

NAHR BEIRUT: PROJECTIONS ON AN INFRASTRUCTURAL LANDSCAPE

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Diplome D'Études Supérieures in Architecture
Lebanese University, 2004

SUBMITTED TO THE DEPARTMENT OF ARCHITECTURE IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF SCIENCE IN ARCHITECTURE STUDIES
AT THE
MASSACHUSETTS INSTITUTE OF TECHNOLOGY

JUNE 2009

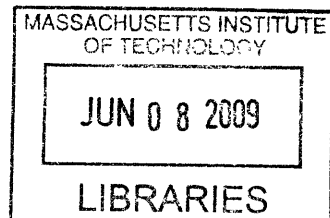
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NAHR BEIRUT

PROJECTIONS ON AN INFRASTRUCTURAL LANDSCAPE

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Sandra Frem

Submitted to the Department of Architecture on May 21st 2009, in Partial Fulfillment of the Requirements for the Degree of Master of Science in Architecture Studies.

ABSTRACT

A century ago, Nahr Beirut was a riparian river which flowed from a mountainous valley to a coastal plain, the Beirut Peninsula, before entering the Mediterranean Sea. After being for centuries the distant edge of Beirut, Nahr Beirut today is the central spine of the Metropolitan Area, coinciding with a major transport corridor linking the coast with the hinterland. In 1968, the river was converted from a riparian river to a concrete canal and eventually, it mutated into an open sewer. The highway built on its right bank completed this conversion into an infrastructural conduit of sewage and transport.

Informed by the notions of infrastructural landscape in Kathy Poole's article, Infrastructure in the ecological city, the thesis investigates Nahr Beirut through an urban and ecological analysis, and proposes measures for restoring the river, creating public space and enhancing the quality and management of water. In doing so, Nahr Beirut acts as a cultural catalyst which addresses citywide concerns of water supply, urban fragmentation and lack of public space.

An overall plan addresses the ecological continuity of the river, flood mitigation, water management and treatment cycles. The plan proposes new navigational paths along the restored corridor, and sequences of public instances which respond to specific physical, infrastructural and urban conditions. Smaller scale proposals include public nodes and a series of land formation strategies that respond to the environmental and infrastructural situations. Each strategy is manifested by formal manipulation leading to a new constructed ground (river + banks + public space) which corresponds to the hydrological mutations of the river across the different seasons.

Advancing that rivers as infrastructural landscapes can become urban, social and ecological structures which sustain amid political and aesthetic fluctuations, the thesis posits Nahr Beirut as a new cultural and ecological spine in the city, which mediates its infrastructural functions with its civic and environmental roles.

Thesis Supervisor

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ACKNOWLEDGMENTS

My decision to come to MIT is one of the most lifelong decisions I would make in my life, on both the intellectual and personal level. I am very grateful to MIT for generously providing the funding and the knowledge that was opened up to me, and for the remarkable persons I met here during the past two years.

This thesis would not have been possible without the support of many persons.

My first thanks go to my thesis committee.

I would like to thank Julian Beinart, for his continuous encouragement and patience throughout this research. His vast knowledge on cities and his ability to identify the most relevant thoughts transformed this research constantly.

I also would like to thank Jim Wescoat who has relentlessly provided me incisive feedback, and much needed information, crucial to carry out my project.

I am particularly grateful to Hashim Sarkis, for his invaluable support. His deep understanding of the intellectual challenge, his insights and guidance, and his own work were a great inspiration to me and a milestone for my thesis.

I would like to thank the amazing faculty I interacted with and learned from in the past two years: Nader Tehrani, Michael Dennis, Alan Berger, Rahul Mehotra, Stanford Anderson, Bill Mitchell, Dennis Frenchman and Fred Salvucci among many others.

In Lebanon, I would like to thank Jean Yasmine, Jacques Khawwam, Bernard Khoury, Jala Makhzoumi, George Arbid, Youssef Fawaz, Youssef Karam, Jocelyne Gerard, Arpi Mangassarian and Haik Papazian for their valuable help.

I would like to thank the great friends I had at MIT, which have provided me a priceless intellectual exchange and warm support. Some of them deserve a special mention; Claire Abrahamse, Christine Outram, Sabrina Kleinenhamans and Nida Rehman for their invaluable friendship.

The time spent in Cambridge would not be as pleasant without the presence of Alberta & Paul Zoummar, Nicole & Mazen Sakr.

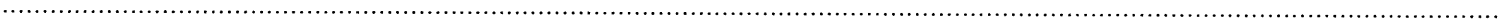
I would like to thank Romeo Chahine for his support and patience for the past two years.

My thanks finally go to my family for their constant support throughout my life. Simon, Jano, Maya and Joe, thank you for being there.

This work is dedicated to Beirut.

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INTRODUCTION

INTRODUCTION

This thesis emerges from different grounds. I started examining the issues of public space in Beirut. This research led me simultaneously to develop the notions of the infrastructural landscape as a public realm for Beirut's context and identify Nahr Beirut as a project.

While I was initially looking at the condition of public space in Beirut and Lebanon in general, several questions arose from the following observations, based on which I selected the river as a site and infrastructural landscape as a tool:

There is a severe lack of public space, which directly relates to the lack of collective initiative in the governmental institutions and social structures. Disciplinary practices nurture the absence of public space and restrict access to existing ones.

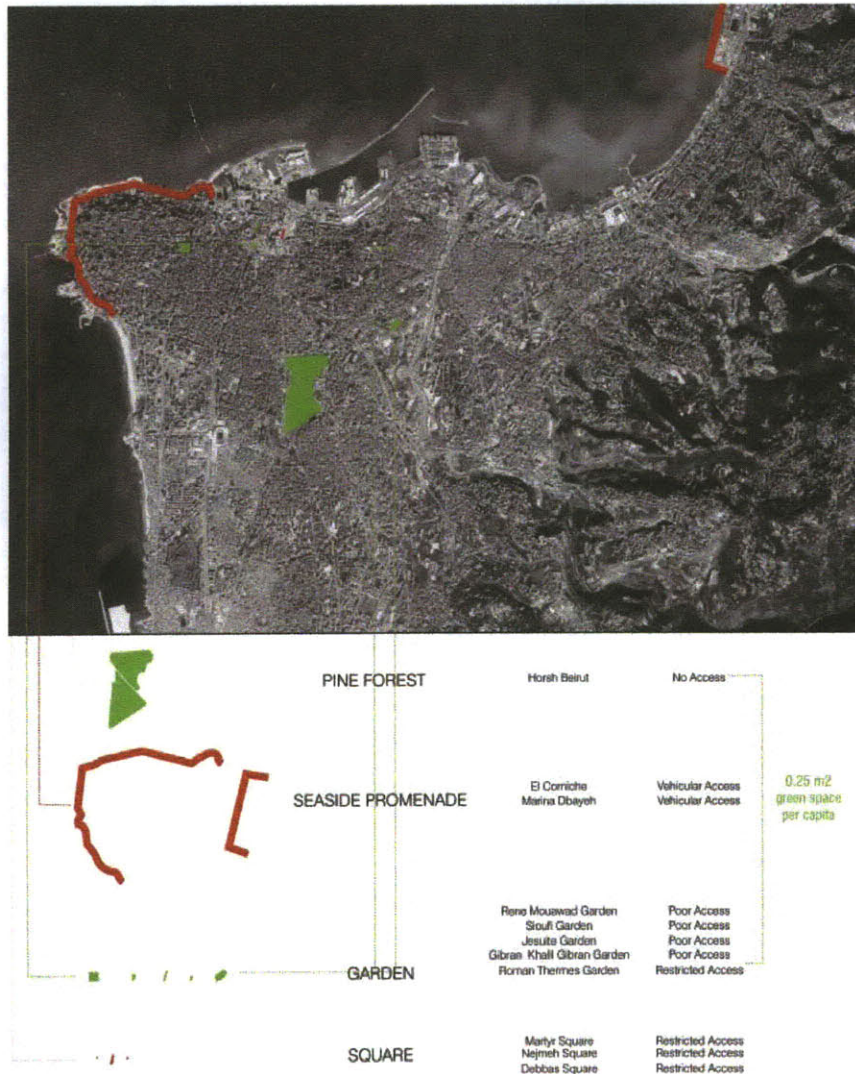


Figure i: Public Space in Beirut
Diagram detailing the existing public spaces in Beirut and their level of accessibility. Most spaces have poor or no access.

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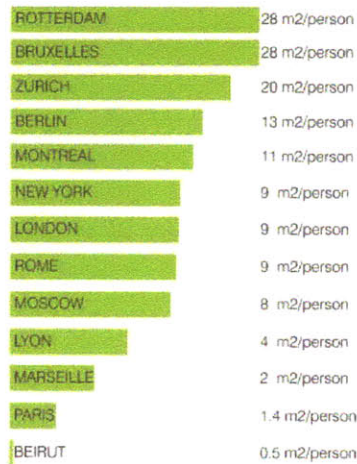


Figure ii: Accessible Green Space per Person
comparative ratio of accessible green space per capita. Beirut currently has one of the lowest ratio among world cities.

Figure iii: the Pine Forest in Beirut
The space is currently closed to the public in order to preserve it from being roughed up.



As such, the current “public spaces” of the city are sterilized, exclusive and suffer from poor access for numerous reasons: socio-political appropriation of the spaces due to their geographic locations, selective access and privatization, remote locations accessible only by car...

Indeed, the geographical location of some public gardens subjects them to the socio-political influence which marks Beirut’s social structure. The spatial appropriation is tacit and sometimes manifested simply by the presence of political slogans, posters or flags. Their catchment zones are considerable reduced, since they become more geared to surrounding residents and specific socio-political groups.

Other green spaces such as the Pine Forest of Beirut or the gardens of SOLIDERE have a selective access and are heavily secured and restricted to the general public.

These exclusive practices are transforming Beirut’s urban nature into a privilege for the rich, creating huge social inequities as well as annihilating cultural and social diversity.

