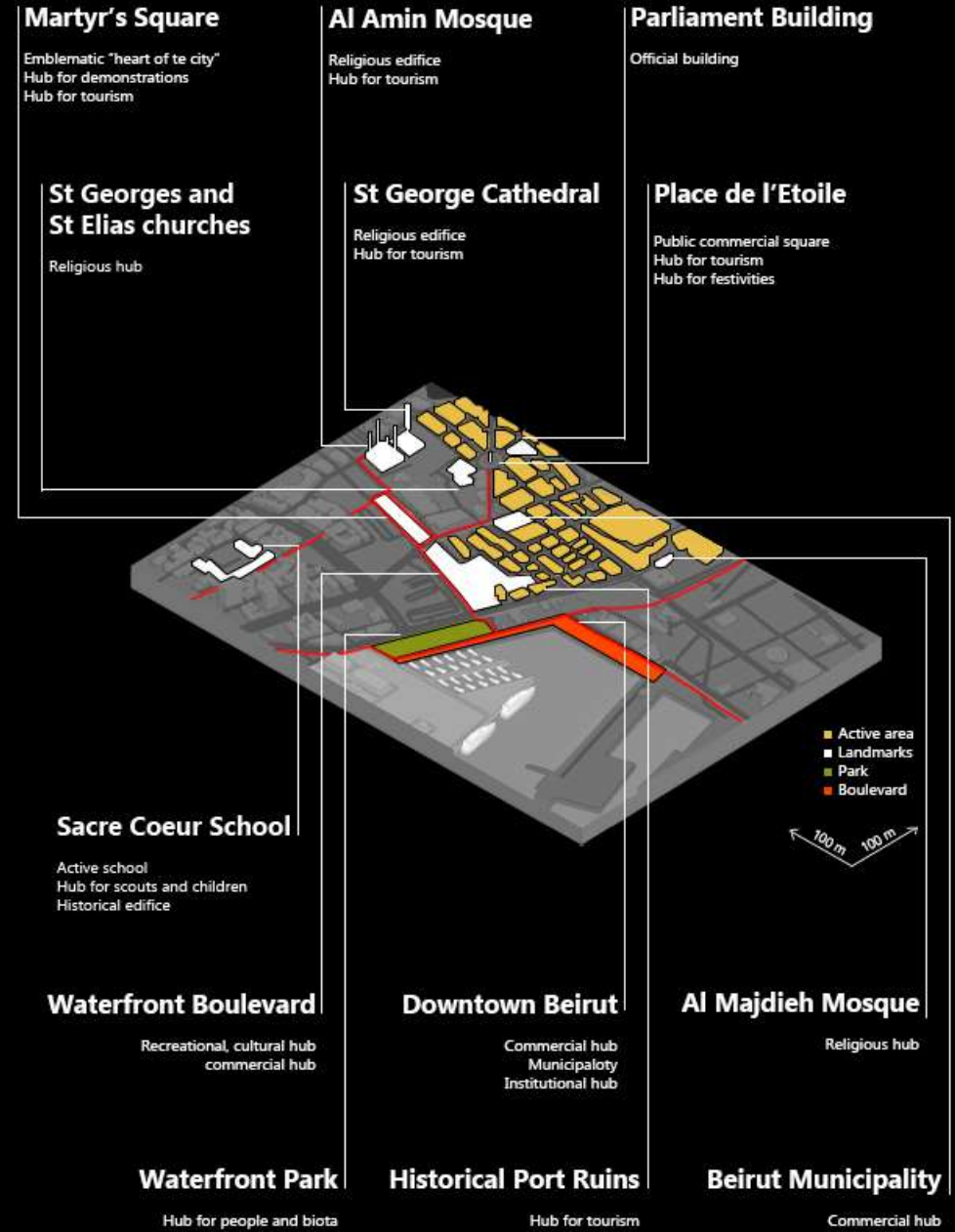


Fig. 1.4: Localisation amid city center landmarks

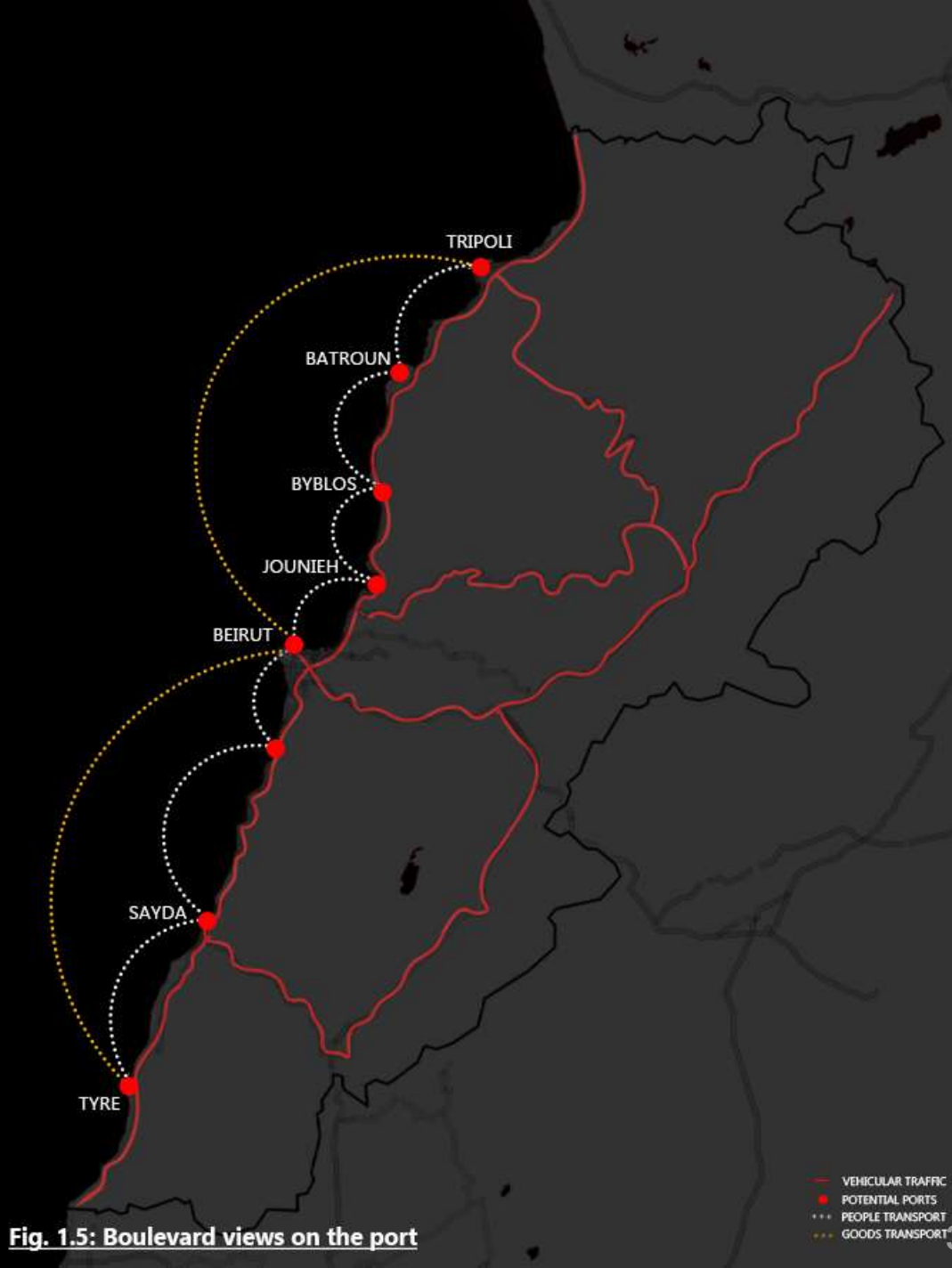


Fig. 1.5: Boulevard views on the port

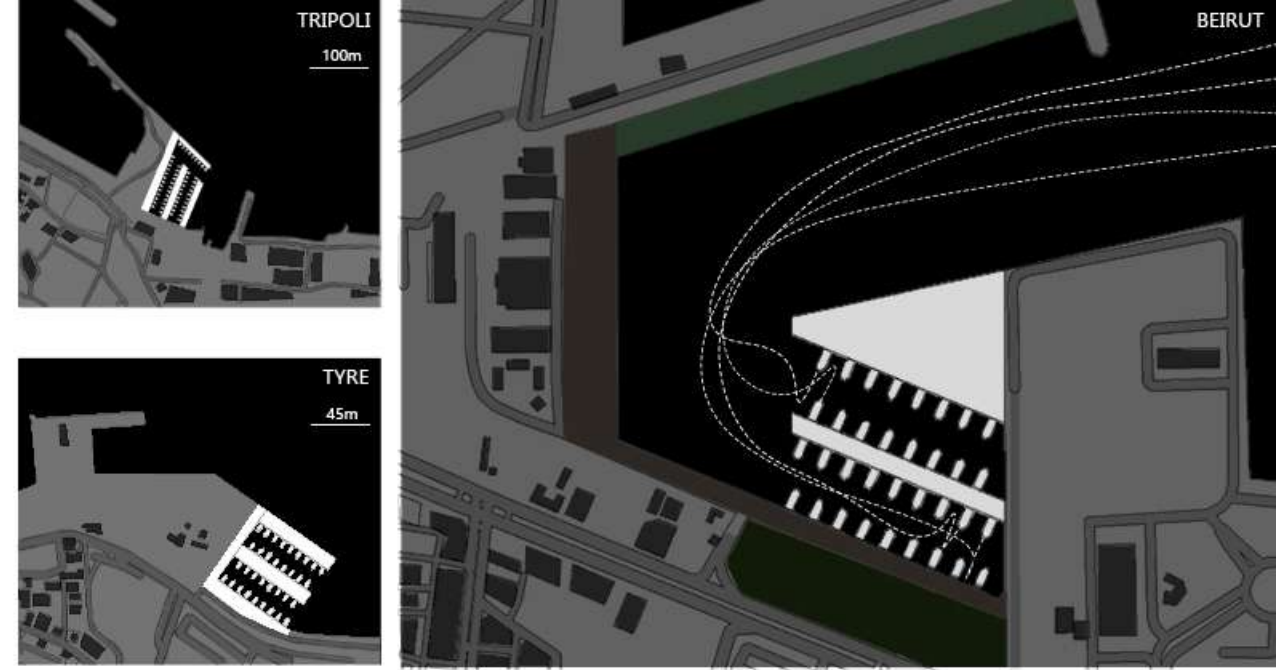


Fig. 1.6: Maps of the three major port extensions across Lebanon

The main highway North to South In the country, the coastal highway is overloaded with traffic, having to handle most of the transportation, from people heading to coastal cities for work and education, to the transportation of goods along the country as well as most of the recreational trips.

An opportunity lies in the use of the convenient linear shape of the country along the mediterranean and the localisation of most of the major cities on the coast.

Innovation in the transportation sector to extend to the sea seems optimal for dealing with the traffic problem as well as play a role in revitalising tourism along the sea.

By introducing small ports inside the different ports along the coast for handling deliveries of goods from Beirut to the other major cities a new water transport system would parallel the coastal highway and help clear it of unnecessary usage for deliveries.

Another opportunity would be to introduce "water buses" that could transport people as well.