To make up for this lack of civic space, three tendencies are currently at play in Beirut’s public scene:

First, there is a complete enactment of public life in private circles such as family, socially close friends, schools, NGOs and in semi-private commercial institutions such as malls, pubs, cafes, bars, private beaches and resorts. However, free interaction is minimized in these places because one has to pay to stay.

Secondly, there is the ad hoc formation of unplanned public spaces like the seaside promenades in Ras Beirut and Dbayeh. These places offer first and foremost a free public access and the availability of a neutral ground allowing the coexistence of different social classes which lacks from other spaces. Their locations at extreme ends of Beirut make them accessible only by car. Lastly, there is an appropriation of infrastructures as an informal public space for markets and playgrounds, deriving from the need for public space, and the availability of such interstitial spaces.

Following these observations, the critical questions which were the starting point of my thesis were how one can conceive strategies for public space which provide the experience of social diversity and free access, avoiding the mentioned traps of sterilization that plagues the existing spaces of Beirut.

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If the precedents of Beirut public space were tied to the presence of nature and infrastructure, how can one use both as a magnet for a bi-fold purpose: one to compensate for the lack of accessible green spaces, and another to provide a collective public realm which is not tied to a political entity or an exclusive model of development?

And finally, how can one envision public green space not as an aesthetic museumification, but as a productive landscape working in tandem with the infrastructures of the city?

My simultaneous research on the infrastructural landscape led me to an illuminating article “Civitas Oecologie, Infrastructure in the ecological city” by Kathy Poole, which provided the theoretical foundations for this thesis. Published in 1991 in the Harvard Architectural Review, Poole’s article demonstrates that the framework of a cultural ecosystem based on the city’s built and natural infrastructures can provide a new civic realm tied to these elements. By drawing from various historical and contemporary precedents, Poole argues that common infrastructures like streets, sewers, water supply and waste disposal are the hidden elements that “permeate the city and its citizens physically, socially, and governmentally”. Because these systems are the most important physical interconnection for all citizens, and yet inextricably tied to the natural systems that supply them, they represent the infrastructural landscape, an enduring cultural public realm which constitutes “a vein of continuity amid political regimes and esthetic narrations”.

Poole mentions the deriving new possibilities for expressing the city in built design, by revealing such infrastructural processes and layering them with civic programs. The result is a landscape with cultural dimensions which inform the citizens about the built and natural interplay of their city’s infrastructural systems.

Informed by these notions, my research zoomed in on Nahr Beirut, a canalized river, which is situated at the North-Eastern limit of the city proper. While being the common boundary to the municipalities of Beirut, Bourj Hammoud, Sin El Fil, Furn El Chebbak, Mkalles, and Hazmieh, the river sits as a no man’s land and a backdoor space of all these administrative entities, isolated by the adjacent highway and the canal’s walls. Furthermore, the location of the artery is central to the Greater Beirut Area and democratically crosses the different neighborhoods of the city, home to diverse and multi-ethnic social groups.

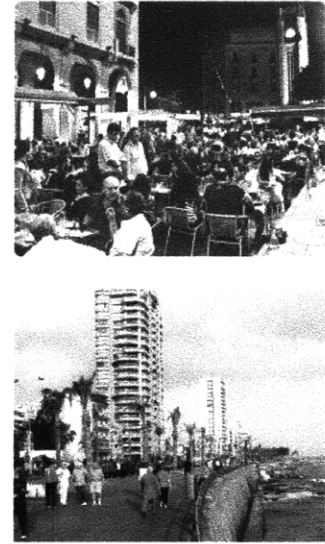


Figure iv: Paid versus Free public life.

Above, a cafe in Beirut Central district. Below, the Corniche in Ras Beirut.

INTRODUCTION

This district currently contains the last remaining open spaces in Beirut, remnants of its past as a national and regional rail corridor. However, these former rail yards are enclosed and inaccessible. Despite their dilapidation, they are a magnet for speculative private development. Already, nearby old industrial warehouses are being converted into art galleries and offices while new high-end residential buildings are emerging on adjacent plots.

This thesis argues that the river's location in the city is too important to allow it to succumb to gentrified models of re-development. Because it sits in neither zone and yet is adjacent to so many, the river forms an ideal location for the proposed public realm, a hydrological, environmental and cultural spine that overcomes its physical isolation to engage with the different social, urban and ecological geographies around it.

In many ways, Nahr Beirut is where all these grounds merge.

By identifying it as a project, a specific design response is deployed on the site, using systematic typologies which confront the theoretical premises to the site conditions.

Consequently, the scope of my thesis stretches out to three dimensions: The first is the city, Beirut, and how its concerns of public space, urban nature, water supply and transport unquestionably input the Nahr as a site. The second is the artery itself, and how it can reconcile its hydrological, transportation and civic roles, should it be re-introduced to the city. The third is how the Nahr can become the infrastructural landscape and form a "Civitas Oecologie", a new civic realm rooted in an ecological sensibility to the river's restored infrastructure.

From here, the thesis proceeds as follows:

Chapter 1 examines the site and its larger geographies. As a site, the Nahr poses several challenges on the level of hydrology, ecology, transport, urban form, land use and property ownership, presenting a fragmented condition on all these levels. Beyond a linear reconstruction of the site's narrative, this chapter reveals a holistic reading of Nahr Beirut's history, ecology, hydrology, urban and social structures, highlighting the past and present dynamics which play an influential role in the artery.

In Chapter 2, I elaborate the notions of infrastructural landscape by expanding on its theoretical foundations and focusing on particular aspects of infrastructural applications which are relevant to Nahr Beirut.

Chapter 3 consists of a detailed mapping of the site. It identifies four different

INTRODUCTION

conditions which Nahr Beirut traverses from its sources to its tip, and extracts simultaneously the design issues, opportunities and aspects which directly inform the design proposal. Deriving from the mapping and the notions of infrastructural landscape, I advance an infrastructural civic program which provides a public space with performative functions linked to the river and its processes. The chapter culminates by the urban design strategies which form the structure of the proposal and details the design concepts.

Chapter 4 unravels the design proposal.

It first then advances the basin-wide plan which addresses the ecological continuity of the river, flood mitigation, storm water and waste water treatment and management cycles. Also on the basin scale, it elaborates the system of public sequences deployed on the Nahr and details the typological language of the different strategies used along the river. These include the pedestrian conduits, the public platforms, the public green, the fields, the pedestrian bridges, and the supporting public programs. Such typologies create a whole new pedestrian framework in which the river is inscribed.

The design proposal at the zone scale examines the spatial and programmatic ramifications for the larger strategies.

The lens of investigation narrows even further to reconfigure the different canal sections leading to a serie of land formation strategies. Each strategy responds to the adjacent physical, infrastructural, environmental and urban conditions, and is manifested by formal manipulations leading to new constructed grounds (river + banks+ public space) which correspond to the hydrological mutations of the river during the dry and wet seasons. Additionally, smaller scale proposals comprise the proposed public platforms where transport, water and public space overlay, creating an augmented instance of the infrastructural landscape.

The design proposal finally concludes by setting a framework of implementation.

Consequently, by setting this framework of civic and ecological linkages on the restored Nahr Beirut, the design proposal allows powerful connections between the different communities and the river, overcoming the omnipresent urban separation. It conjoins natural and municipal infrastructures, and stages the river's hydrological processes and the municipal water reclamation cycles instead of camouflaging them. The proposal embodies the infrastructural landscape as a new public realm for Beirut.

1

GEOGRAPHIES

NATURAL GEOGRAPHIES

URBAN DEVELOPMENT

NAHR BEIRUT AS A HYDROLOGICAL INFRASTRUCTURE

NAHR BEIRUT AS A TRANSPORT INFRASTRUCTURE

LAND USE

SOCIAL GEOGRAPHIES



Figure 1.0: Situation Map.
The dotted white fill shows the extent of Beirut Metropolitan Area, while the red fill shows Nahr Beirut.

GEOGRAPHIES

NATURAL GEOGRAPHIES

Natural Geographies

As a coastal river meeting the Mediterranean, Nahr Beirut represents one of many similar cases punctuating the Lebanese Littoral (figure 1.1).

Springing from the western slopes of Mount Lebanon at an altitude of 1890 meters, the river flows westward for approximately 20 km from a mountainous natural upper basin, before changing direction to flow north in its last 5 km through a densely urbanized coastal plain, the Beirut Peninsula, to enter finally the Mediterranean Sea at Beirut (figure 1.0).

The flow of Nahr Beirut is intermittent and torrential, given its considerable topographic gradients. It is mainly influenced by rainfall and snowmelt, with a total annual discharge of 100 millions cubic meters¹.

Set in a humid Mediterranean climate, the basin receives a considerable amount of precipitations which are the main factor influencing its hydrology (figure 1.2). Its hydrological cycles comprise a dry season from May until November and a wet season from December until April, with flow rates between 0.01m³/sec and 16 m³/sec²(figure 1.5).

In addition to rainwater and snowmelt in the wet season, continuous sources like Dachouniyye used to provide its flow in the dry season, before becoming completely diverted to provide the city's drinking water supply (figure 1.7). Despite the modest discharge levels, the sedimentation which emerges from the valley remains considerable, reaching 100.000 cubic meters of eroded materials a year³.

Nahr Beirut's flooding cycles attain a flow rate of 431m³ per sec for the 50 years' flood, 581 m³ per sec for the 100 years' flood, and 1571m³ per sec for the 1000 years' flood. Its current channel is designed to contain up to an 1100 m³ per sec flow rate⁴ (figure 1.4).

The river's upper basin is made of steep-sided ridges of limestone and marl, between which Nahr Beirut have carved deep canyon valleys with narrow gorges (figure 1.6). The karstic nature of the valley absorbs most of rainfall and snowstorm and the terracing of the mountain sides for traditional agriculture reduces surface runoff to a great extent⁵. The upper basin hasn't witnessed any floods, given its steep-sloped geography and the exclusive concentration of urbanization on its ridges.



Figure 1.1: Nahr Beirut Basin. The red fill highlights the basin's location in Central Lebanon. Similar basins are lined along the Lebanese, between Mount Lebanon and the Mediterranean Sea.

NAHR BEIRUT IN NUMBERS

100 MILLIONS M3
TOTAL ANNUAL DISCHARGE

100000 M3
ANNUAL ERODED MATERIALS

1571 M2/SEC
FLOOD MAXIMUM FLOW RATE

16 M2/SEC
AVERAGE MAXIMUM FLOW RATE

0.01 M2/SEC
MINIMUM FLOW RATE

Figure 1.2: Nahr Beirut's Topography.

From above to below, a topographical map showing the situation of Nahr Beirut in the lower basin, a sectional elevation of the two main tributaries which form Nahr Beirut, and a topographical map showing the amount of precipitation in the basin.

Figure 1.3: Original Condition of Nahr Beirut

This image was taken in 1904. It shows the Mediterranean Sea and the Lebanese Mountain in the background, and Nahr Beirut surrounded by agriculture in the foreground..

On the other side, the lower basin has had an important flooding history before becoming canalized, due to the dense urbanization of the coastal plain and encroachments in the flood zone of the river starting the 1940s.

Far from being flat, the coastal plain, the Beirut Peninsula, occupies a wedged site between the base of Mount Lebanon and the sea. Nahr Beirut crosses the low-lying areas between the two hills of Ashrafieh on the north-western side of the peninsula and Sin El Fil on the north-eastern side.

Early historic maps show that before its canalization, the river was a braided stream type, with shallow alluvial banks. Given the short length of the alluvial plain, the river meets the sea in a compacted waterfront delta instead of a floodplain with meanders and wetlands, which is normally the case for the braided typology.

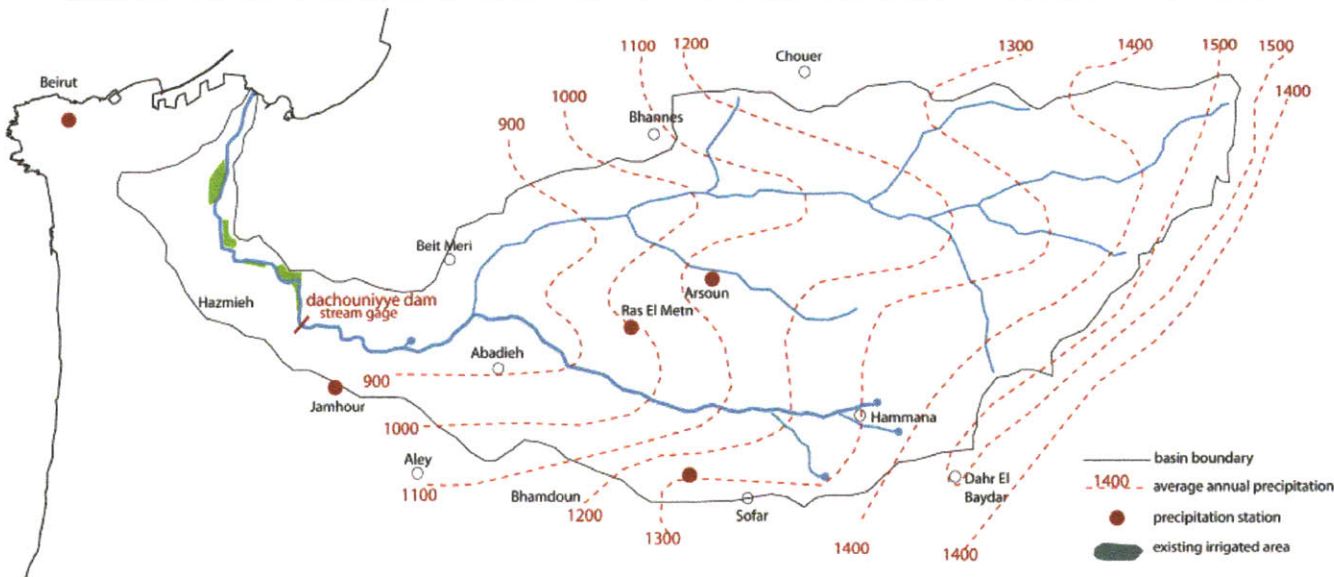
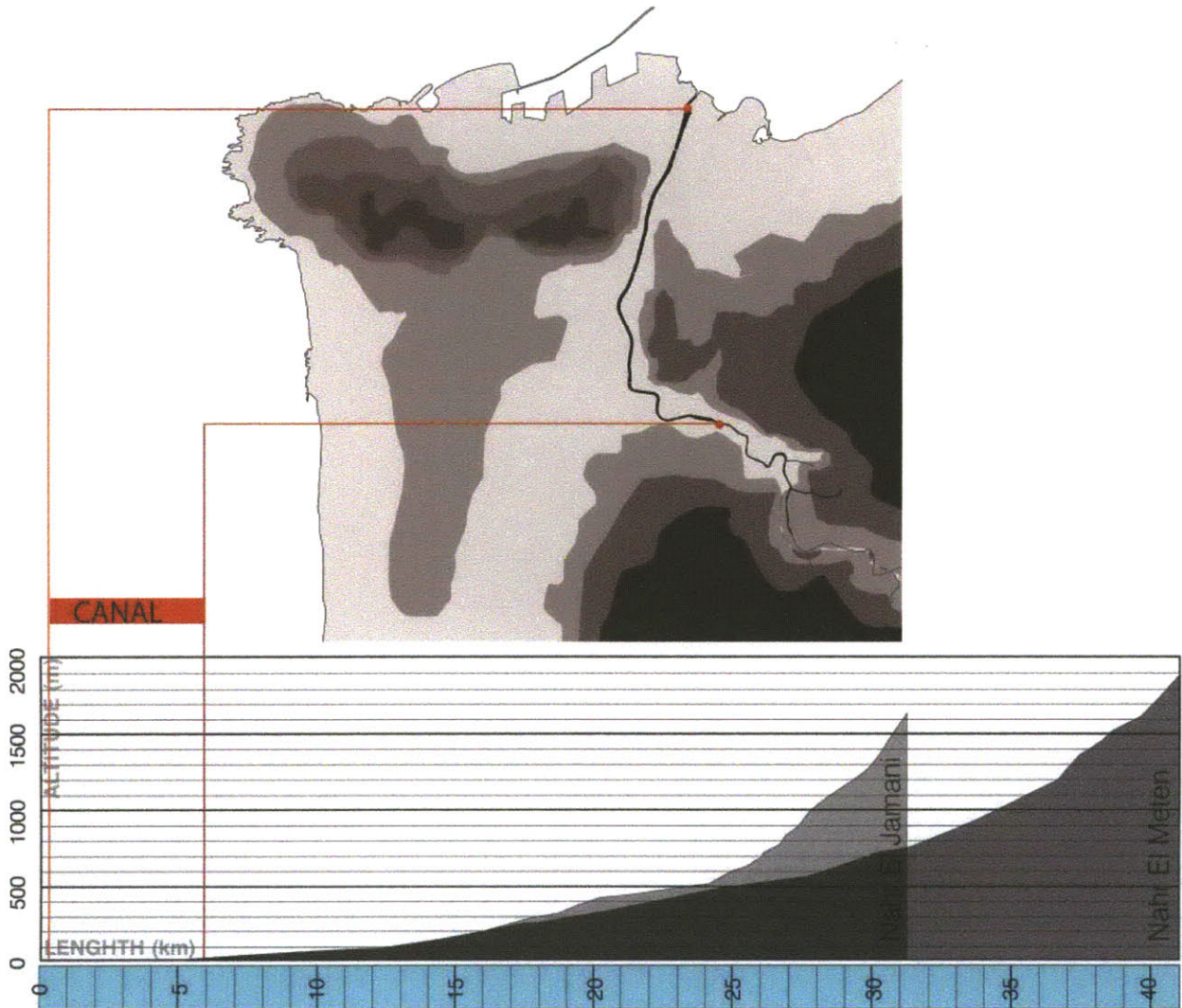
As such, the hydro system of Nahr Beirut remains incomplete⁶.

Before the canalization, the original riparian ecosystems of the river allowed a gradual passage from the valley's habitats to the waterfront's estuary.

At present, this ecological continuity is broken due to the absence of any ecosystem in the canalized section. The current fragmented natural landscapes are the waterfront estuary, the valley, and fragments of urban nature such as pine woods, and post-industrial nature.