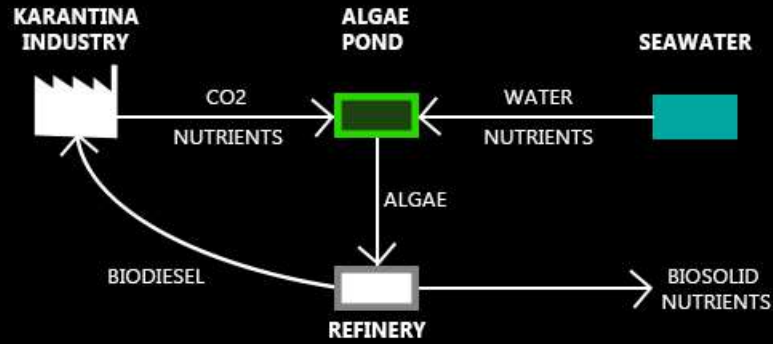


Fig. 1.7: Algae pond strategy diagram

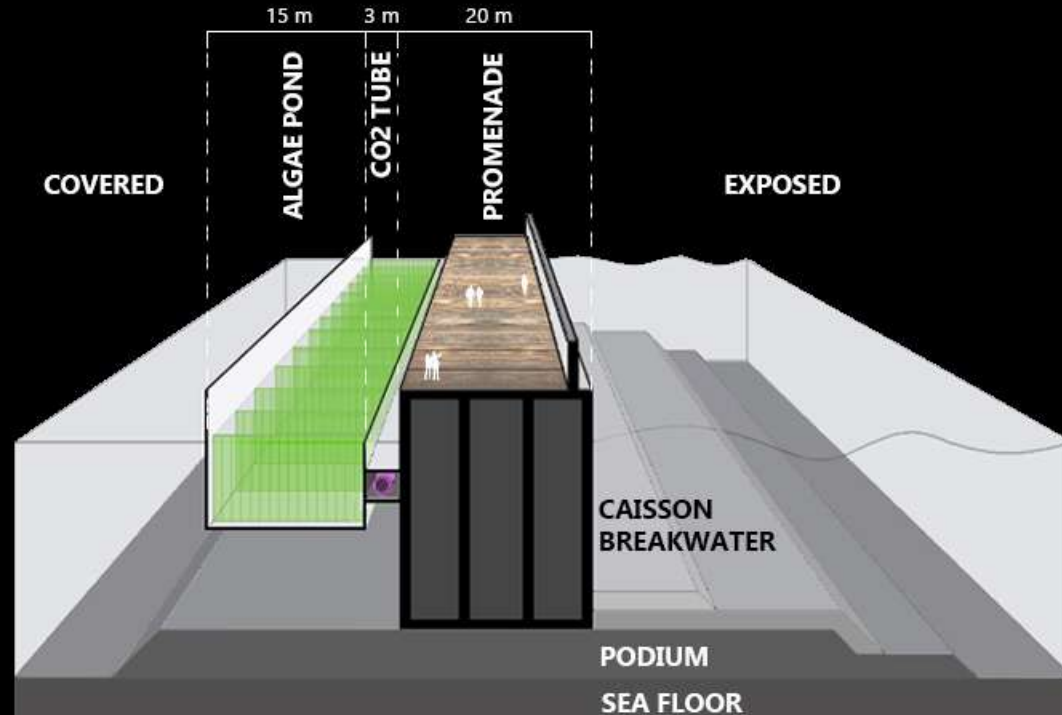


Fig. 1.8: Algae pond and upgraded breakwater section

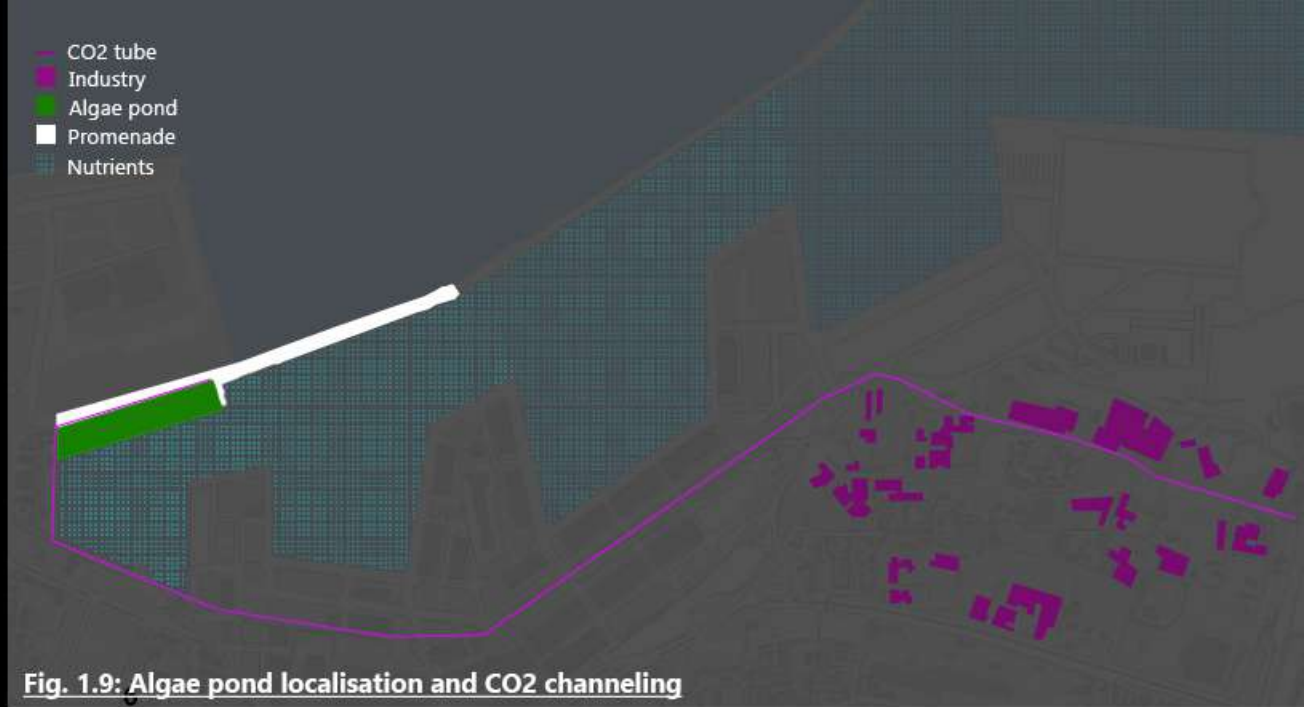
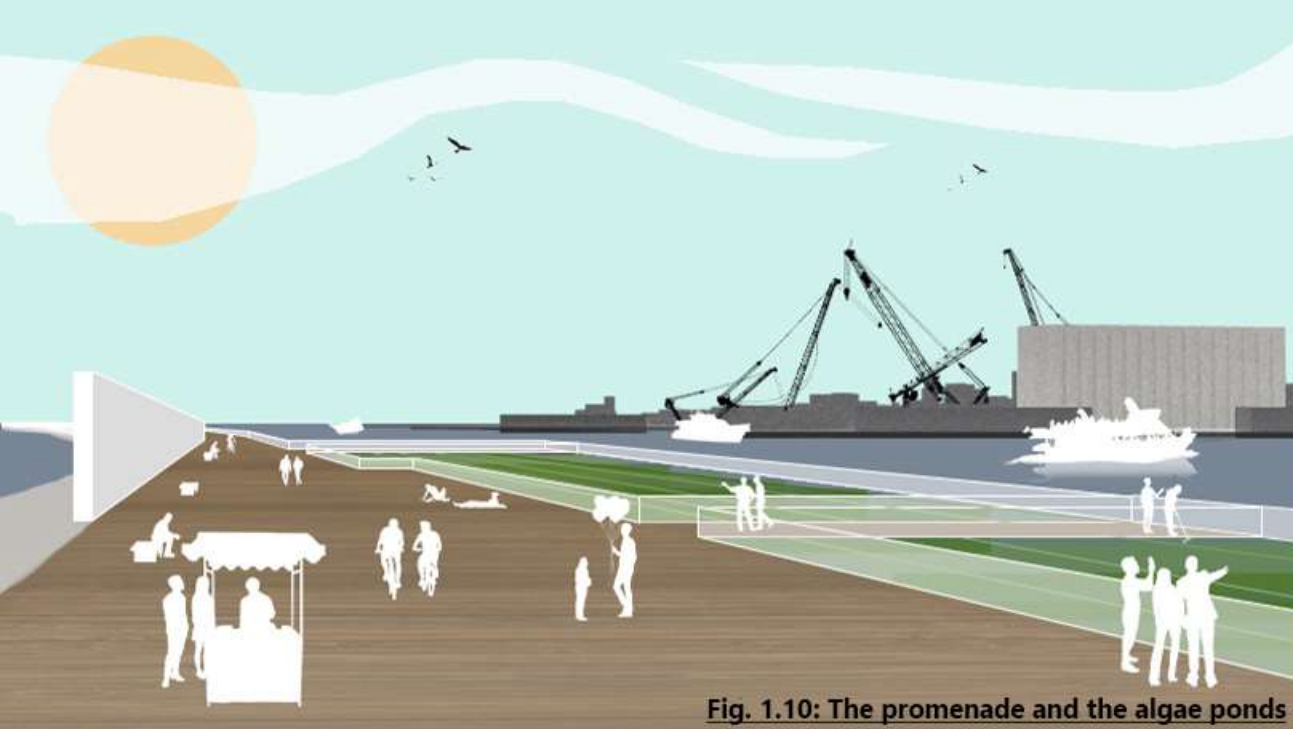


Fig. 1.9: Algae pond localisation and CO2 channeling

The installation of a new breakwater using a modified caisson typology designed to host a public promenade on top as well as a tube channeling the CO2 collected from the industry zone around Karantina. Aquafarms would connect to this tube and be placed in basin 1, where an excess of water nutrients is found.

The algae ponds would play a key role in forming a new cycle, in a sustainable scheme that aims on using the algae ponds to lower the concentration of the water nutrients in basin 1's waters which will help the farms prosper. These farms would be boosted by the CO2 collected after the installation of collectors in

each individual factory in the nearby Karantina area. The algae cultivated would be sent to a refinery that would separate the algae oil for biofuel production which would be sent back to the Karantina industries, and the algae, as biosolid nutrients that would be sent to different industries (make-up, agriculture, animal food...).

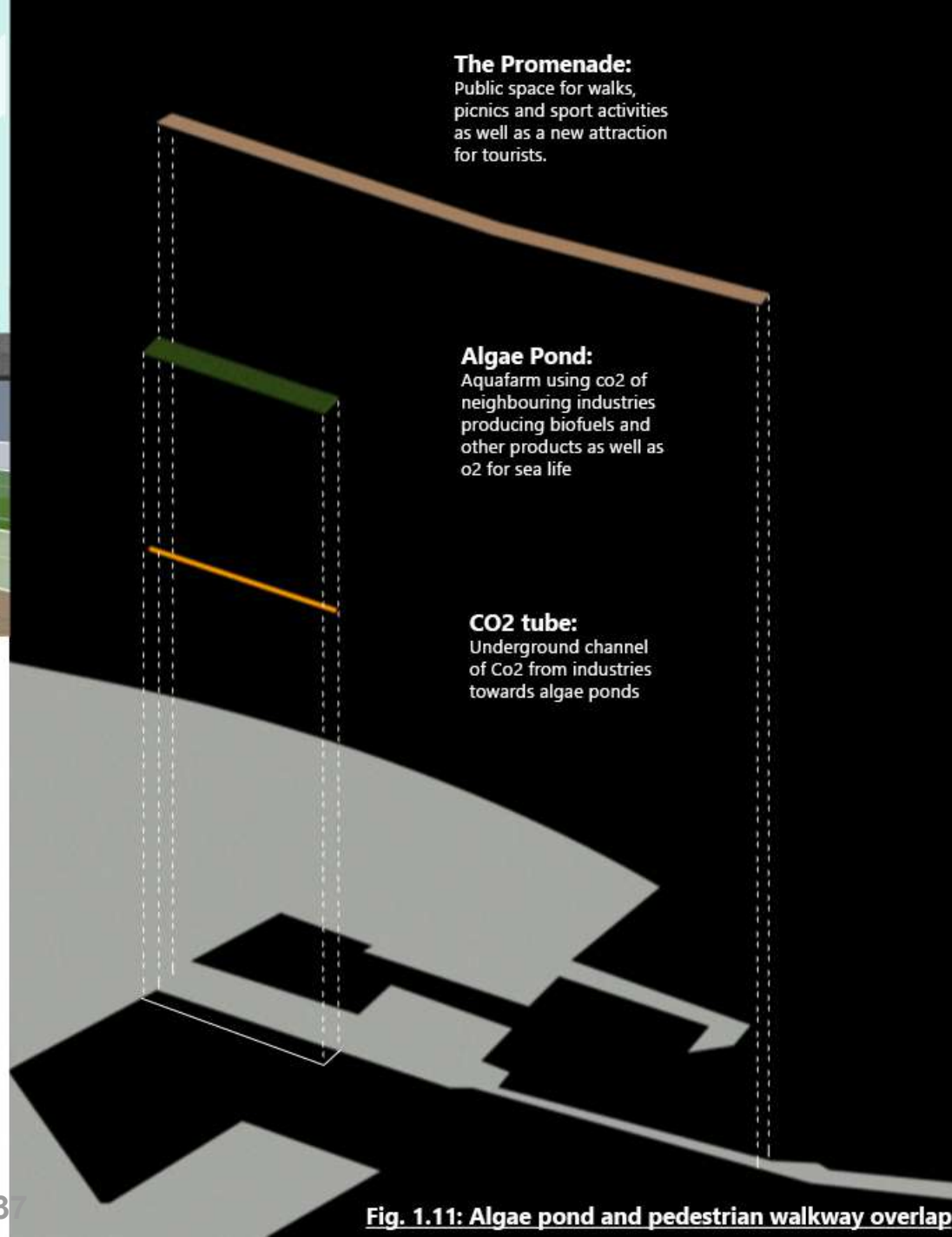


**Fig. 1.10: The promenade and the algae ponds**

The breakwater in the port of Beirut is a primitive one, with no additional function other than the traditional one, although its extension in front of the port for almost 3 km, makes of it a dominant element in its organisation and form and thus can play a role by hosting new functions to revitalise the area and attract new visitors.

The location of nearby industries and the Co<sub>2</sub> emitted can be used to enable the introduction of algae aquafarms along the breakwater, by capturing the emitted co<sub>2</sub> and pump it inside ponds where algae would flourish and later on be cultivated.

The new Breakwater would be able to accommodate a tube channeling the co<sub>2</sub> captured from industries to the aquafarming ponds, with algae being used as biofuel or other products from plastic to sediments. Another element would be the promenade, which would go along the breakwater giving the public unprecedented views of the port, making the relationship between people and port even stronger.



**The Promenade:**  
Public space for walks, picnics and sport activities as well as a new attraction for tourists.

**Algae Pond:**  
Aquafarm using co<sub>2</sub> of neighbouring industries producing biofuels and other products as well as o<sub>2</sub> for sea life

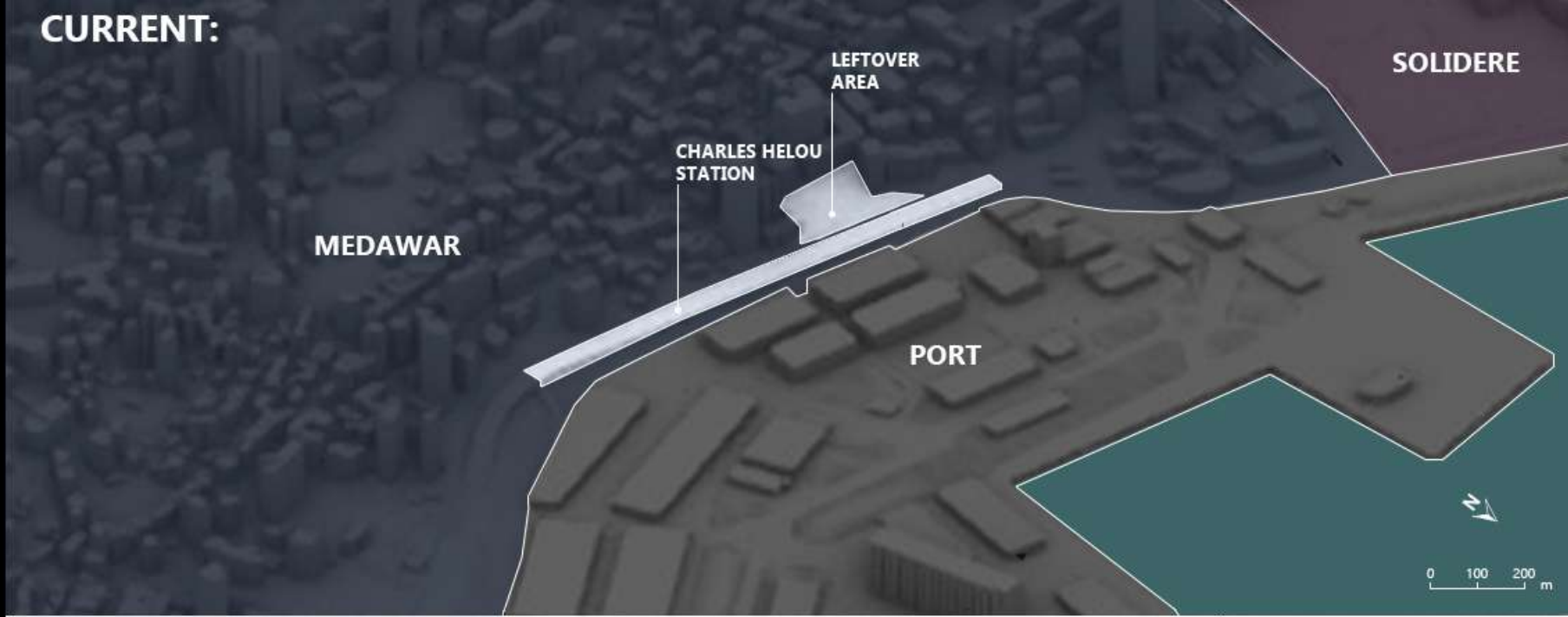
**CO<sub>2</sub> tube:**  
Underground channel of Co<sub>2</sub> from industries towards algae ponds

**Fig. 1.11: Algae pond and pedestrian walkway overlap**

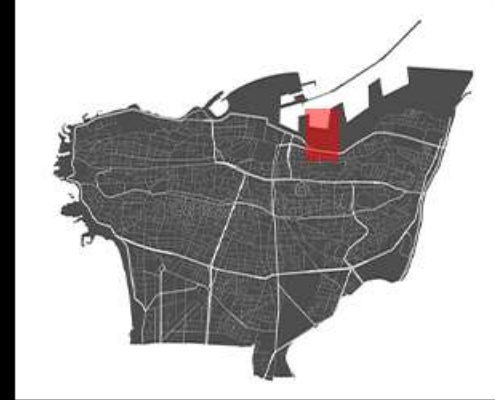
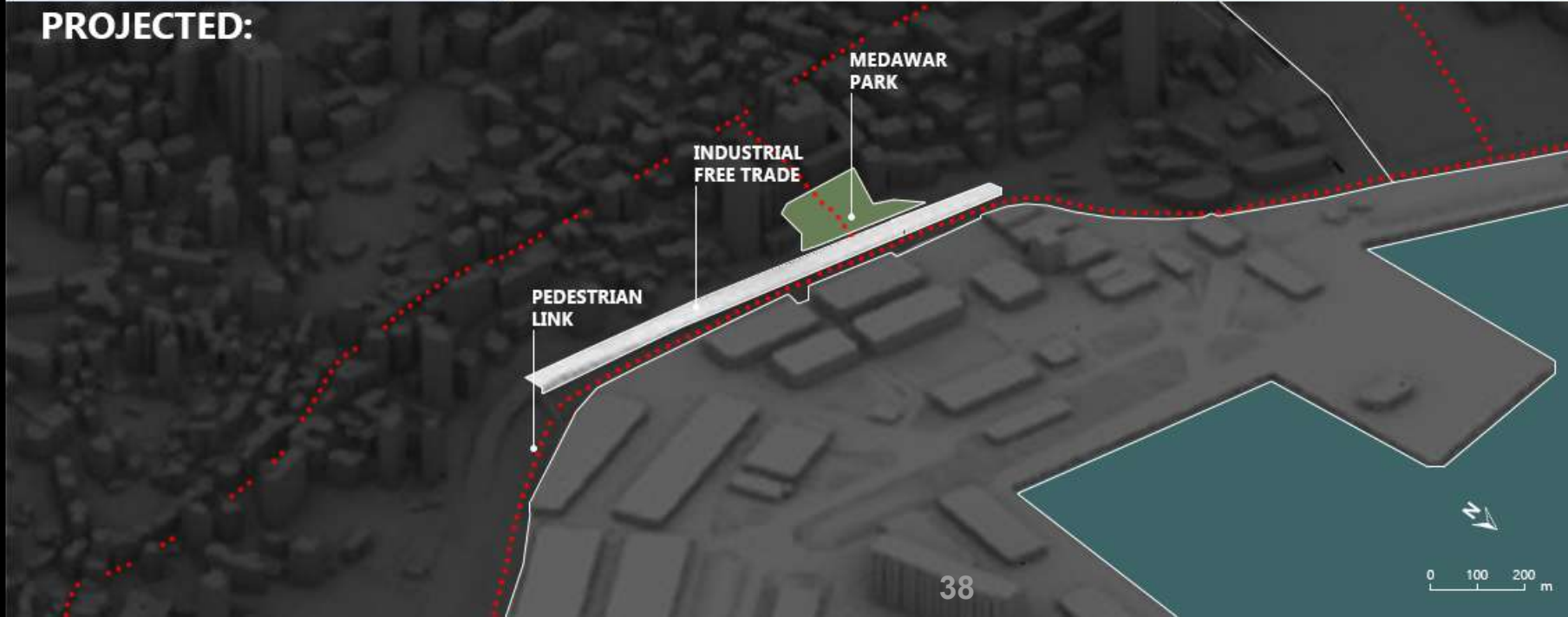


# STRATEGY A: CHARLES HELOU STATION

## CURRENT:



## PROJECTED:



Interstitial spaces, in between port and city are key to the identity of the port in relation to the rest of the city. Using these spaces to develop and innovate in programs and designs that would provide trade opportunities as well as recreational spaces would strengthen the connection and familiarity between port and city.