GEOGRAPHIES
NATURAL GEOGRAPHIES



GEOGRAPHIES
NATURAL GEOGRAPHIES

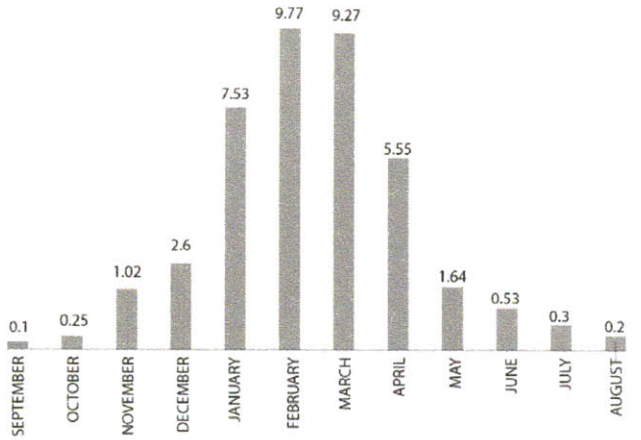
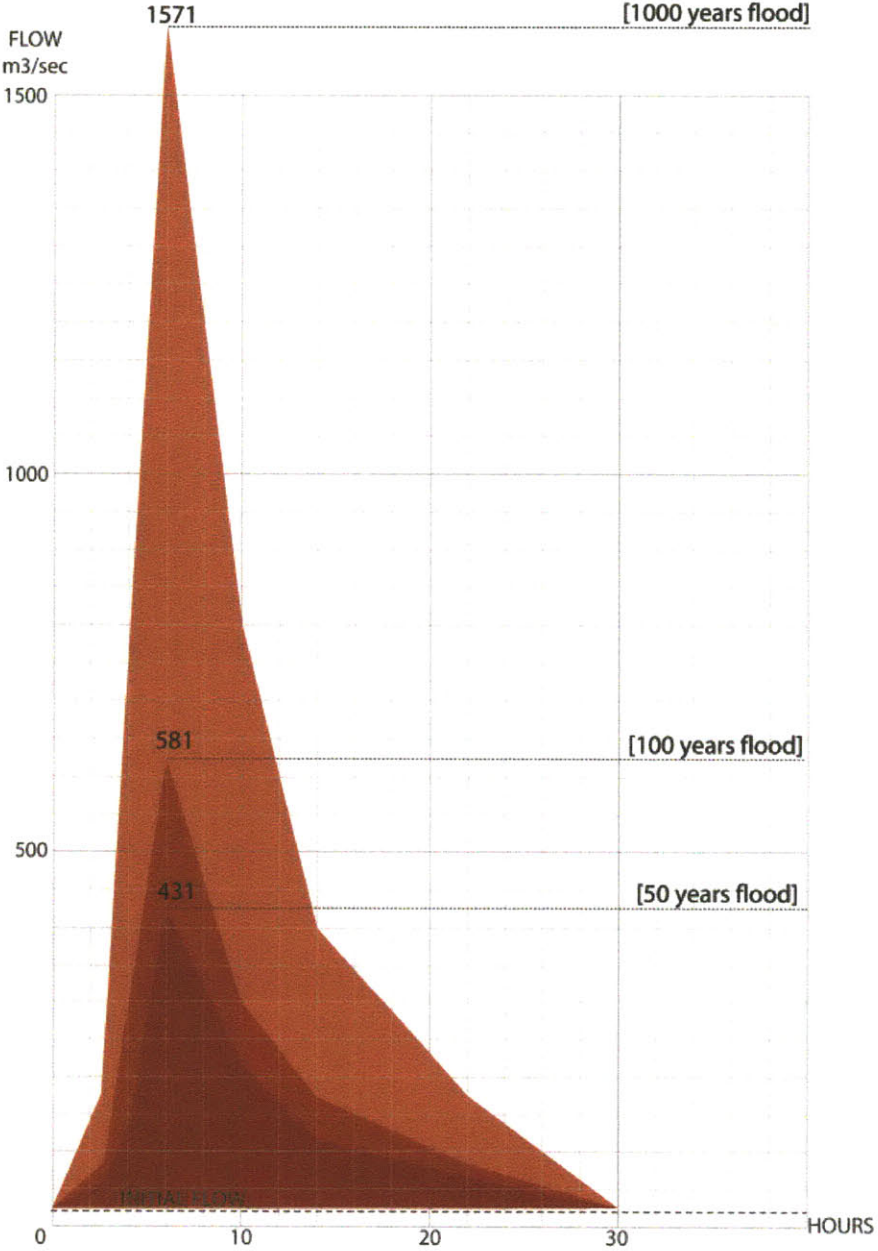


Figure 1.4 (above): Nahr Beirut Flooding
 Figure 1.5 (below): Nahr Beirut Flow

GEOGRAPHIES
NATURAL GEOGRAPHIES

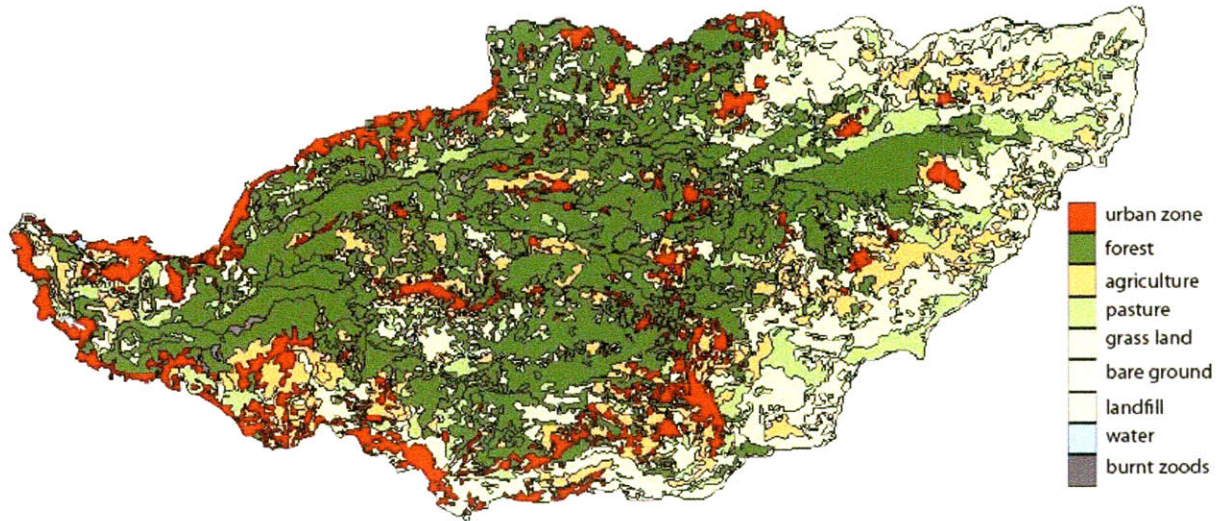


Figure 1.6: Nahr Beirut Basin Land Use

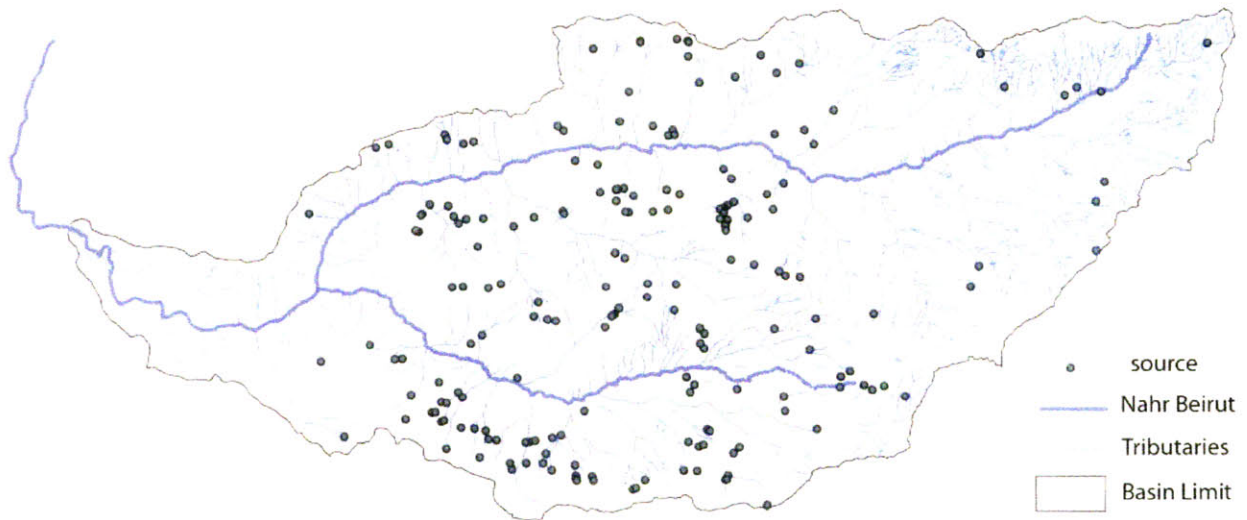
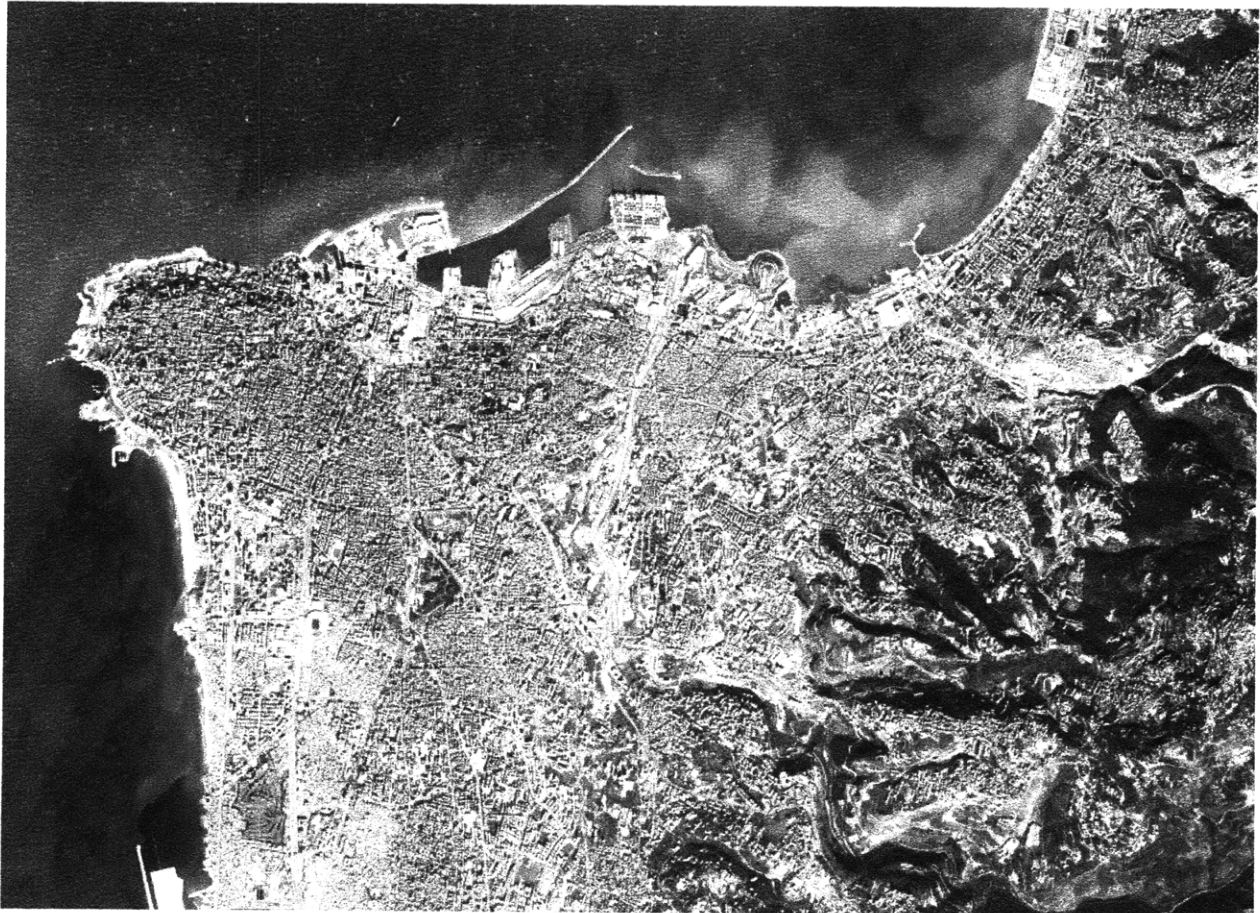


Figure 1.7: Nahr Beirut Basin Hydrology



Urban Development

Figure 1.8: Aerial Map of Beirut Metropolitan Area.
Nahr Beirut's location today is at the centre of the Metropolitan Area.

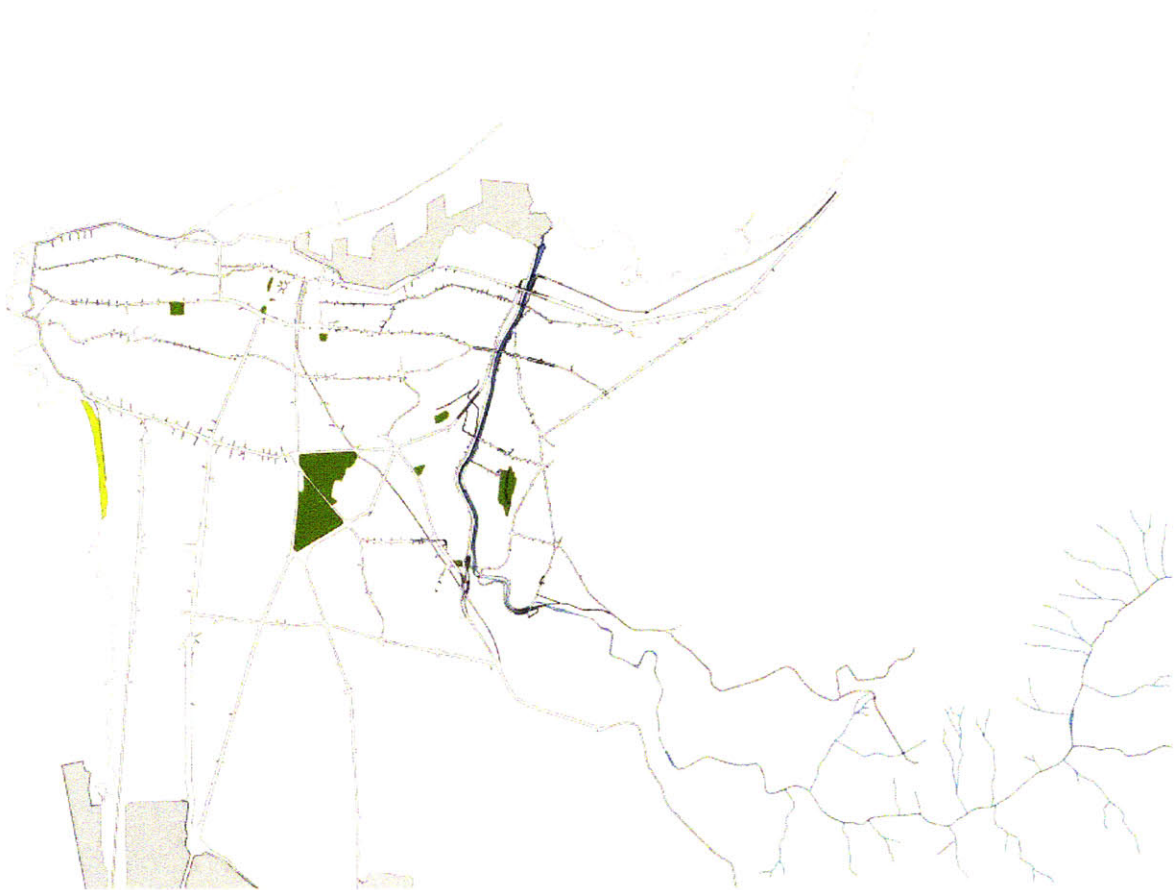
Roman Beirut was founded between the two hills of Achrafieh and Mousaytbeh, favoring a naturally defensive site and a favorable port location⁷. An earthquake wiped the city in the 6th century. The Arab and Ottoman cities were later developed on the roman foundations and remained modest agglomerations.

The city didn't expand extra-muros until the late Ottoman period, when it raised as a major port city and imperial capital of the province in 1888⁸.

All through these periods, the Nahr was a vast agricultural plain with orchards and fields, limited bridge crossings at the waterfront and Jisr El Bacha and punctual cultural spaces like the roman temple near Deir El Kalaa, Jisr El Bacha pedestrian bridge and the Bacha's public gardens...

Starting 1920, Nahr Beirut became urbanized at a very rapid pace, under the effects of immigration, migration, industry, and infrastructural development. While urbanization concentrated along the river banks and sometimes in

GEOGRAPHIES URBAN DEVELOPMENT



the river bed in the waterfront, Bourj Hammoud and Rmeil, it stayed at a distance in Sin El Fil, Tahouita, and Furn El Chebbak, due to the large rail yards and rail tracks which halted adjacent urbanization.

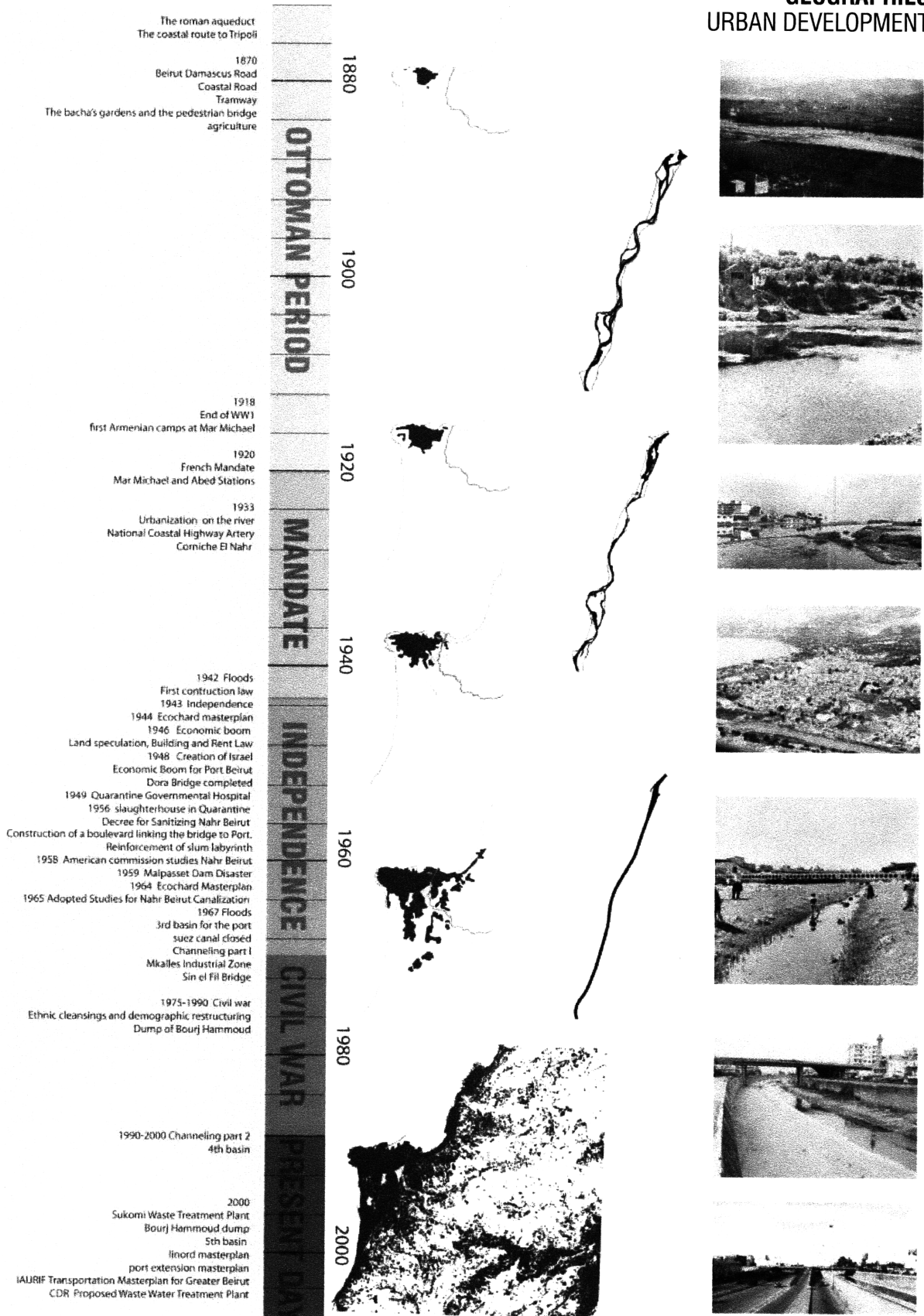
During the war, the upper villages on the basin's crests expanded to form a continuous urbanized ribbon, while the southern part of the lower urban zone was getting denser.