In this section, the Charles Helou retired bus station and its surrounding area are investigated for their strategical location parallel to the port, thus form crucial nodes connecting both East from the city center, West towards Karantina street, as well as North from the waterfront, South towards the residential areas of Medawar.

Charles Helou bus station is one of the largest pieces of infrastructure in the city that has caused a significant separation between the urban streets and the port, leaving a lot of leftover spaces along its borders, that are currently neglected and used as parking lots or green residual spaces.

These spaces, as well as the station could become landmarks in the public domain.



# REVITALISING CHARLES HELOU STATION



Fig. 1.12: Charles Helou station localisation

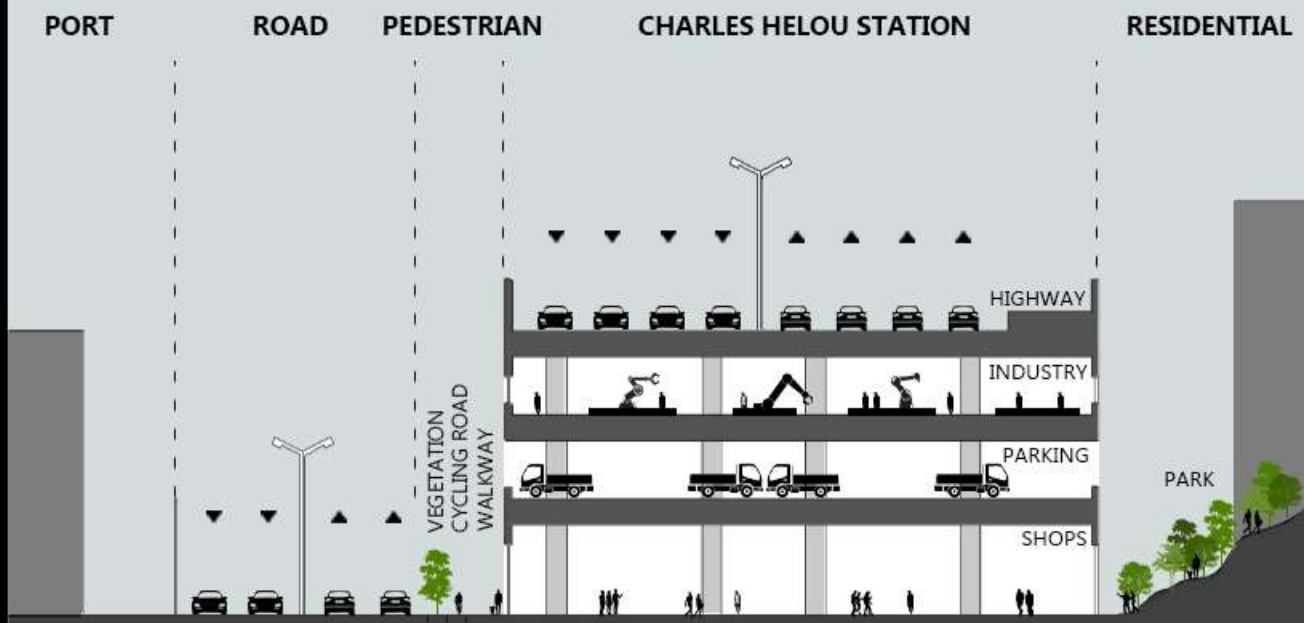


Fig. 1.13: Charles Helou station, corridor and park section

The location of the Charles Helou station in between the port and the city, with the highway passing above gives it the possibility to link the residential area in Medawar to the waterfront on ground floor.

The top floor will be equipped with machinery, turning it into an industry that takes in incoming IT parts and equipment, among others, to the port, merging them, post-producing them and placing them on sale on the ground floor of the building. The first floor would be left for parking of cars and transportation trucks.

The leftover space behind the station is envisioned as a residential park that slopes down from the higher level of the residential street to the port level. This park would be used by the local residents as well as the people visiting the new shops.

The pedestrian pathway consists of three parallel stripes, the vegetation and landscape stripe, the cycling lane and the walkway. These stripes link the new waterfront and the Charles Helou station by passing through the commercial port area among other key locations inside the bigger scheme.





Fig.1.14: Charles Helou corridor

The Charles Helou bus station is one of the biggest infrastructures in the city, it used to host the main bus station of Beirut but has been inactive for decades with the station moving elsewhere and is currently used as a parking for taxis.

The infrastructure consists of three levels initially designed for bus and car parking, with only staircases connecting the floors.

An opportunity to make use of the proximity of the station to the port arises by developing an industrial duty free, where industrial elements of products arriving to the port are assembled and sold in shops on the ground floor in a duty free area or delivered from the station.

Another step would be to plan a green, commercial street on ground floor, one that would parallel the barrier set by the port, connecting public and pedestrian activity North to South.

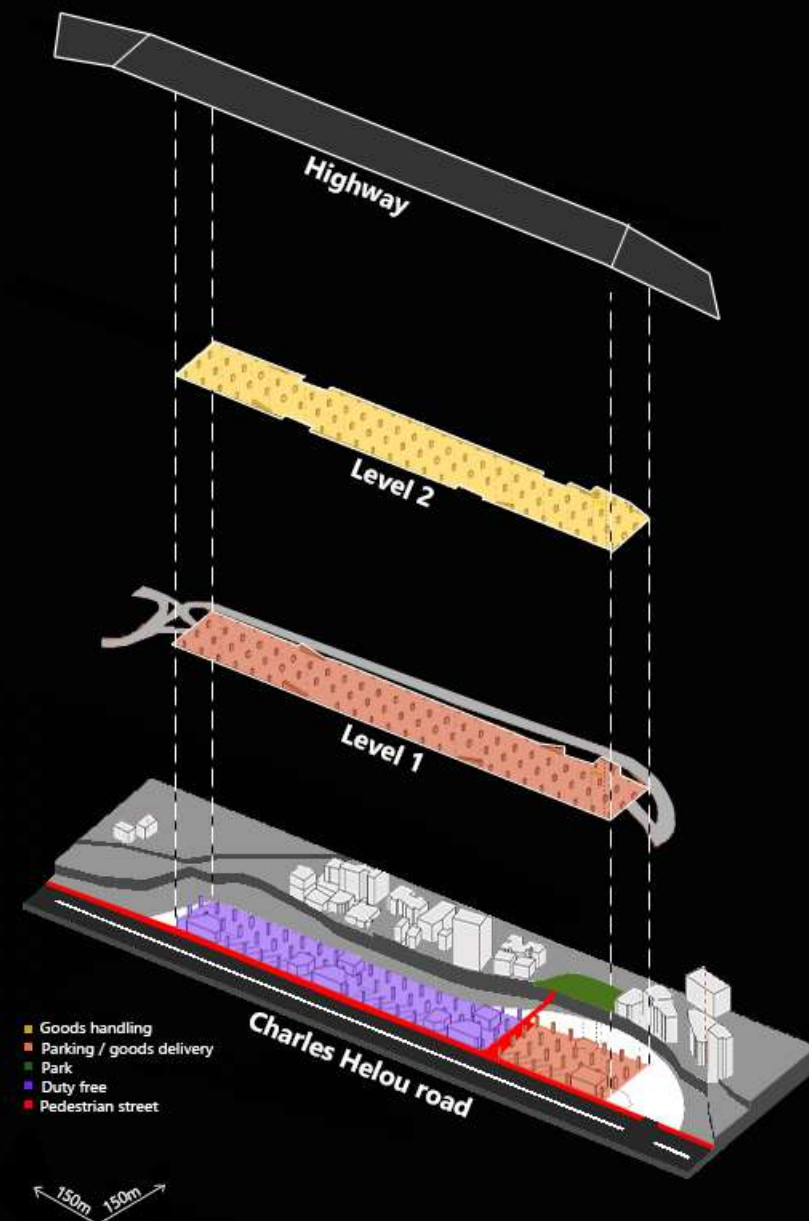
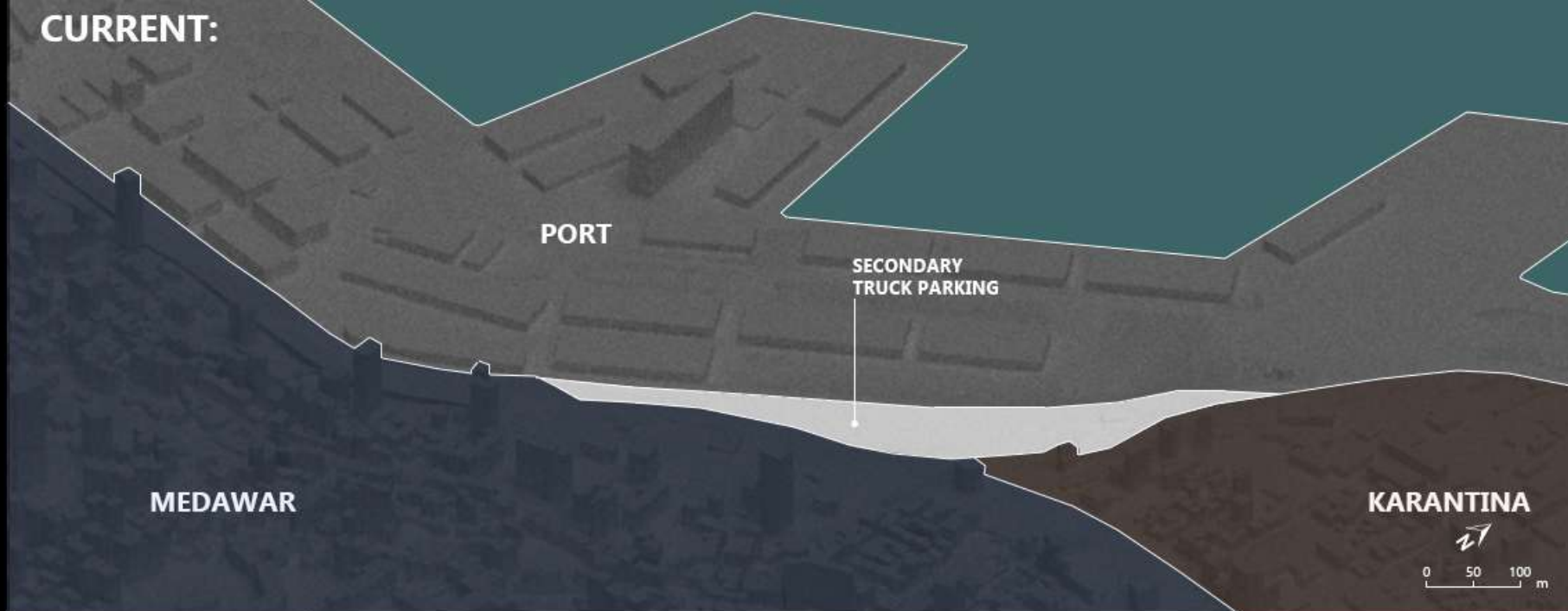


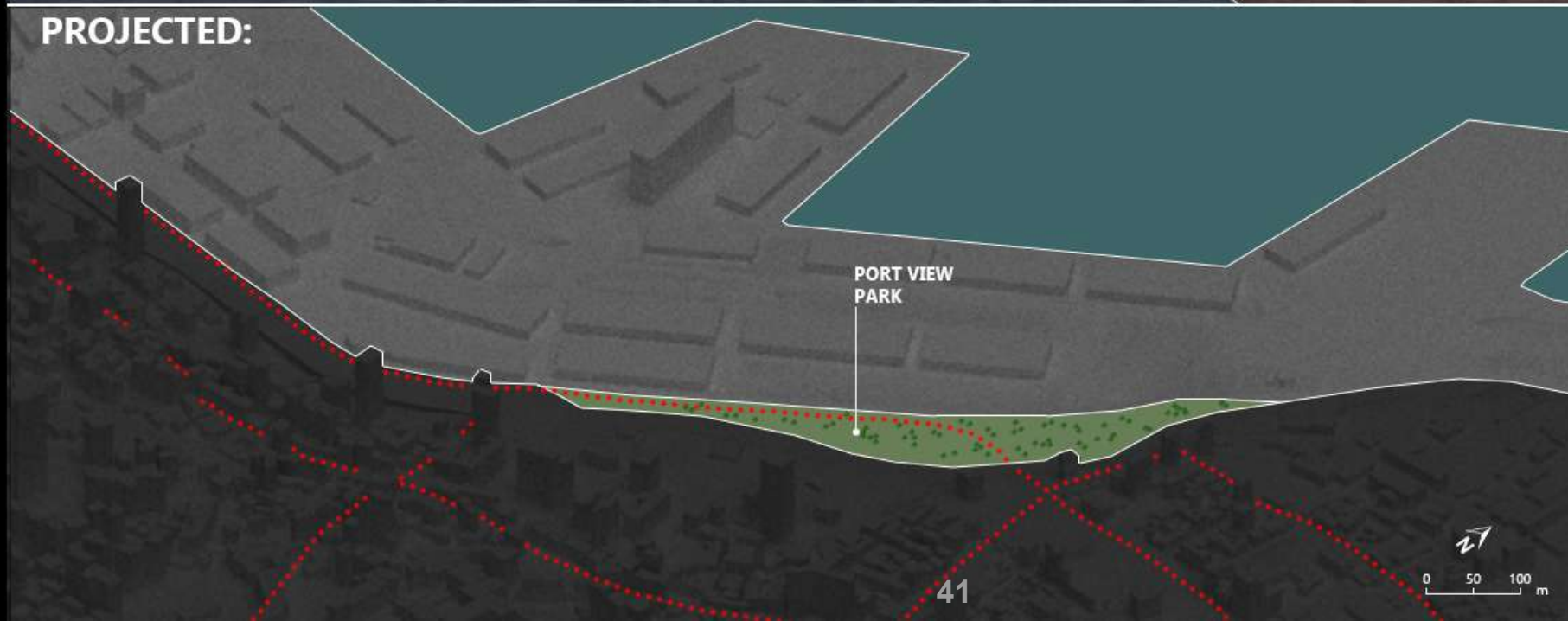
Fig. 1.15: Charles Helou station new program

# STRATEGY A: PORT TRUCK PARKING

CURRENT:



PROJECTED:



The planning and organisation of the port are crucial for both efficiency and program. The port of Beirut has suffered from a lack of organisation, with most of its current parts dating since the end of the ottoman era, others being residual spaces from its bordering with the new construction of the coastal highway. Re-organisation of these spaces could play major roles in upgrading the public domain while maintaining the level of the port's efficiency.