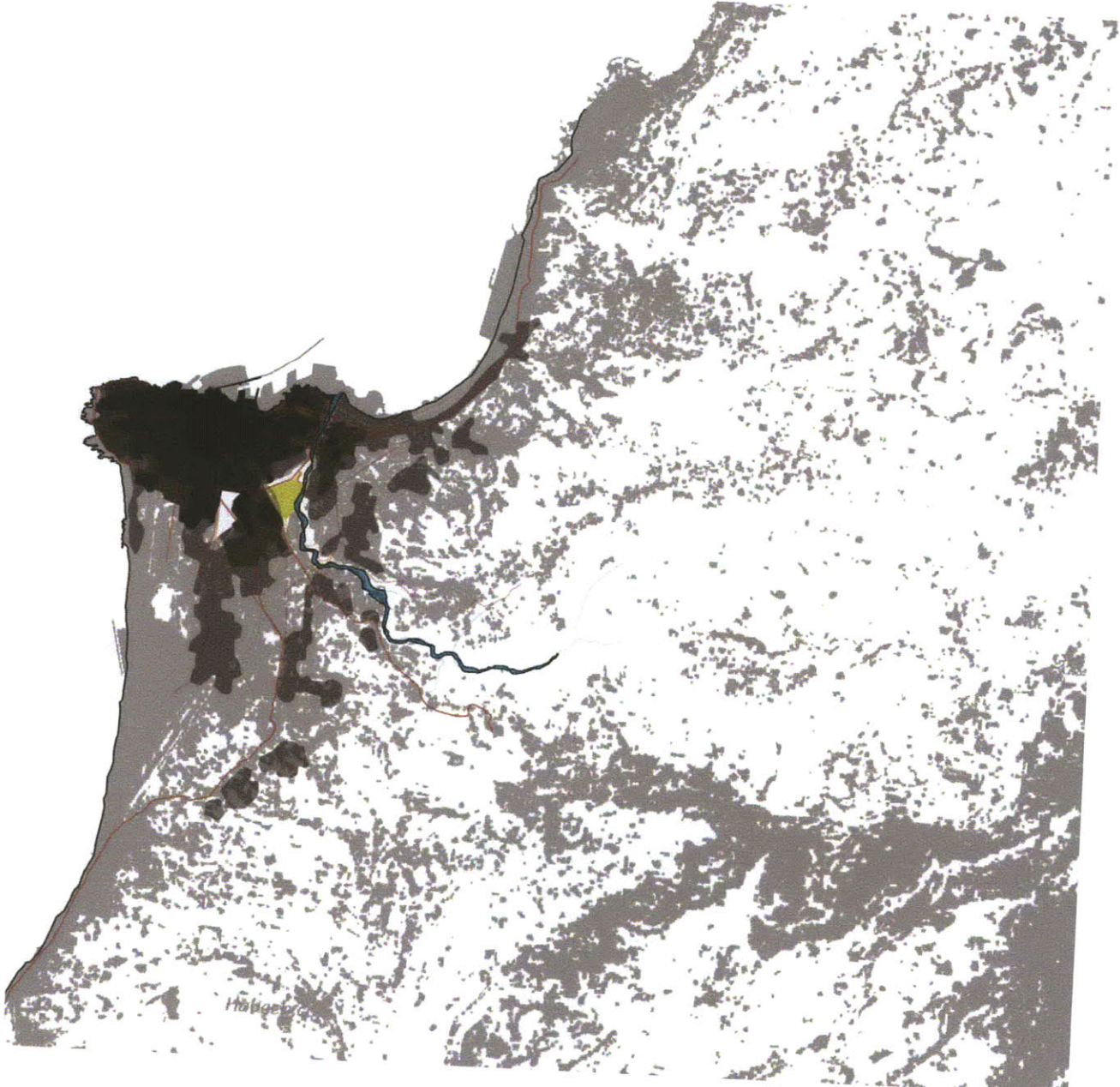
In the post-war years and until the present day, the river has witnessed an incremental densification and a tremendous pressure to occupy the last remaining open spaces of the city, which concentrate along Nahr Beirut.

Today, one can observe four distinct morphological sequences on Nahr Beirut various edges. They are easily summarized as the valley, starting from the two sub-basins sources until the plain beneath Mkalles, the agricultural transition, extending from Jisr El Bacha until Sin El Fil, the urban section, extending from Sin El Fil until Bourj Hammoud, and the waterfront which spans between the Coastal Highway and the water.

Figure 1.9: Civic Structure of Beirut. Nahr Beirut is a major artery forming a north-eastern linear threshold to the city proper.

GEOGRAPHIES URBAN DEVELOPMENT





**Figure 1.9a (opposite page):
Historical Timeline of Beirut
and Nahr Beirut**

**Figure 1.9b (above): Historical
Urban Development of Beirut.**

GEOGRAPHIES

NAHR BEIRUT AS A HYDROLOGICAL INFRASTRUCTURE

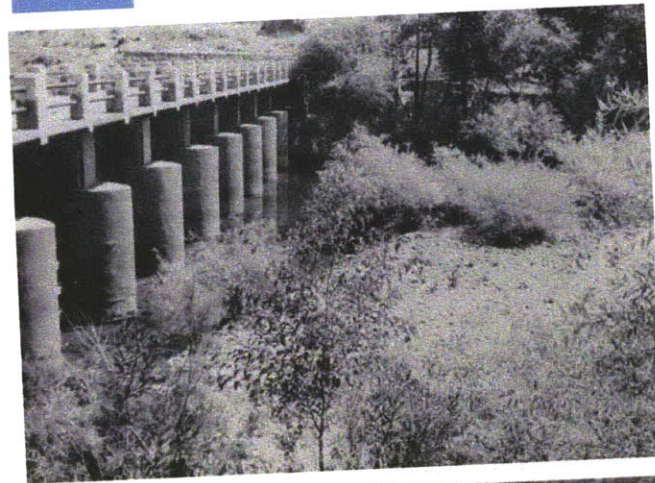
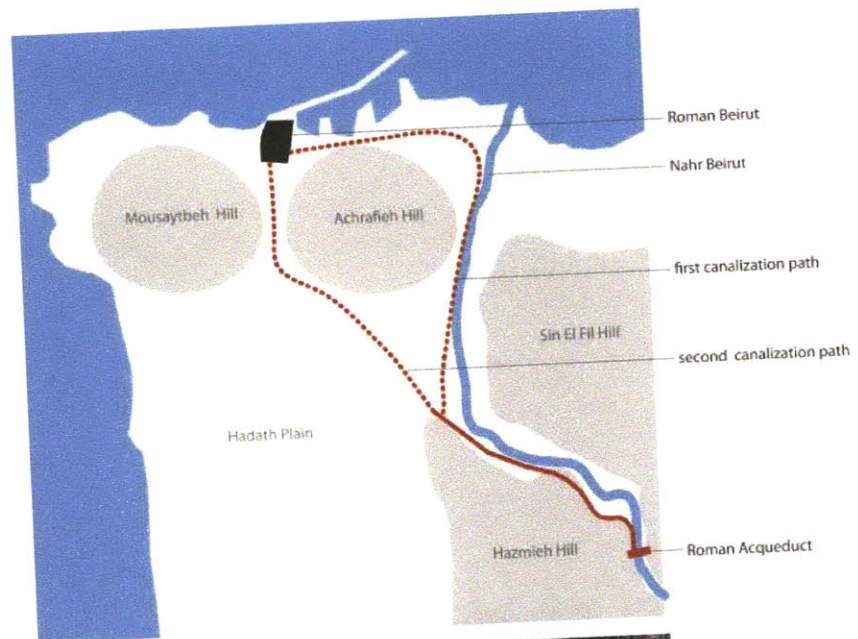


Figure 1.10 (above): Water Supply of Beirut in the Roman Period

the Roman conveyed water from Nahr Beirut to the city via a system of tunnels and aqueducts. The system remained active until early Ottoman period.



Figure 1.11 (middle and below): the Dachouniyyeh Dam

The French authorities executed the dam in 1934. The year after, most of its storage capacity was neutralized by sediments.

GEOGRAPHIES

NAHR BEIRUT AS A HYDROLOGICAL INFRASTRUCTURE

Nahr Beirut as a Hydrological Infrastructure

Historical Water Geographies

When Beirut was founded as a roman colony, the Nahr was crucial to the city's water supply. Because the city was located on a defensive site away from Nahr Beirut, the Romans conveyed water from a diversion dam below the source of Dachounye, through a canal and box tunnel along the right bank of the river, throughout the aqueduct at Zbeide -which remains are still standing today, and finally into a tunnel in the mountain to distribute water to the city⁹ (figure 1.10). It is believed that this system remained active until the early Ottoman period. When the roman system fell in ruin, the city which was a modest agglomeration relied on its wells for a couple of centuries¹⁰.

In the 19th century, Beirut expanded demographically due to its rise as capital of the ottoman province and a port city. The city turned to Nahr El Kalb for water supply, after subsisting so far on its existing wells. While Nahr Beirut became largely used for irrigation, Nahr el Kalb, which had a much powerful and continuous discharge, transmitted some daily 350 m³ of water through a system of dams, pumps and canals. Nahr el Kalb is still until today Beirut's main surface water drinking source¹¹.

During the Mandate period, the French built the Dechounye Dam and Beirut Canal (1934) on Nahr Beirut in an attempt to modernize agriculture which concentrated around the Nahr (figure 1.11). The built infrastructures were meant to irrigate approximately 1000 hectares of land. However, the concrete diversion dam which consisted of an overflow structure and eleven manual gates proved its inefficiency after only one year of its activation.

The French commission failed to take in consideration the rapid rate of sedimentation which was- and still is- a major handicap for any development plans for storage reservoirs located in the immediate course of Nahr Beirut. Indeed, the small reservoir area behind the dam which had a 15000 m³ capacity was completely filled with sediments during its first year of operation, impairing the efficiency of the structure. As such, the hand operated sliding gates are inoperative today. Furthermore, the canal which consisted of a conduit on the left bank of the river was constantly damaged by material erosion thus requiring permanent maintenance, given the steep site on which it was constructed¹².