In this section, a secondary port truck parking lot, located on the border of the highway, is investigated as another node, projected as an innovative park design, with views on the port, providing spaces for recreation and commerce between residential areas of Medawar and the port.

This node would link with the projected street of Karantina, maximising potentials to develop the area for social housing and other programs.







The port of Beirut hosts a number of misused areas due to lazy planning and lack of organisation with the current port plan dating in parts since the 1970s. This is clear in the section of the port behind basin number 3 which is used for container handling operations in extension to main container terminal to the East.

In this section many spaces used for truck parking are the leftout spaces between the highway and port limits, and are mostly under used due to the immensity of the plots.

An opportunity to strengthen the port city relationship would be to ease the separation between the two by providing the public with park and recreational spaces, strategically located in between port and city with views to the ships and sea.

The conversion of the selected parking lot into a sloped park would introduce greenery in one of the most polluted parts of the city as well as play a role as another element in the green belt around the port limits.

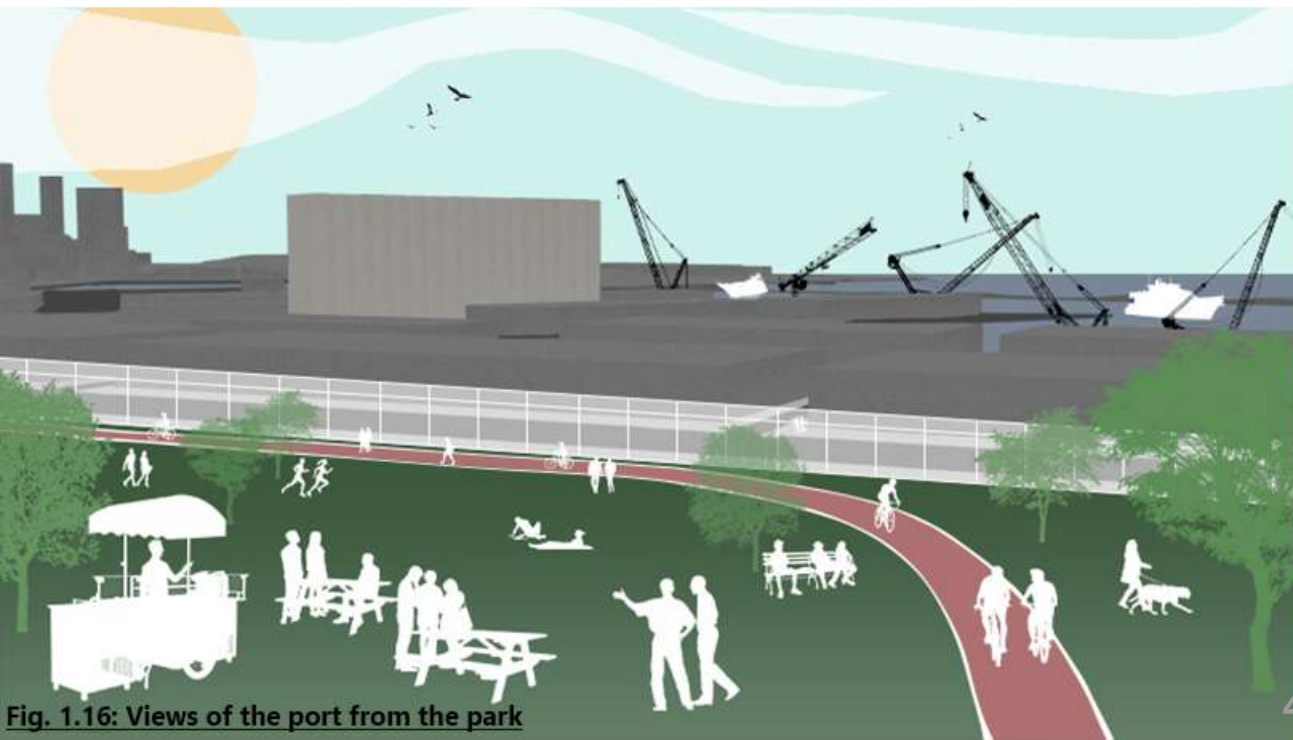


Fig. 1.16: Views of the port from the park

50 m

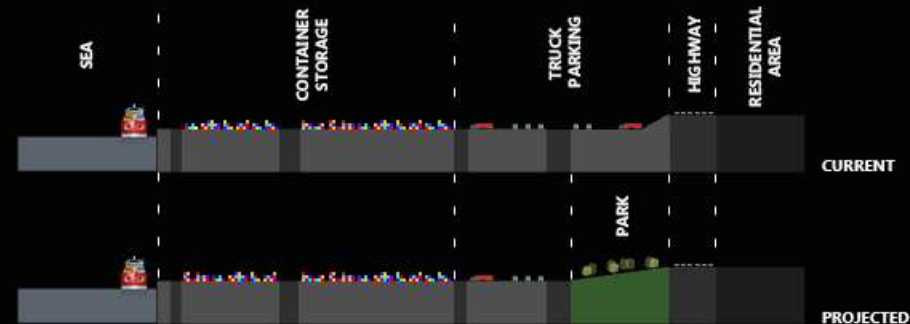
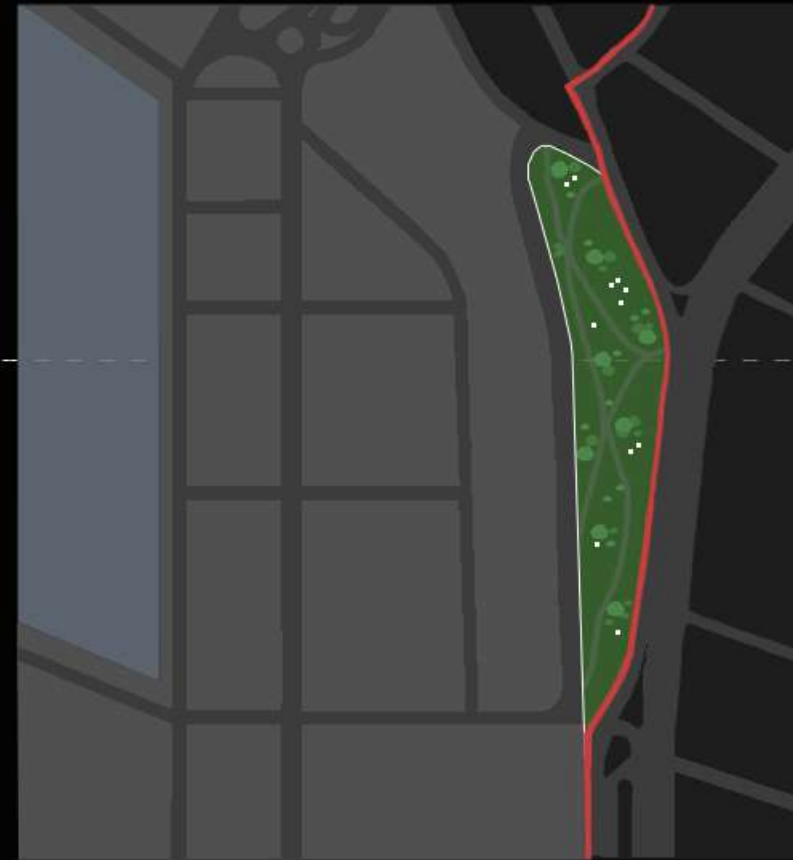
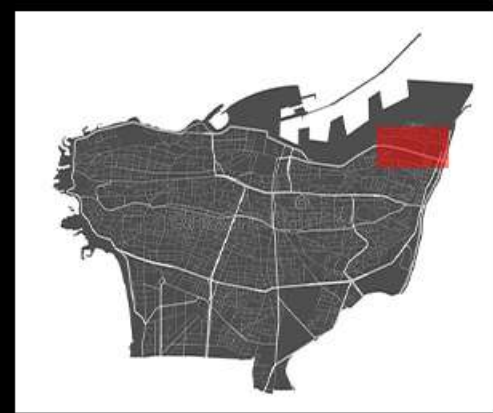
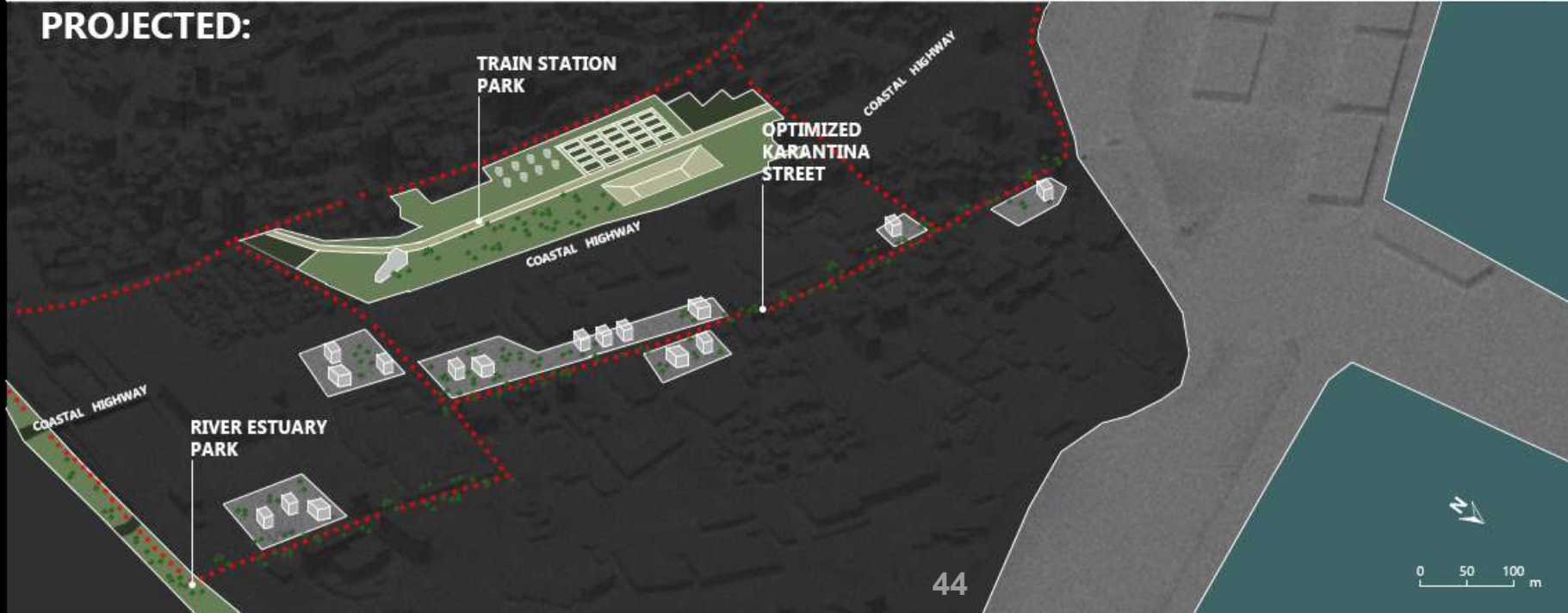


Fig. 1.17: Park localisation and sloped section





The construction of the coastal highway in the 1980s has led to the separation of the residential quarters in the Medawar zone of Beirut from the port and the sea, though one significant part of the city, the Karantina area happens to be located on the northern side of the highway and thus remains an area with a linked identity to its location, adjacent to the port.

In this section, the Karantina sector as well as the near-by retired trainstation are investigated. for their potential to generate a link between the port and the residential zone in Medawar, South of the highway.

The retired trainstation is a big plot at the gate of the city that has no on-going plans for re-development, thus could become a new landmark with enough area to accommodate a large program that would serve the needs of the neighbourhood as well as play a role of a central park in a city that lacks one.

The development of the trainstation would create a new node at the entrance of the city linking to the Karantina street which would make of it an ideal location for future development.







The train station plot is 80 000 m<sup>2</sup> plot on the coastal highway facing Karantina. The trains has stopped working for more than three decades and yet no plan has been made to repurpose the plot.

The area around the plot is a residential neighbourhood on a popular street with a famous nightlife with bars, restaurants and cafes, it has become the main hub for youth, artists and students as well as tourists.

One issue the residents face is the lack of green public spaces that are almost absent not only in the neighbourhood but also very rare in the whole of the city

The conversion of the plot into a park using the size of the plot to introduce a diverse program that fulfills the needs of the residents and visitors as well as help in reinforcing the greenery in the city.

On a design level strategy, placing the skatepark adjacent to the agricultural fields could create an opportunity to use the scape of the skatepark to store the rainwater in times of storm and use it to water the fields.



Fig. 1.18: Mixed program adjacent to one another

## 1 PARKING

Parkings at both ends of the plot to serve the park as well as Armenia street.

## 2 SPORTS

In an area filled with youth, and very low numbers of sport facilities.

## 3 AGRICULTURE

Urban agriculture that would involve the neighbourhood and its residents

## 4 SKATEPARK

The park is also used to store rainwater to be used in the agricultural field

## 5 MARKETPLACE

A market for the cultivated products, as well as a farmers market inside the city.

## 6 PARK

A green space densified with trees and plants, reinforcing biota in the city.

## 7 AL KHODR

A fromal space for cerimonies and festivities, near the emblematic Al Khodr mosque.

## 8 OLD RAILWAY

The old railway line converted into a park promenade.



Fig. 1.19: Park localisation, program and section

Karantina is an almost forgotten part of the city, cut off from the rest by the coastal highway as well as from most of the municipal budget and services which lead to the demise of the neighbourhoods

But unlike the rest of Beirut, Karantina lies on the North of the highway and thus is directly connected to the port and the waterfront.

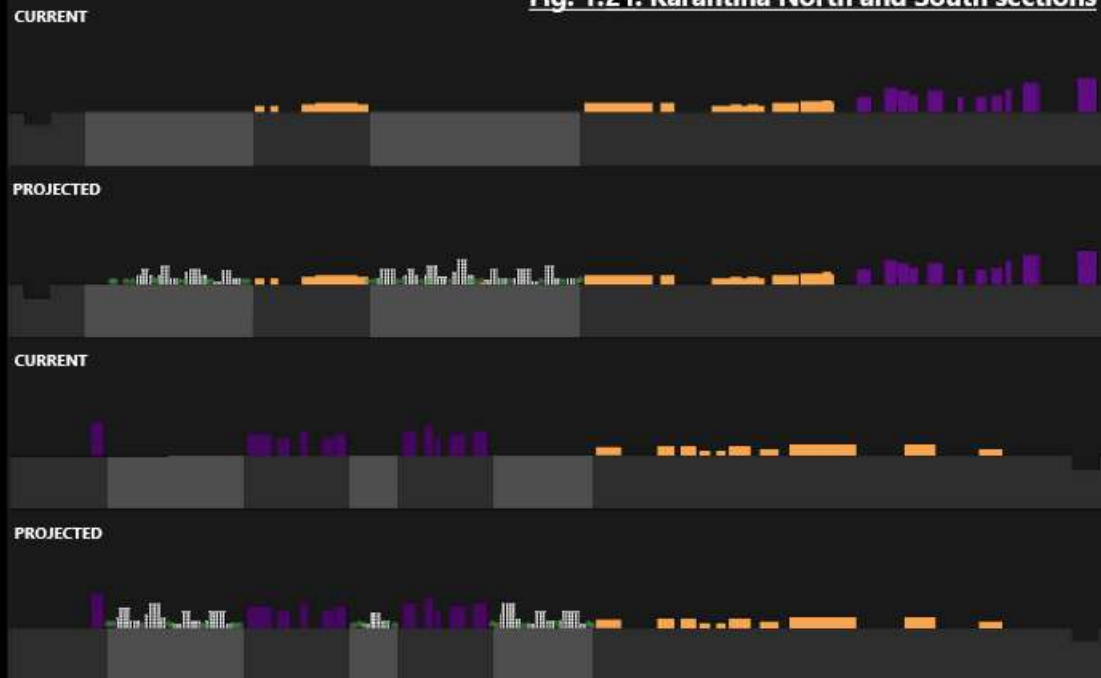
Yet there is a high potential to reinvision the area of Karantina, with it being in most parts vacant with not a lot of built area, its proximity to the city center and its immediate relation to the port that is currently in demise.

The lack of social housing in Beirut and the low prices of land in Karantina compared to the rest of the city, makes the area ideal for such projects.

By identifying potential plots along one street in Karantina that would be linked to the pedestrian green belt formed around the port, a new hub would be created in the city, in an area ultimately linked to port activities.

The main typology to be used for these social housing projects would have to commit to the liberation of the ground floor either for public activities, or for shops, fish markets and other port related flows and activities.

Fig. 1.21: Karantina North and South sections



Average level height: 3.5m

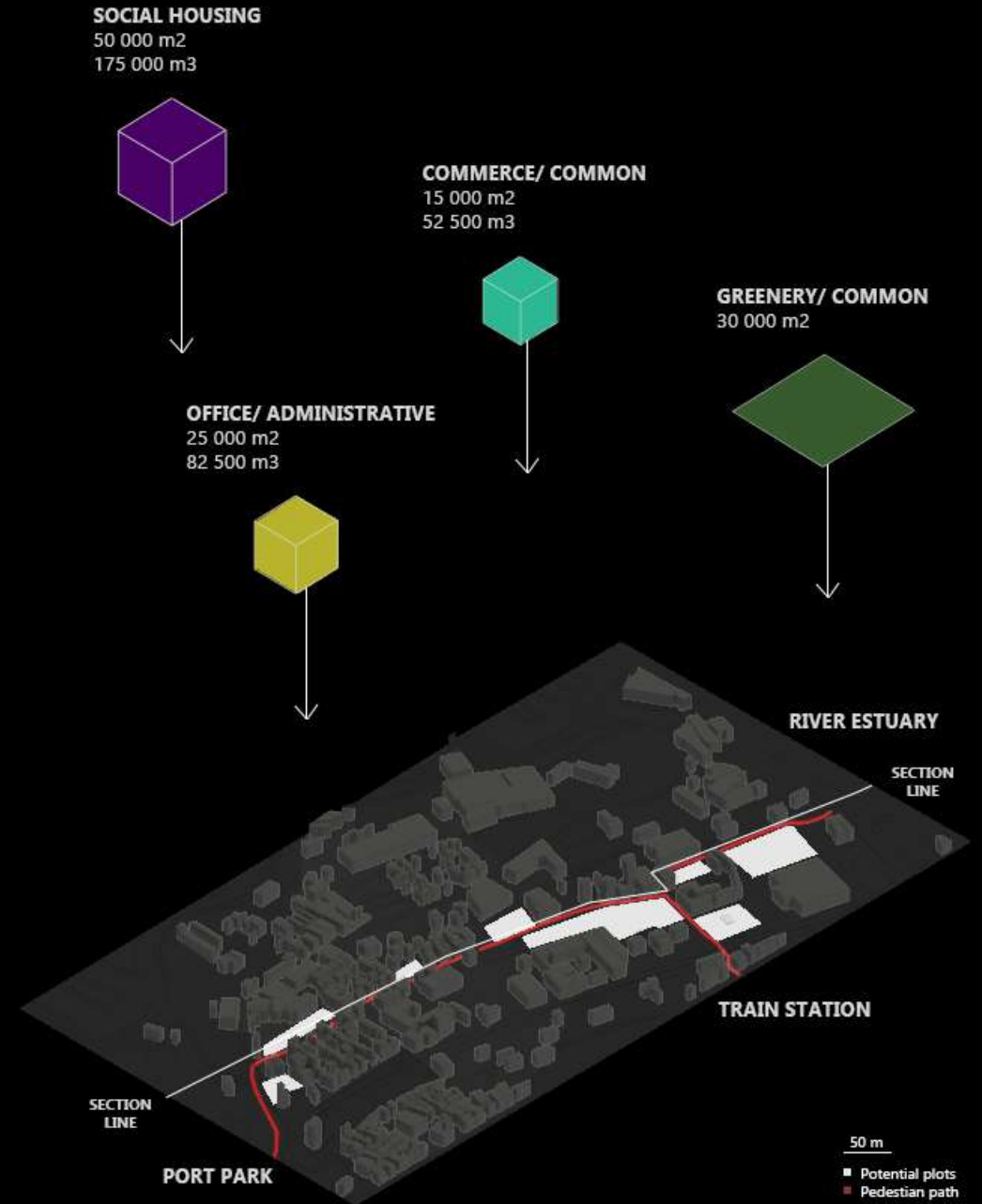


Fig. 1.22: Karantina opportunities and vacant plots



# REGAINING THE RIVER ESTUARY

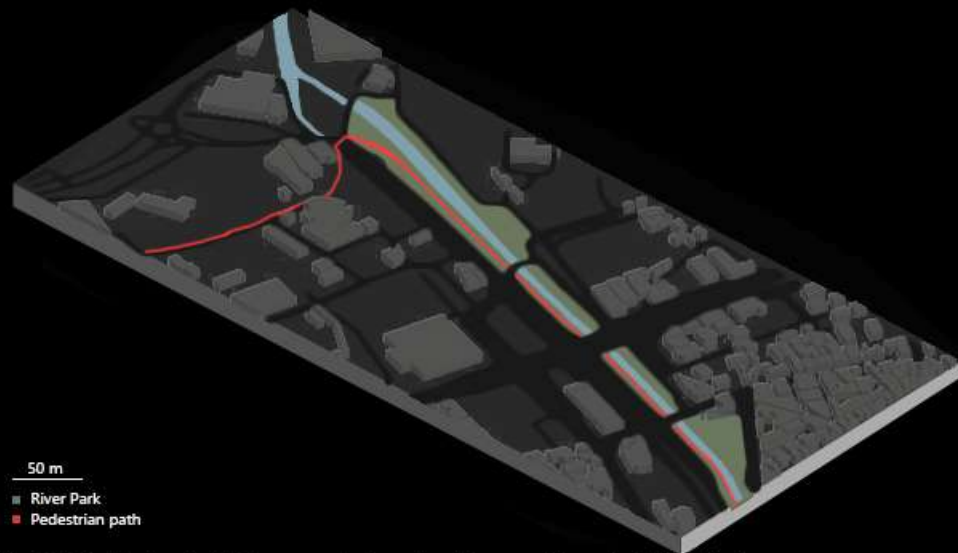
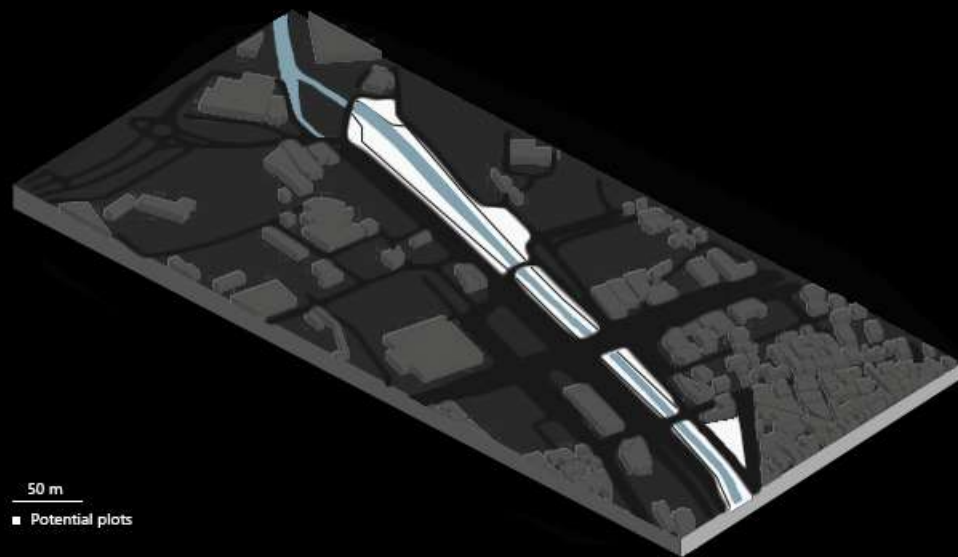


Fig. 1.23: Projected river park localisation and pedestrian links

The river estuary in Beirut, once a green symbol of the city, where the first settlers used to meet in a biodiverse scene, where migrating birds, fish and land animals used to flourish has witnessed a heavy and devastating transformation along the years that has made it into one of the most undesirable places to be in Beirut.

From the water bottling companies cutting off most of the fresh water from reaching the city, sewage systems dumping their waste in the river and most notably, the transformation of the river ground from natural soil to a concrete ground and walls turning the river into a literal huge concrete sewage channel.

In this step, the focus is on the extra space inside the river limits that is left due to the river being dry of most of its fresh water, this space, merged with some vacant plots along the river.

These spaces have the potential to change image of the river back to its original one of a biodiverse, public friendly area, one that would also play a major role as another element in the green belt projected around the port barrier.



Fig. 1.24: River park as a recreational space



## **STRATEGY B**

### **NEW RIVER SYSTEMS WASTE WATER TREATMENT AND PORT EXPANSION**

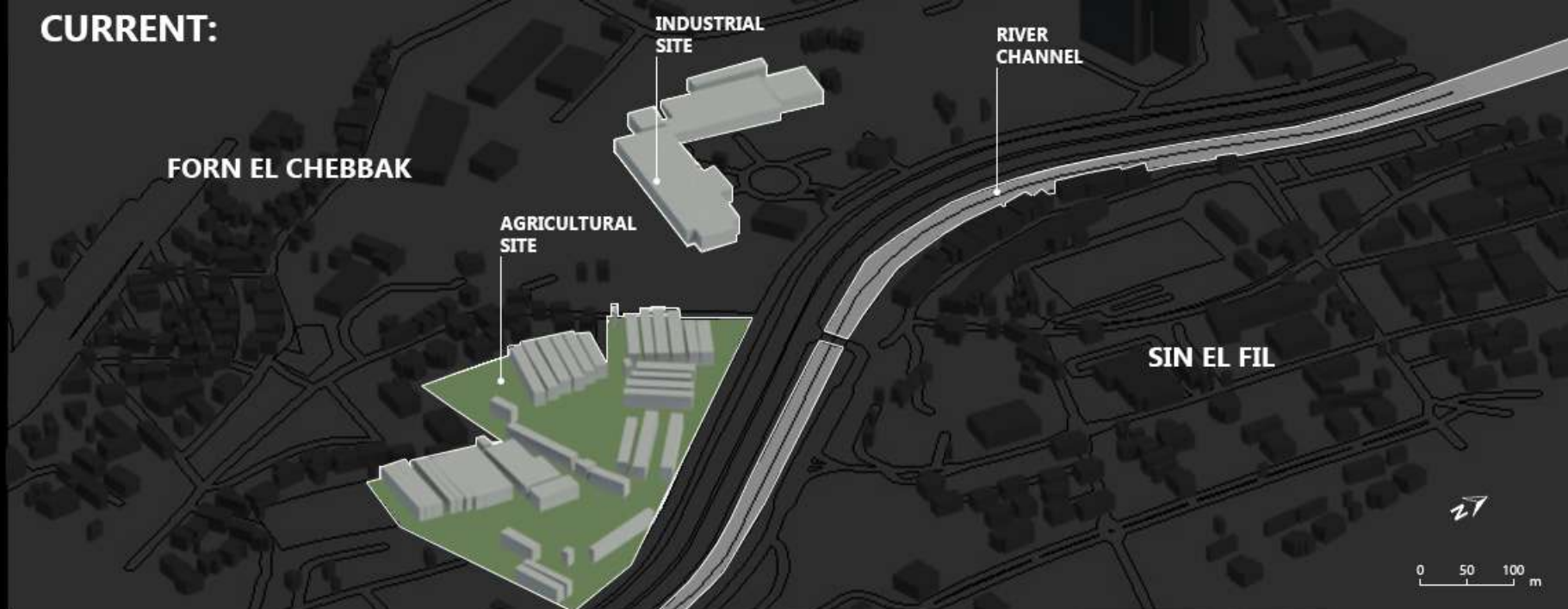
This strategy aims on upgrading the current river system throughout its length, into an important multifunctional piece of infrastructure, which would be indispensable for the previous step of regaining the waterfront estuary.

The river systems lead to implementing a water treatment plant already proposed on the waterfront near the river which would fit in the plans of expanding the port to the eastern side of the river.

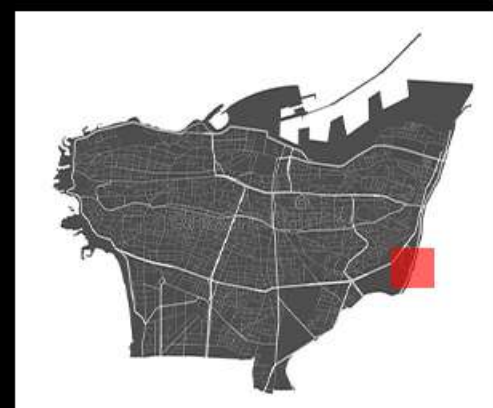
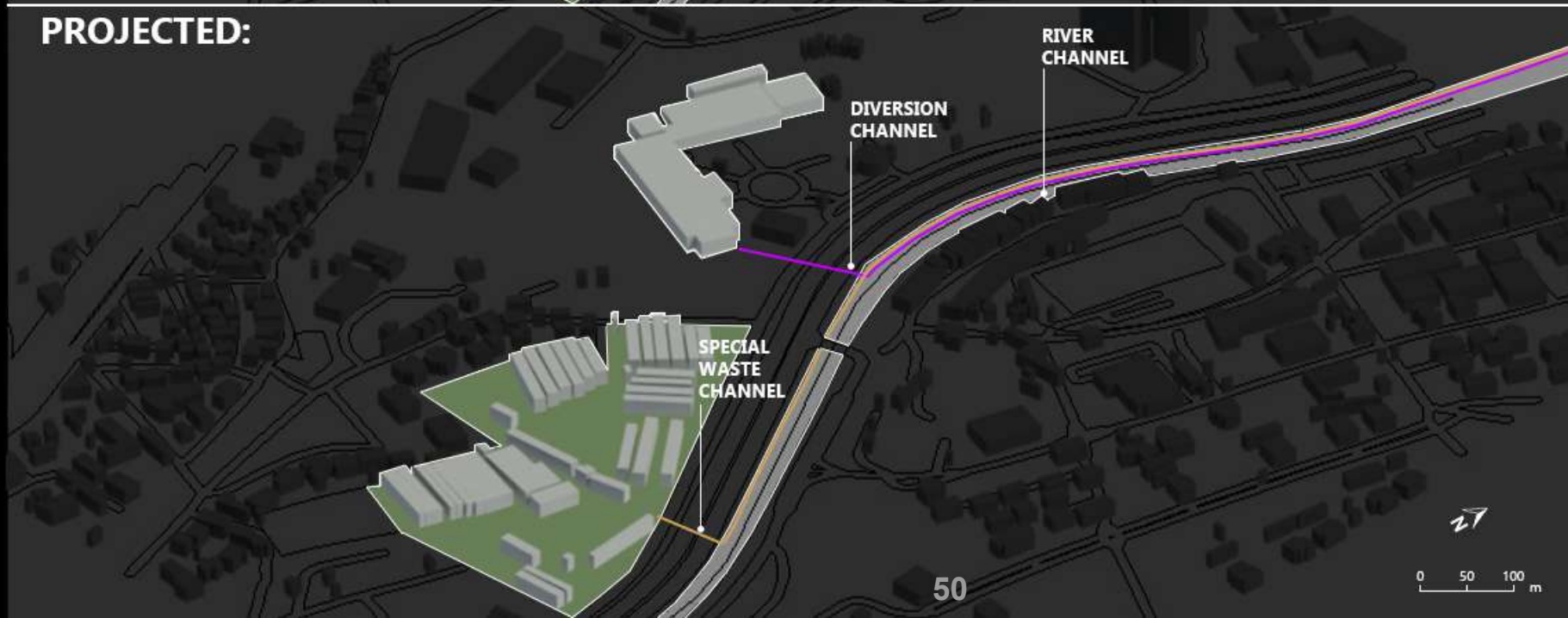


# STRATEGY B: RIVER MITIGATION

## CURRENT:



## PROJECTED:



The Beirut river, once a natural resource where both biota and people would meet is now dried out for most of the year, due to water bottling companies taking most of the fresh water. The river is also used as a sewage waterway, causing stench in time of drought.