GEOGRAPHIES
NAHR BEIRUT AS A HYDROLOGICAL INFRASTRUCTURE



1921



1931



1970



GEOGRAPHIES

NAHR BEIRUT AS A HYDROLOGICAL INFRASTRUCTURE

From River to Conduit: Walling Nahr Beirut

Starting 1933, Armenian refugees which were originally set in Quarantina relocated to Achrafieh and Bourj Hammoud, respectively on the western and eastern banks of Nahr Beirut¹³ (figure 1.12). The initial urban footprint was setback from the river banks, but continuous influx of immigrants pushed the informal urbanization into the river flood zone, starting immediate encroachments on the fluvial domain and subsequently the first recorded flood damages in 1942 .

"Since 1942, the ground level of the river was elevated by sand and gravel sediments, as well as constructed infill which aim was to reclaim portions of the public domain. The poor people didn't distinguish anymore the limits of the fluvial domain, and settled in the course of the river, limiting its capacity to a 400m³/sec flow rate." ¹⁴

On March 19th 1942, the daily newspaper Lisan El Hal, reported a flood which was estimated of a 700m³/sec flow rate: *"Last Thursday, rainfall provoked violent torrents which flowed from the mountain to the valley with a terrible force. The water inundated the houses and farms of the lower zone and destroyed everything it encountered, causing enormous damages in the slums neighborhoods."*

The canalization decree was issued the year following Nahr Abou Ali flood in the northern city of Tripoli. Nahr Abou Ali was similar to Nahr Beirut, yet the occurrence of its 100 years flood in 1955 provoked a bottleneck in the valley which stormed in the city with a 10m height wave, causing 160 human lives, destroying thousands of houses and agrarian lands¹⁵.

The response of the government to such phenomenon was the canalization of Nahr Abou Ali on the whole length of the agglomeration. Given the torrential character of Nahr Beirut, a similar response was applied as a mitigation measure. This engineering approach to flood mitigation was typical of modernist planning solutions applied to urban rivers across the world during the fifties.

In 1956, the Ministry of Planning issued a decree to canalize Nahr Beirut¹⁶. In an odd coincidence, the ministry designated in the same year the formation of Beirut's administrative boundaries, limiting its north-eastern edge to Nahr Beirut's middle axis (figure 1.15).

The western bank of the river would successively border Beirut, Furn El Chebbak and Baabda municipalities, while its eastern bank would delineate Bourj Hammoud, Sin El Fil, and Mansourieh municipalities.



Figure 1.12 (above): Armenian Refugees Settlements in Bourj Hammoud.

Figure 1.13 (opposite page, above): Historical Transformation of Nahr Beirut.

The form of the river in 1921 shows its original braided condition.

In 1931, the form of the river was already narrowed by gradual encroachments on its flood zone. The footprint of the river became smaller after its canalization in 1968, and the former flood zone was open to urbanization.

Figure 1.14 (opposite page, below): Nahr Beirut since its canalization.

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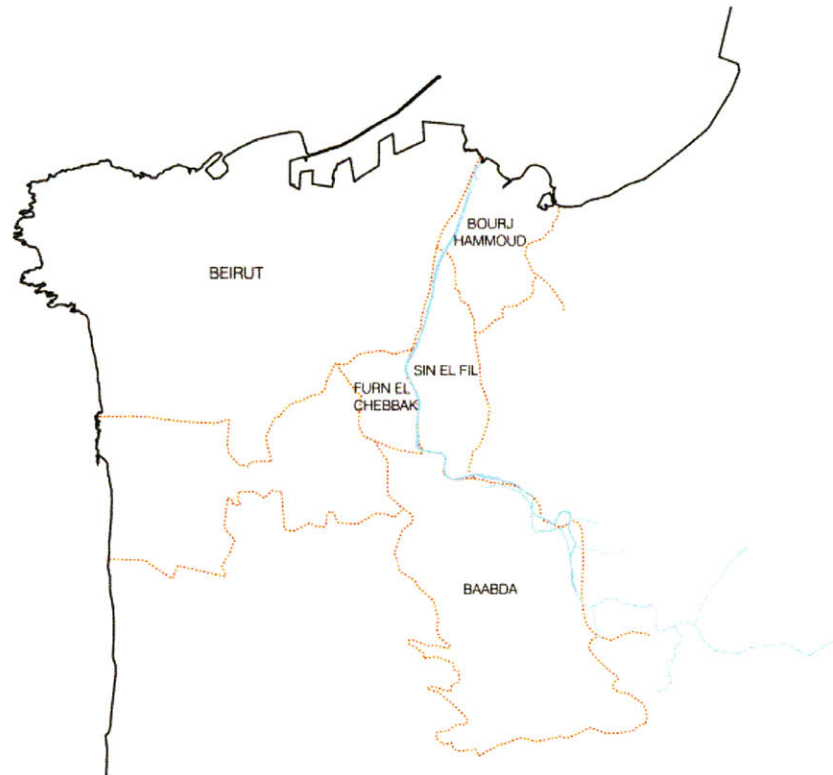


Figure 1.15: Administrative Limits of 1956.

In the same year, The government has issued the decree to canalize the river and to set the administrative limits of the different municipalities based on the river's old form.

As such, a future channeling the river meant also reshaping the edge of Beirut.

Preliminary studies for the river canalization advanced a proposal which stayed on the river's old axis, and re-examined the properties ownership along the river, along with proposed highways bordering the river from both sides and bridges crossing it from the different communes¹⁷. However they were was not adopted.

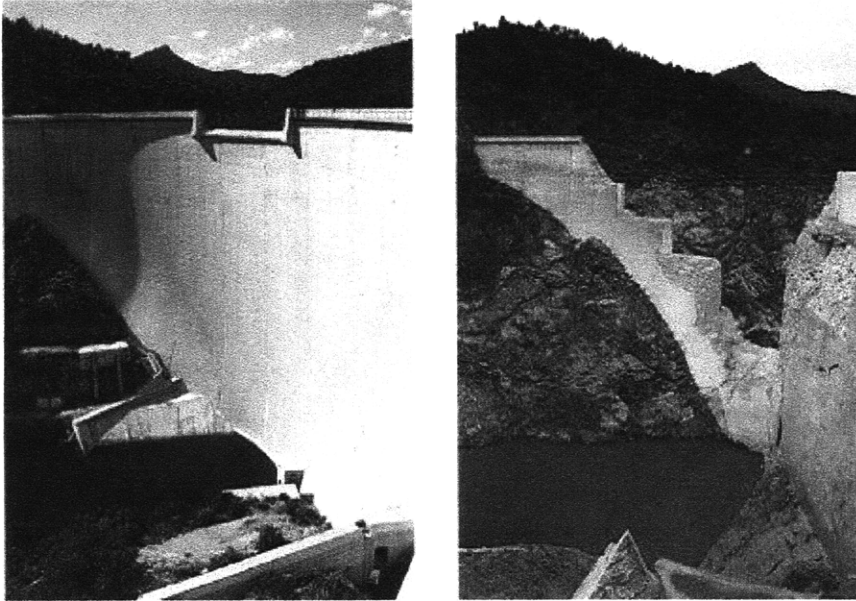
The final studies for the canal proposal shifted the axis towards the suburbs, annexing the large fluvial domain to Beirut proper. The study invoked the great danger that a 1000 years flood would cause for the dense urbanized area.

"What would be the effects of a 1500m³/sec flood? The flow would form a 7.40 meter high wave which will inundate the region of Sin El Fil and submerge the whole region of Bourj Hammoud and the Waterfront, reaching the Dora roundabout. Even though a 1000 years flood occurs every 1000 years, it obeys to the laws of nature and there are no guaranties it won't occur next winter."

The study considered the constraints of sedimentation and road infrastructures which would accompany the project. The proposal consisted of the current Beirut Canal with 3 different sections. The first section extended for the first

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2.4 km with a 1.5% slope and a profile of 43mx3m. The second section spanned between the Seaside Road connector and Tahouita plain for 1.65 km with a 3.5% slope and a profile of 30mx5m. The third section extended from the Tahouita Plain until Jisr El Bacha with a section of 23mx7m and a slope of 6.5 %. Other elements of the proposal included proposed highways, bridges and interchange nodes, and finally sewage collectors bordering the river¹⁸.

Additionally, the scheme evaluated the possibility of building a dam in the Mkalles area, and addresses its functions to reduce sedimentation and reduce floods. However, the government rejected the solution of the dam following the catastrophe of Malpasset in France in 1959 where the collapse of a megadam generated a 40 m height wave which destroyed the city of Malpasset, causing heavy human and material losses¹⁹ (figure 1.16) . This rejection was maintained since then, and justified to avoid the risk of structural failure which would cause a great danger on the dense urban area beneath it.

However, this position have resulted in an underexploited river, and an unregulated water flow, without mentioning that the canal currently stands alone in its flood mitigation functions, should a flood superior to 1100m³ occur.

Figure 1.16: Malpasset Dam before and after its collapse in 1959.

This catastrophe influenced the government to refuse the solution of a dam, by fear of a similar structural collapse and the resulting risk on the dense urban area of Beirut.

NAHR BEIRUT AS A HYDROLOGICAL INFRASTRUCTURE

In 1968, the river was canalized from the waterfront until Sin El Fil completing the first two sections. After two decades of interruption due to the Lebanese civil war, the third section from Sin El Fil to Jisr El Bacha was executed in 1998 in the same time of the Emile Lahoud Highway, completing this conversion of the riparian river into an infrastructural conduit of sewage and transport.

The environmental consequences of the canalization were a complete obliteration of the fluvial braided system, the destruction of the riparian habitat, the eradication of any hydrological exchanges between the river and its adjacent water tables, and the augmentation of the water velocity in the channel due to the lack of any vegetation to mitigate its speed and the reduction of its total length. The river was transformed from a functional ecosystem to an open air sewer, deprived of any self-cleansing abilities²⁰. On the other hand, there were no recorded flood damages since the channel's execution, and the former flood plain was reclaimed for urbanization.

The channel's adopted plan revealed the politics of its resulting form, which shifted towards the suburbs rather than Beirut, annexing the large field of the fluvial domain to Beirut proper (figure 1.17). This shift has produced an immediate adjacency between Bourj Hammoud and Sin El Fil and the canal: The street grids ended abruptly on the canal's walls.