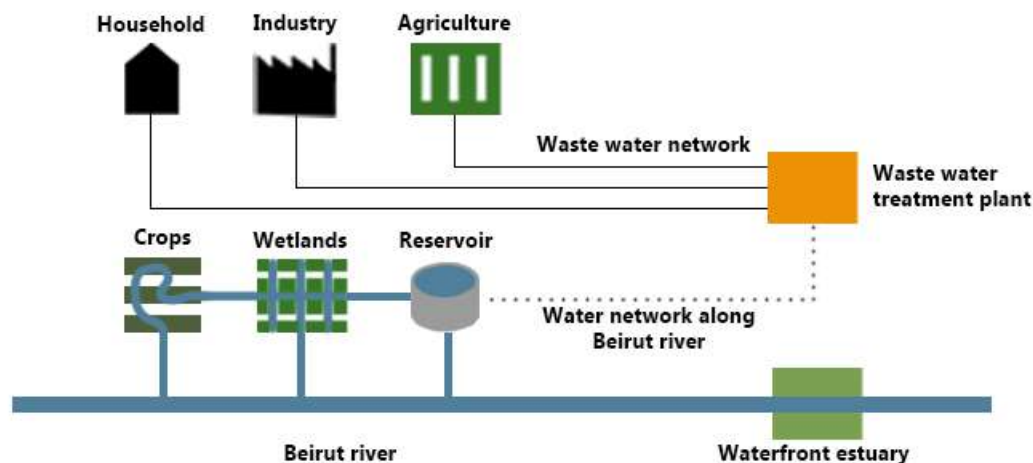
In this section, the river is investigated for its potential to regenerate biodiversity and public spaces along its length, all the while upgrading its system to be able to deal with the sewage water and collect in time of storms excess rainwater.

This step is inevitable to link the port and sea inwards to the rest of the city, but it also paves the way to locate the water treatment facility near the estuary, at the Bourj hammoud landfill.









**Fig. 2.1: Waste water, water storage and channeling diagram**

The Beirut river plays the role of a crucial element in both flood mitigation as well as sewage water channeling.

Although a heavy role, the river is not equipped enough to deal with these tasks as there are no water storage capacities, no water treatment facilities and no separation between waste and storm water as well.

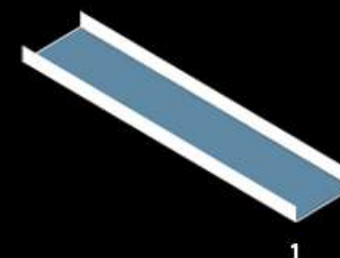
This strategy aims on upgrading the current state of the river into a multi-functional water system that would be necessary for the previous step of regaining the river estuary.

The strategy consists of deploying water mitigating infrastructures along the Beirut river, from storage of excess water, collection of excess water or the crucial channeling and separation of waste water. It would be also able to pump back stored water inside the river in dry seasons to balance the smell of underground waste water.

These steps lead to the choice of locating the waste water treatment plant on the waterfront at the end of the river to strategically be able to receive the channeled waste water.

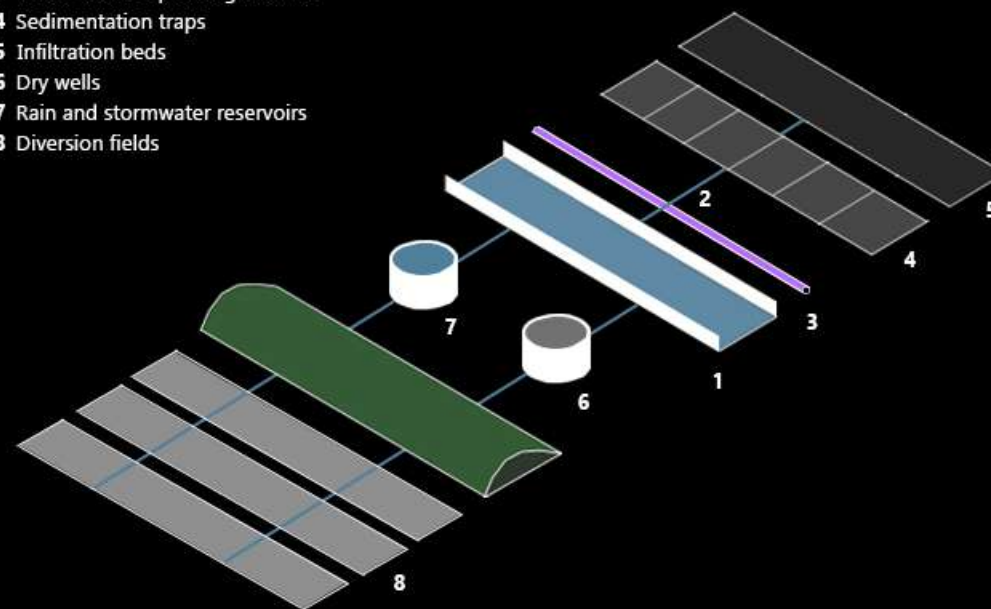
## Current system:

1 Decanalized channel



## Projected system:

- 1 Decanalized channel
- 2 Water network
- 3 Waste water separating channel
- 4 Sedimentation traps
- 5 Infiltration beds
- 6 Dry wells
- 7 Rain and stormwater reservoirs
- 8 Diversion fields



**Fig. 2.2: Projected river system strategy**

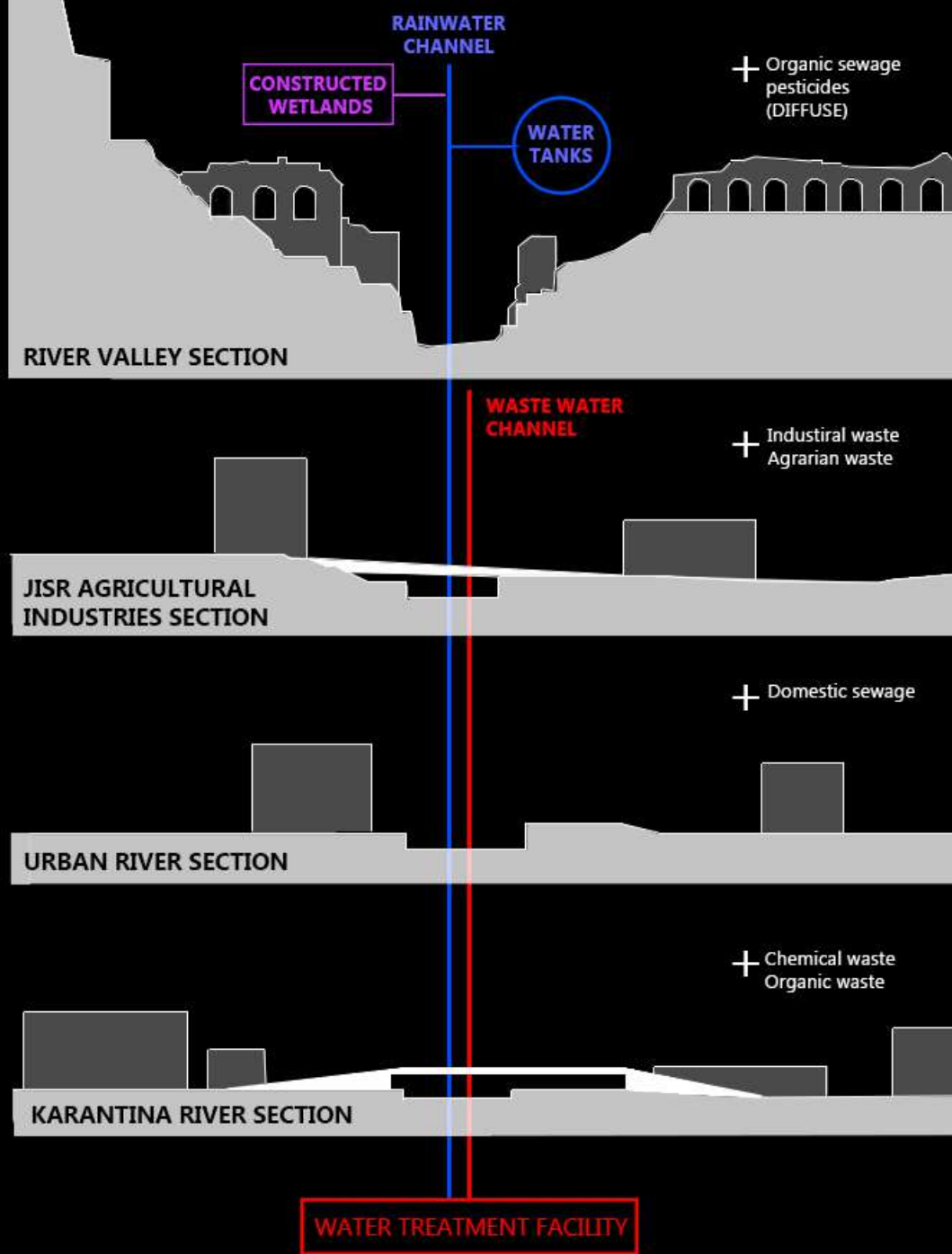


Fig 2.3: Strategy river sections

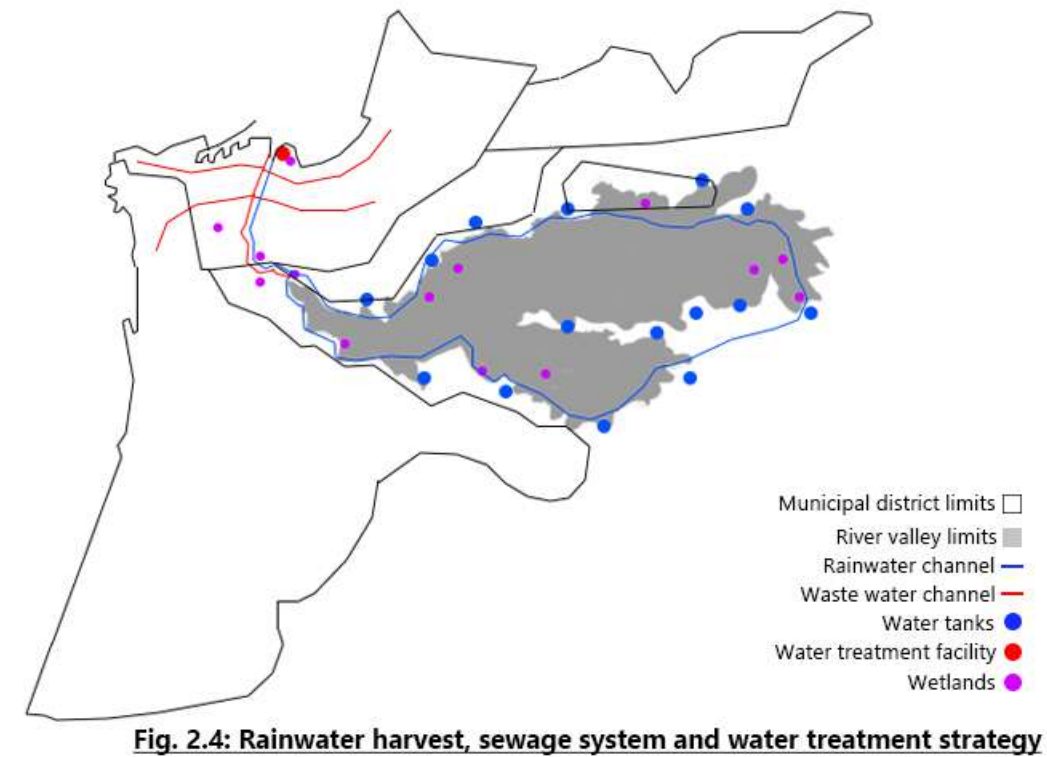


Fig. 2.4: Rainwater harvest, sewage system and water treatment strategy

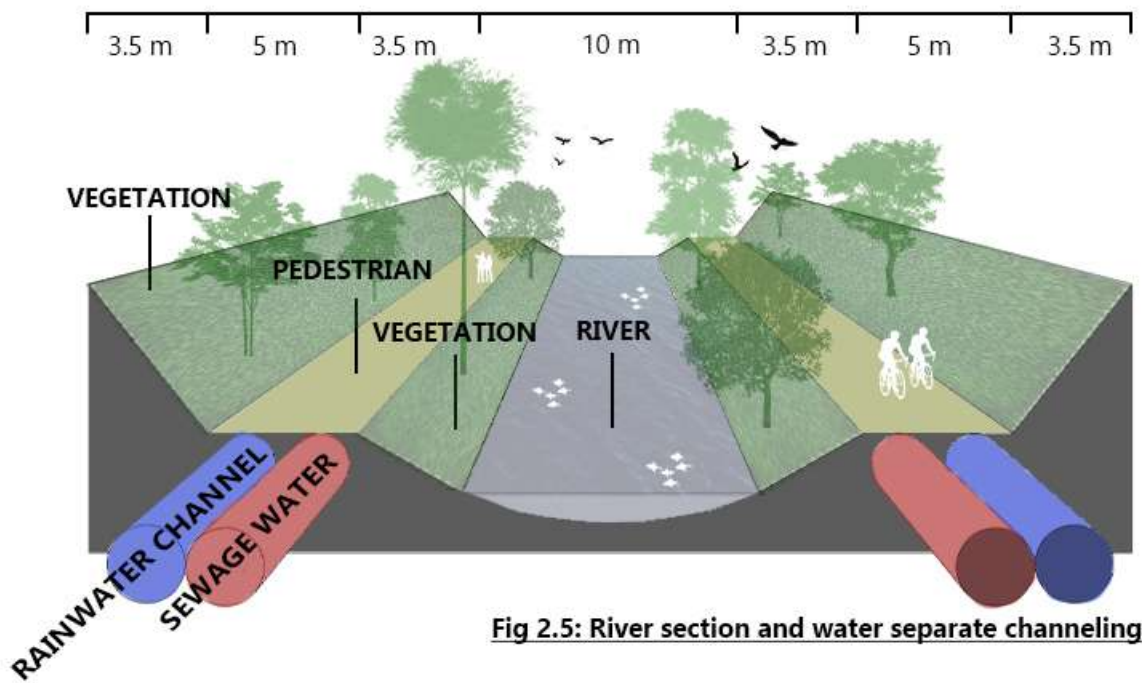
In order to maximise the efficiency of a new water network system that could both deal with the sewage dumpings in the river banks as well as capitalise on the opportunity to collect and store rainwater, we need to zoom out to the full length of the river to seek out the variety of options in different parts of the river, where the state of the water changes according to the context and in doing so, realising the different needs as well as chances set out by these specific areas.

The four sections analysed are selected in different parts of the river, the first, the river valley section is taken outside of the city's boundaries and thus the state of the water up to this point would be in favorable condition to store due to the clean condition of the river, apart from diffused pesticides in the natural soil.

Water tanks and constructed wetlands could become new ways to deal with the water storage and provide safety in times of storms and floods. The second section is set in the JISR area, where industries and agricultural fields have become infamous pollutants of the river due to the industrial waste and agrarian waste that due to the low flow of water in summer time, cause a stench and give the river a redish colour. These problems could be dealt with by the stored water in the tanks around the previous section.

The rest of the sections are inside the urban neighbourhoods of the city, where the waste water channel leads the dumpings of domestic sewage to the water treatment at the end of the river channel.





**Fig 2.5: River section and water separate channeling**

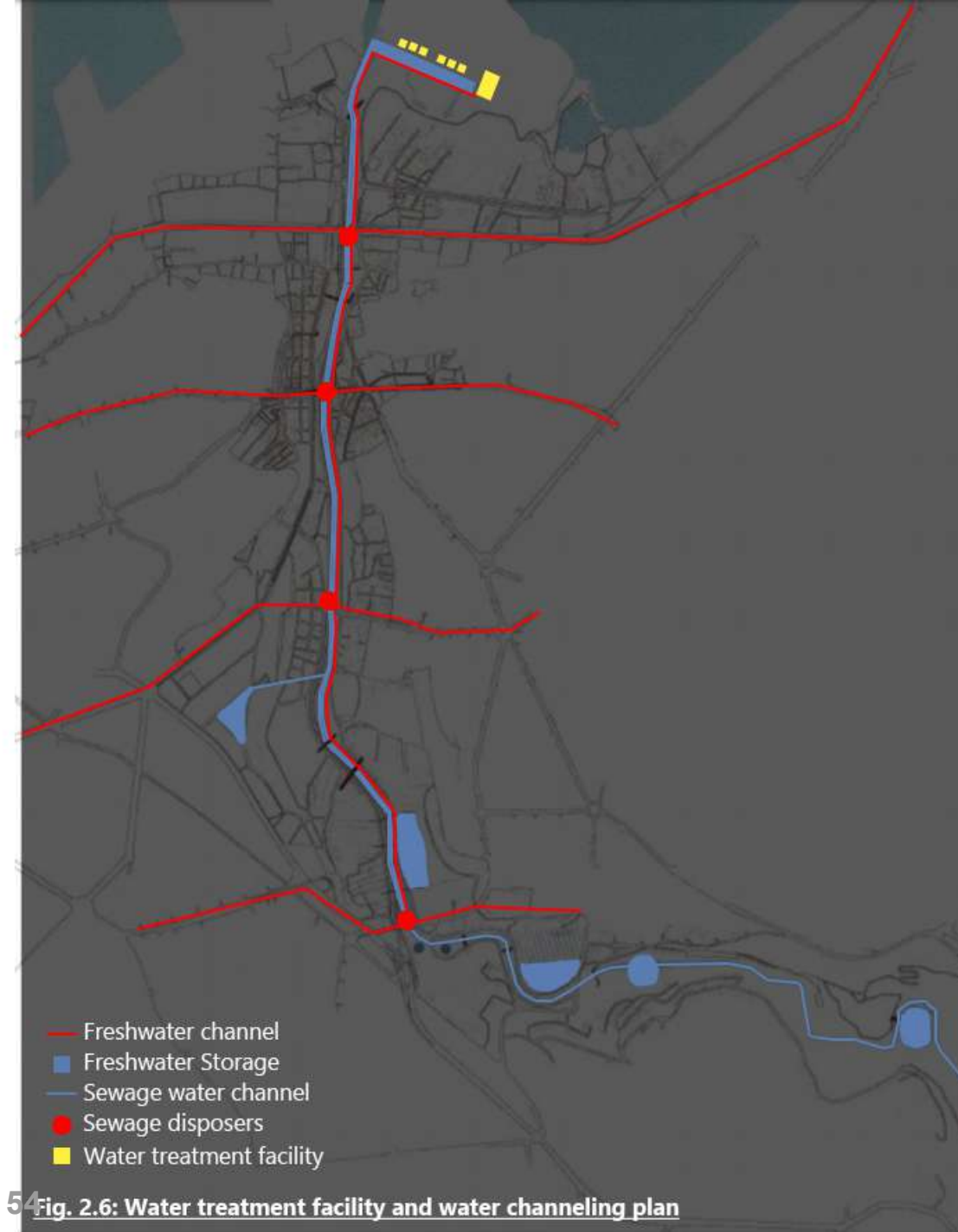
Zooming in on the urban section of the river, the water system plugs into the present sewage channels, currently dumping into the river and connects them to the water treatment facility that is to be constructed at the end of the river.

Water basins and storage tanks located at both ends of the urban section of the river, near the agricultural fields to the south and near the port's borders to the North. These water storages control the level of the water in the river, storing rain water in winter and releasing it in summer.

By controlling the sewage water in underground pipes, the chance for biota to flourish inside the river becomes possible again. Vegetation, from trees, bushes and grass, the migrating birds that fly over the Lebanese coast, and the fish and animals that would be able to inhabit the river water.

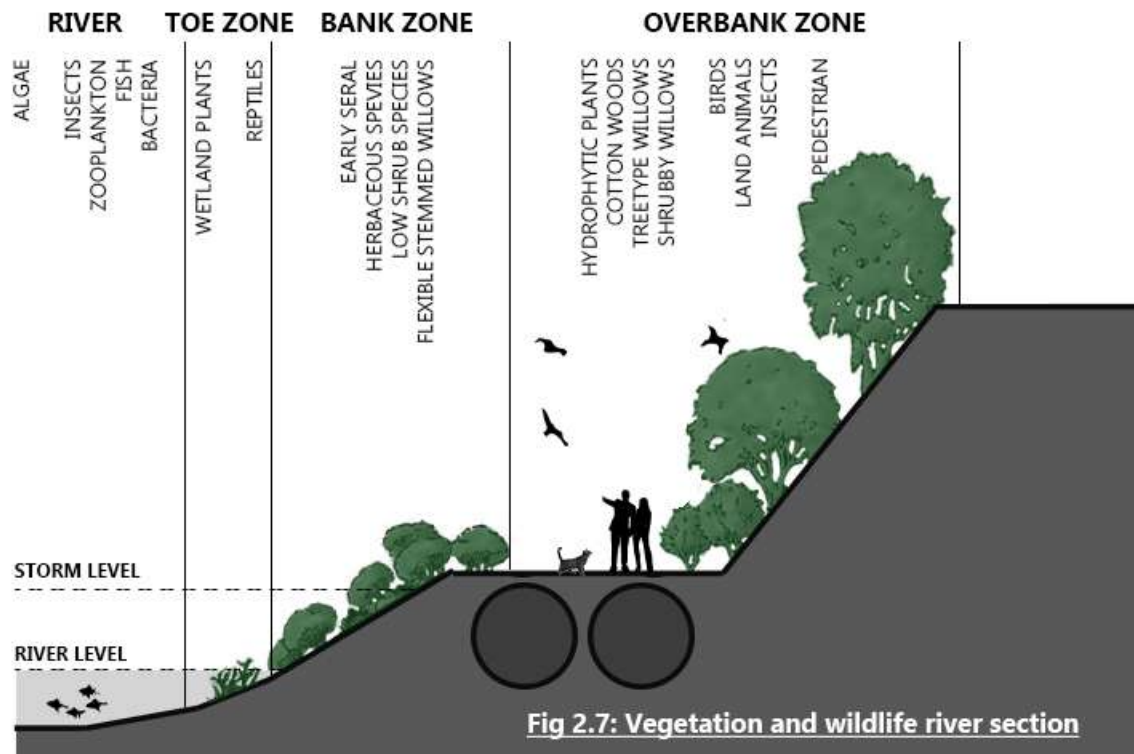
Pedestrian and cycling lanes could be set inside the river linking different parts of the city, to the port.

The river would become a "spine" in the city, where people, biota, freshwater and waste flows overlap in an efficient way.



## UPGRADING THE BEIRUT RIVER

**54 Fig. 2.6: Water treatment facility and water channeling plan**



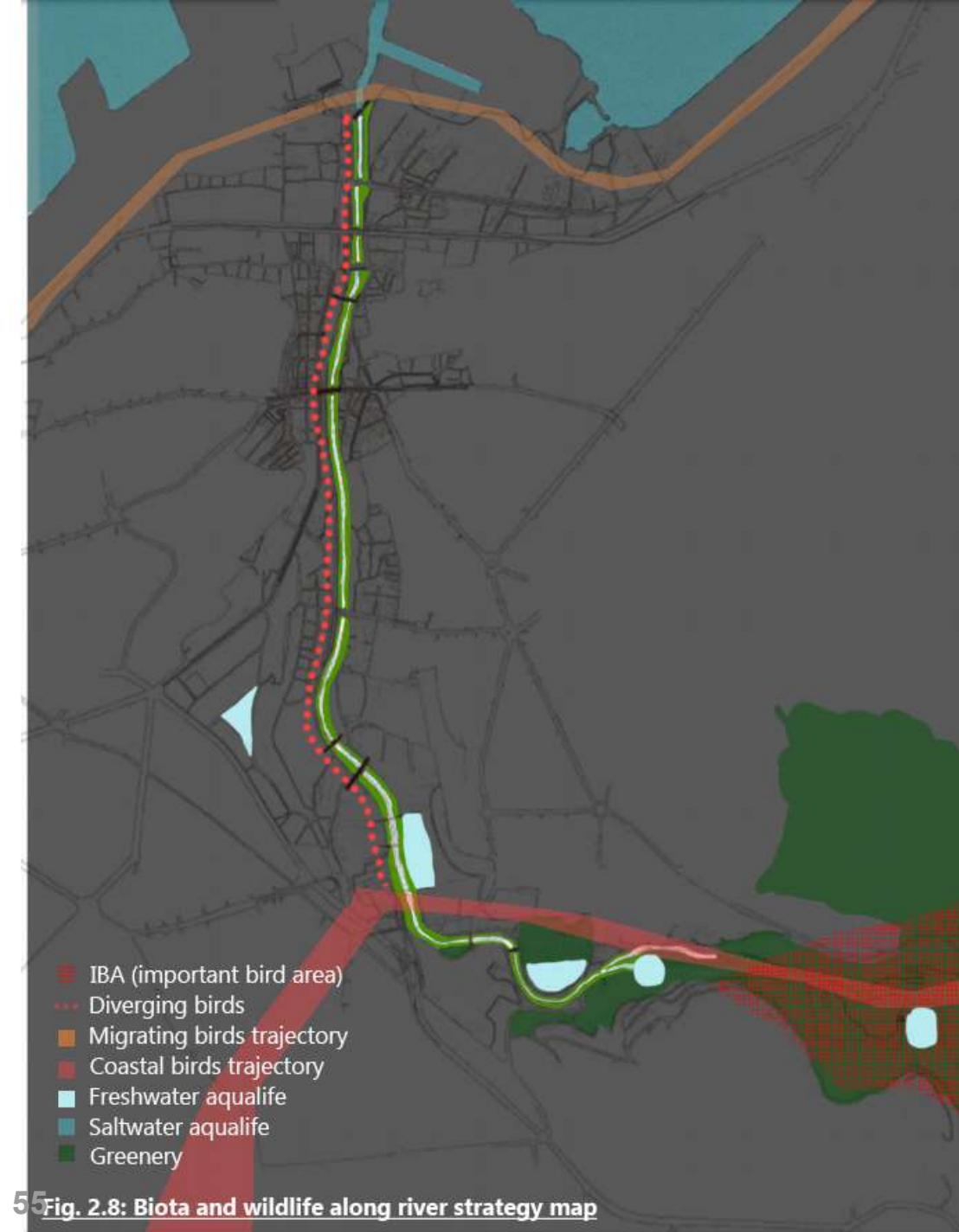
Given the depression of the river section below the city level, a microclimate can be formed. By replacing the walls of the channel and replacing it according to the section above, the riparian ecosystem can be re-established, linking the coastal habitats to the habitats uphill.

The established green corridor would re-introduce flora and fauna along the river inside the city, starting from local species of trees, bushes, grass, animals and bacteria that would have allocated spaces in the new river section that would permit them to survive and flourish inside the perimeters.

This corridor would be very useful for the high amount of diverging birds that travel along the coast, and through the important bird areas inside the country.

Another addition is the freshwater fish life that would first be introduced in the freshwater basins placed along the river, and could then extend into the river channel.

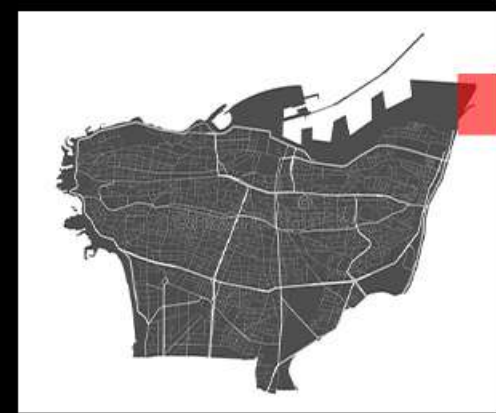
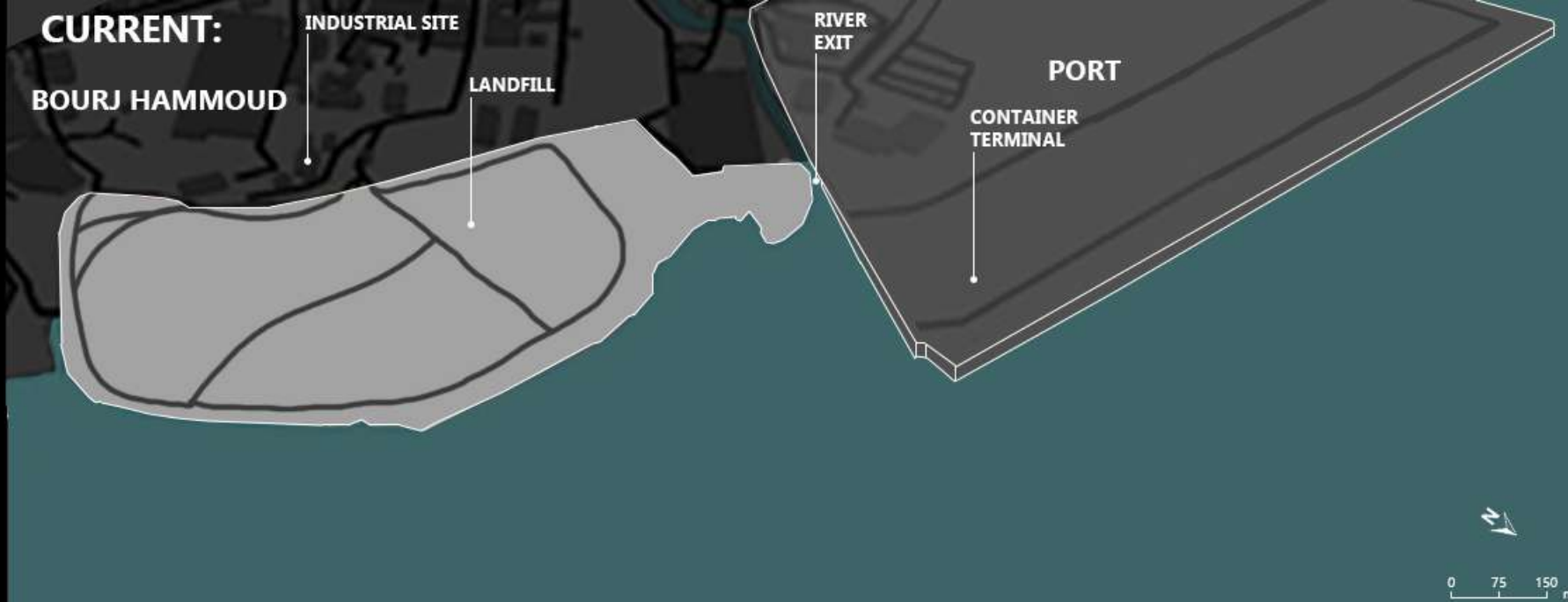
# UPGRADING THE BEIRUT RIVER



55 **Fig. 2.8: Biota and wildlife along river strategy map**



# STRATEGY B: PORT EXTENSION



The port of Beirut is one of the largest in the region. The port is the main gateway for cargo transportation and ports are inevitably adapt to this condition in order to keep up with the market and to maximize profit. This certainly applies to the case of Beirut, where container related activity provides 70% of the total yearly income of the entire country.

In this section, the Bourj Hammoud landfill is investigated as an ideal area to receive the future port expansion, as it is located at the estuary of the Beirut river and is as well adjacent to the port, which makes it both crucial for land expansion of port facilities, storage and parking lots, as well as for the mitigation of the water and the dealing with the treatment of the sewage water flowing inside the river.

Both port expansion as well as water treatment facilities are planned with no definite sites chosen yet. The landfill could be able to host both, while ridding the city the landfill that is located so closely to the residential neighbourhood of Beirut and Bourj Hammoud.

- Water treatment facility location
- Sanitary landfill



**Fig 2.9: Landfill waste evacuation along Beirut river**

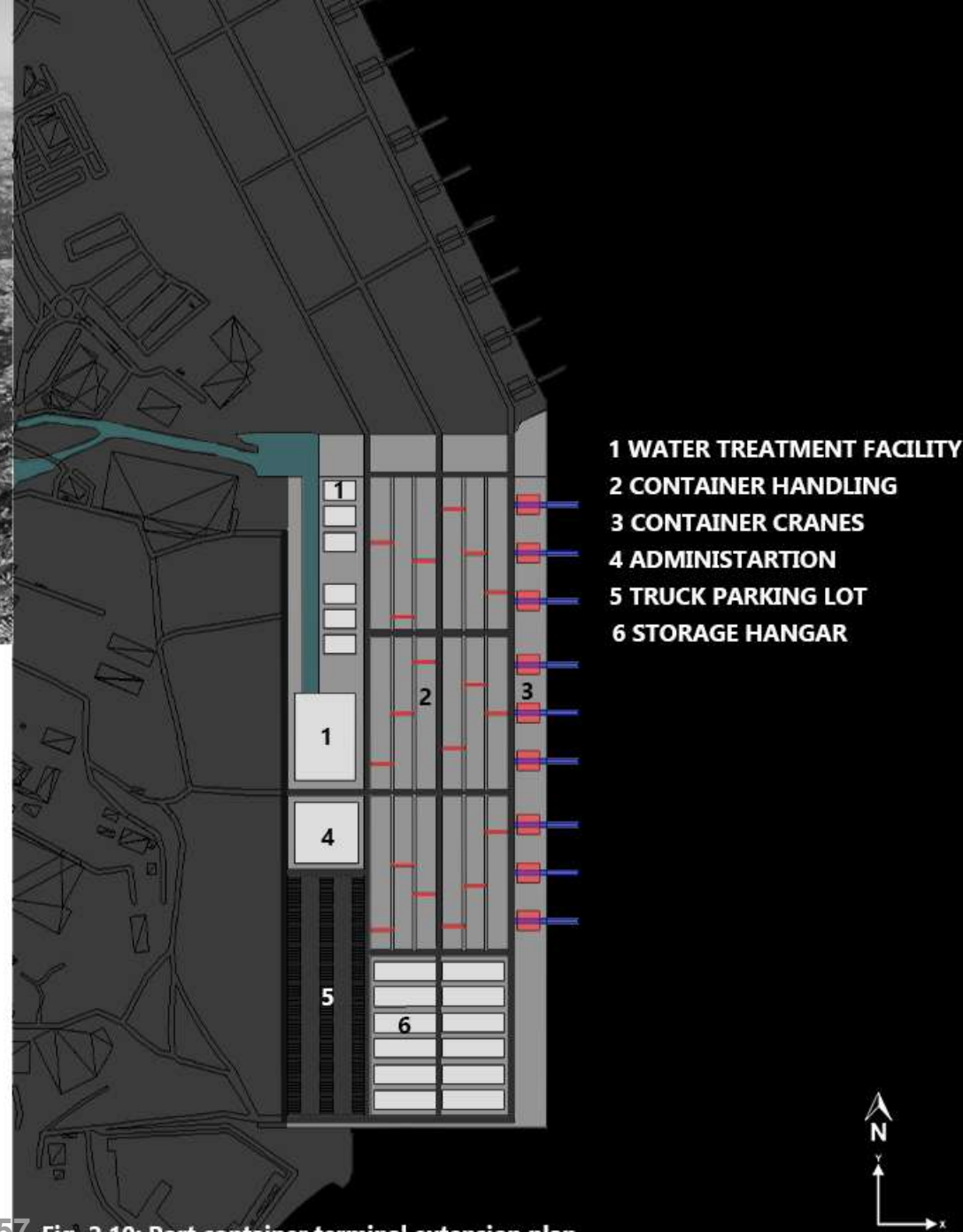
The Bourj Hammoud landfill lies at the Beirut river estuary, adjacent to the current active container terminal.

At the moment, the plot stores a big amount of solid waste which would require a new location to be moved in a sanitary landfill. One important sanitary landfill is located in the Bekaa region, and could become the new destination for waste, emptying the landfill area.

The conversion of the area into the port extension would also require a lot of soil for eventual land reclamation. This soil all the land reclamation projects in Lebanon, would come from the Bekaa area as well, anchoring the relationship of transportation along the riverline, from Beirut to the Bekaa regions.

On the other hand, a water treatment facility has long been planned for the city of Beirut, with no definit location decided upon. The landfill area would be suitable for such a facility due to its crucial location on the edge of the Beirut river, facilitating the water channeling and storage, using the upgraded river system.

Another possibility would be to bridge over the river from the container terminal to the current landfill area, with the option to block off the river completely in dry seasons, preventing the polluted water from reaching the sea.



**57 Fig. 2.10: Port container terminal extension plan**

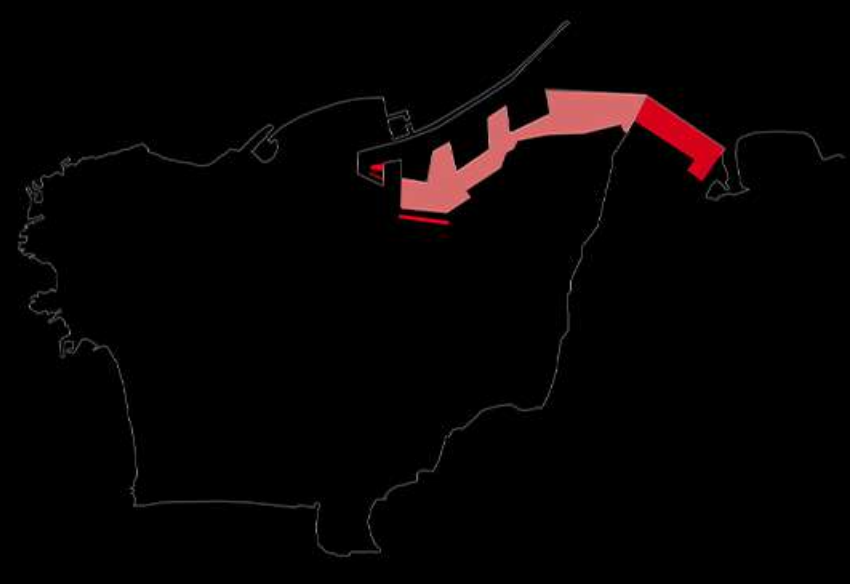




**FRESHWATER**



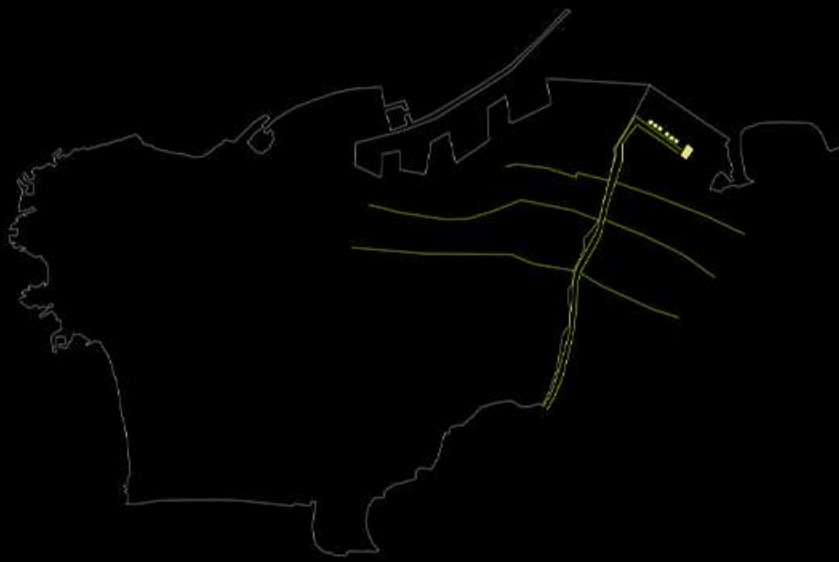
**BIOTA**



**GOODS**



**PEOPLE**



**WASTE**



**ENERGY**

Through the metabolistic analysis of the six flows (goods, waste, biota, people, freshwater and energy) and the spatial analysis of the city of Beirut and its port in previous sections of this thesis, six conxlusive maps of flows have been accordingly deduced.

**FRESHWATER:** projected along the Beirut river and throughout the uphill areas of its valley, this intervention seeks to offer the city water storages collecting rainwater and channeling it along the river borders, to be used for different purposes.

**BIOTA:** these new spaces for flora and fauna to flourish inside the city in areas where it wasn't able to do so before, interconnected either by green corridors or wildlife movement aim to raise the amount of biota in its different shapes.

**GOODS:** centered on the port and its container terminal, interventions for goods transporations in basin 1, goods collection and processing inside Charles Helou station and the expansion of the container terminal aim to boost the flow of goods and capitalize on set opportunities.

**PEOPLE:** public spaces, pedestrain walkways, and cycling networks define the interventions set out for the flow of people, generating links across the ports borders, connecting the waterfront to the east with the river and its estuary to the west.

**WASTE:** Also projected along the Beirut river, this flow seeks to evacuate in its first steps the waste inside the waterfront landfill, uphill, towards the facilities located in the Bekaa region.  
In other steps, the river would also serve as a waste water channel, separating the water and leading it to the projected facility projected on the landfill.

**ENERGY:** This proposal seeks to create a relation between the industries located in Karantina, the seawater and the port by introducing algae ponds in the port that could flourish by decreasing both the CO2 levels released by the industries and the levels of water nutrients inside the saturated water inside the port's basins.



## FRESHWATER

- + Water storage area  
100 000 m<sup>3</sup> <unit capacity < 200 000 m<sup>3</sup>  
2 000 000 m<sup>3</sup> in total
- + Flooding mitigation capacity 1500m<sup>3</sup>/sec
- + New channeling along Beirut river



## BIOTA

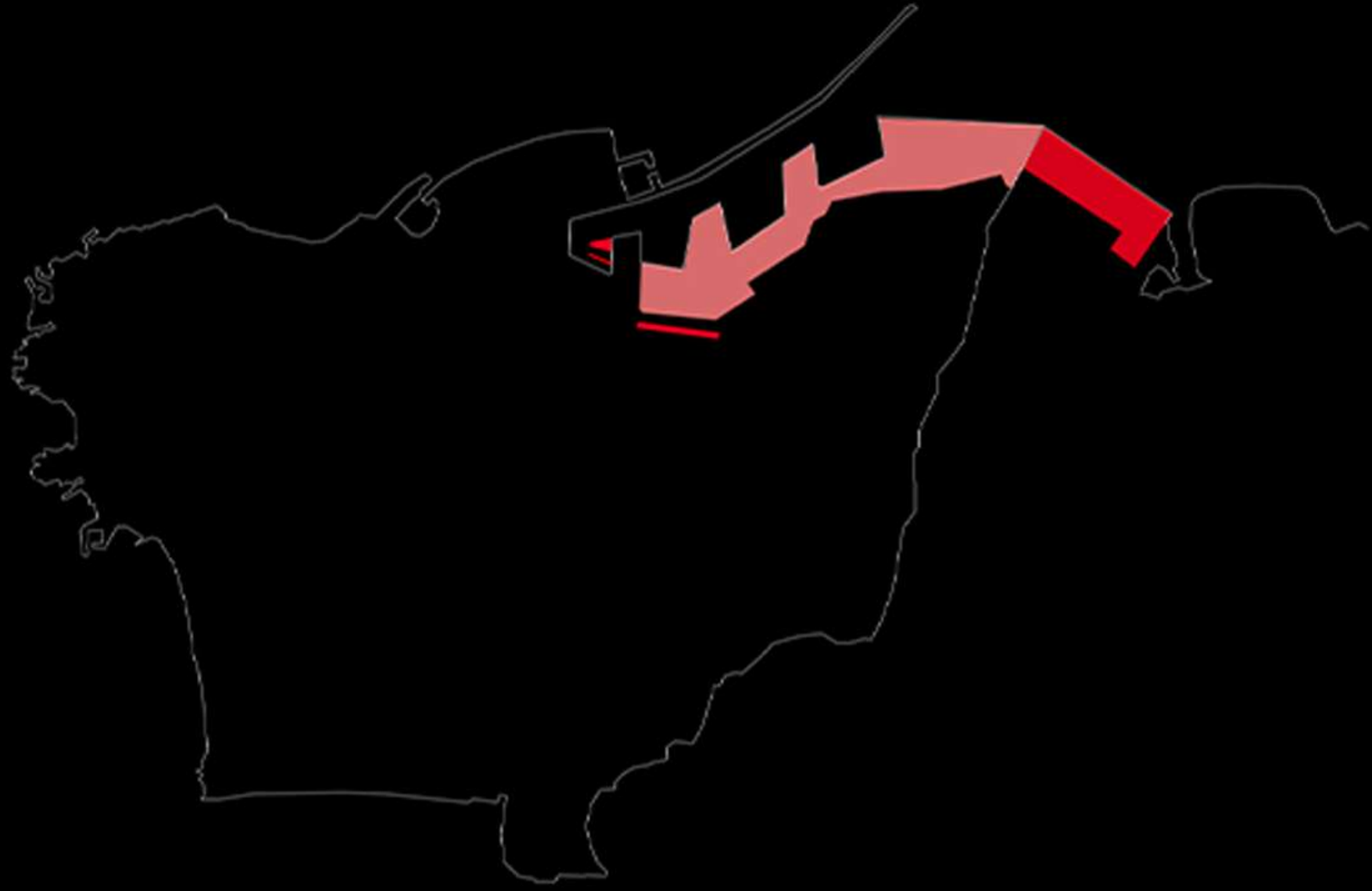
- + Green area suitable for wildlife:  
Waterfront Park: 2 500 m<sup>2</sup>  
Charles Helou Park: 250 m<sup>2</sup>  
Train Station Park: 1 000 m<sup>2</sup>  
River Park: 5 000 m<sup>2</sup>  
Total: 8 750 m<sup>2</sup>
- + Total green space of 9 000 m<sup>2</sup>
- + Migrating birds connections
- + Fishlife in Beirut river





## GOODS

- + Port container terminal extension  
3 000 m<sup>2</sup> in total  
2 000 m<sup>2</sup> of storage space  
750 m<sup>2</sup> of handling space  
10 new container cranes
- + New transportation port of  
50 micro container boat capacity
- + New industrial free trade zone



## PEOPLE

- + 7 000 m2 of recreational space
- + 9 500 m2 of public space
- + New skate park
- + New urban farming
- + New river Park
- + New waterfront boulevard
- + New port park
- + New cyclable pathway of over 10 km of length





## WASTE

- + 6 000 m length of waste water channeling
- + Waste landfill evacuation
- + New water treatment facility



## ENERGY

- + CO2 collectors in Karantina industry
- + CO2 channeling along port length of 2 500 m
- + Algae aquafarming:
  - biofuel source
  - biomass source





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