On the other side, The Beirut side was buffered from the river by two highways, Corniche El Nahr and Emile Lahoud Highway, in between which was located an irregular urban block, result of the fluvial domains' reclamation. This urban block is currently used for governmental buildings, as well as land donations for NGOs headquarters like arc-en-ciel and auxilia (figure 1.17).

In other instances, the public domain resulted with no man's land situation, such as the parcel adjacent and underneath the Jisr El Wati Bridge. The parcel is currently used for the informal Sunday market .

In addition to this morphological divide, the channel produced a psychological boundary, ending some of the communities' cultural rituals which used to take place in the orchards and the banks of the river. The obfuscating presence of the canal's walls walled mentally the residents of each side, announcing clearly the end of a territory.

In 1998, the river underwent a new constraint, when the solid waste company, Sukomi, tightened the river's tip to reclaim land for its factory. The result was a dangerous bottle neck effect which proved its fatality in 2003, when a flood estimated as the 100 years' flood destroyed the bridge located at the tip²¹ (figure 1.18).

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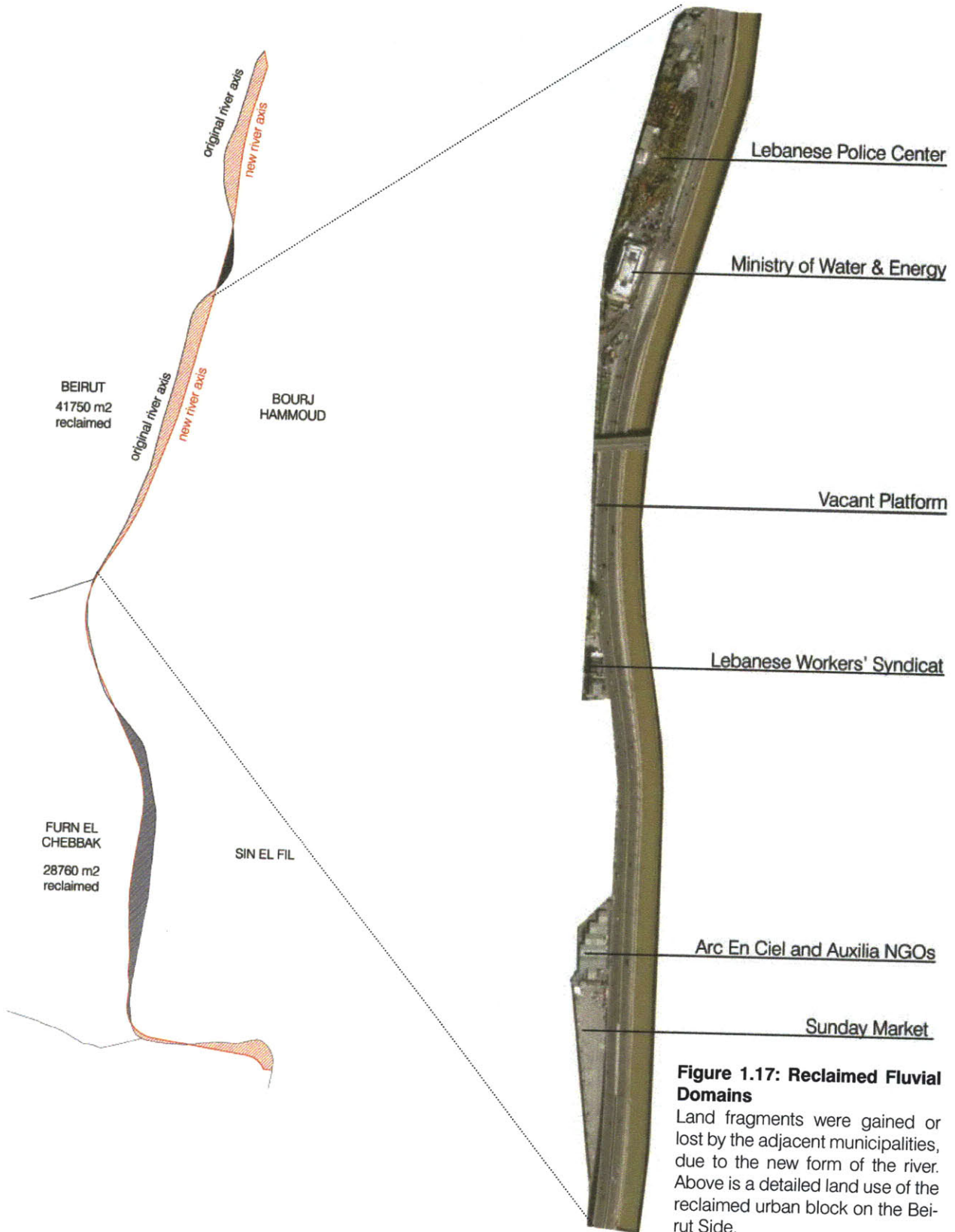


Figure 1.17: Reclaimed Fluvial Domains
 Land fragments were gained or lost by the adjacent municipalities, due to the new form of the river. Above is a detailed land use of the reclaimed urban block on the Beirut Side.

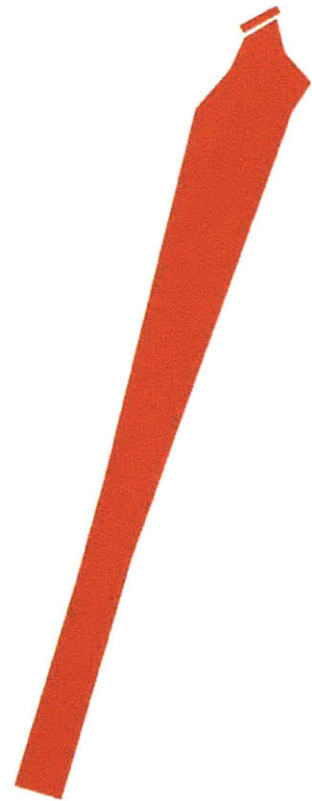
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Figure 1.18: The Bottleneck Effect

Sukomi waste treatment plant was built in 1997 on the fluvial domains. The protagonist behind its implementation was the former Prime Minister Rafic Hariri. Its location has produced the bottleneck effect which in 2005 under a major flood, caused a bridge to collapse and the waterfront to be flooded.



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Current Water Geographies

Water Supply

Today, the Dachouniyye source is totally deviated from Nahr Beirut's course to provide Beirut's water supply with 30000 m³ per day in the wet season and 20000m³ per day in the dry season, which accounts for 10% of the total surface water allocated to the city²² (figure 1.19). As such, Nahr Beirut run dry in the summer, except for inputs such as sewage and industrial effluents, solid and organic waste.

Beirut's current water supply is provided by Nahr el Kalb, Nahr Beirut as well as various wells, while most of the upper agglomerations obtain water out of municipal and private wells.

The water is subdivided between industry, agriculture, domestic use and tourism (figure 1.20) . A water treatment plant is located near the Dachounye source to filter the water before its distribution. However, the city currently suffers from a gap between total allocated water and the existing demand²³. This shortage is accentuated in summer, provoking severe ratifications.

| Source | Local nomenclature | Flow (m ³ /day) | |
|---------------|--------------------|----------------------------|---------|
| | | Wet | Dry |
| Surface water | El Kalb river | | |
| | Current | 250,000 | 104,000 |
| | Future | 500,000 | 104,000 |
| | Beirut river | | |
| | Current | 30,000 | 20,000 |
| | Future | 73,000 | 29,000 |
| Groundwater | Various wells | | |
| | Current | 110,000 | 140,000 |
| | Future | 110,000 | 187,000 |
| Total | Current | 390,000 | 164,000 |
| | Future | 647,000 | 320,000 |

Figure 1.19: Total water supply capacities for the Beirut Metropolitan Area

| Year | Sector (m ³ /day) | | | | | | |
|------|------------------------------|-------------------------|-------------|---------|------------------------|-----------|-----------|
| | Domestic Wet and dry | Industry Wet and dry | Agriculture | | Tourism Wet and dry | Total | |
| | | | Wet | Dry | | Wet | Dry |
| 2000 | 427,500 | 211,818 | 0 | 136,739 | 6,209 | 645,527 | 782,265 |
| 2010 | 455,625 | 363,574 | 0 | 90,751 | 12,428 | 831,627 | 922,378 |
| 2020 | 471,600 | 421,663 | 0 | 59,486 | 21,287 | 914,550 | 974,036 |
| 2030 | 540,000 | 554,020 | 0 | 43,867 | 35,686 | 1,129,705 | 1,173,572 |

Figure 1.20: Seasonal sectoral water demand of the Beirut Metropolitan Area

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Water Quality

The quality of the water in Nahr Beirut is directly impacted by the degree of urbanization on its sides and the nature of the land use.

In the upper zone, the linear urbanization which concentrates on the basin's ridge lines comprises mostly residential villages, and subjects the valley to a dilute level of contamination. Indeed, the input of organic waste and sewage is currently contaminating the water tributaries from their sources as well as infiltrating in the groundwater table, compromising the water reserves.

Also in the valley, a stone quarry used to contribute to the solid discharge in the river, before stopping its activities a decade ago.

In the lower zone, the pollution input is more immediate as the city's sewage network is directly connected to Nahr Beirut's canal. The three industrial zones in Mkalles, Sin El Fil and Quarantina generate punctual sources of chemical effluents discharges. Furthermore, the industrial zone of Mkalles discharges solid waste linked to construction materials fabrication, while the slaughterhouse near the Waterfront discharges most of the solid and liquid waste associated with its activities.

This pollution also affects the waterfront, as all the industrial factories in this area are directly discharging their effluents on the coast, through separate outfalls which do not comprise mediating treatments. Furthermore, the waterfront line witnessed a new source of pollution during the war, a major landfill of domestic waste, which emerged due to the absence of municipal services back then.

Agriculture also plays an active role in contamination, given the high amount of pesticides used in the current agrarian techniques.

Combining all these aspects, the resulting water flowing in the canal becomes highly toxic beyond any possible immediate reuse.

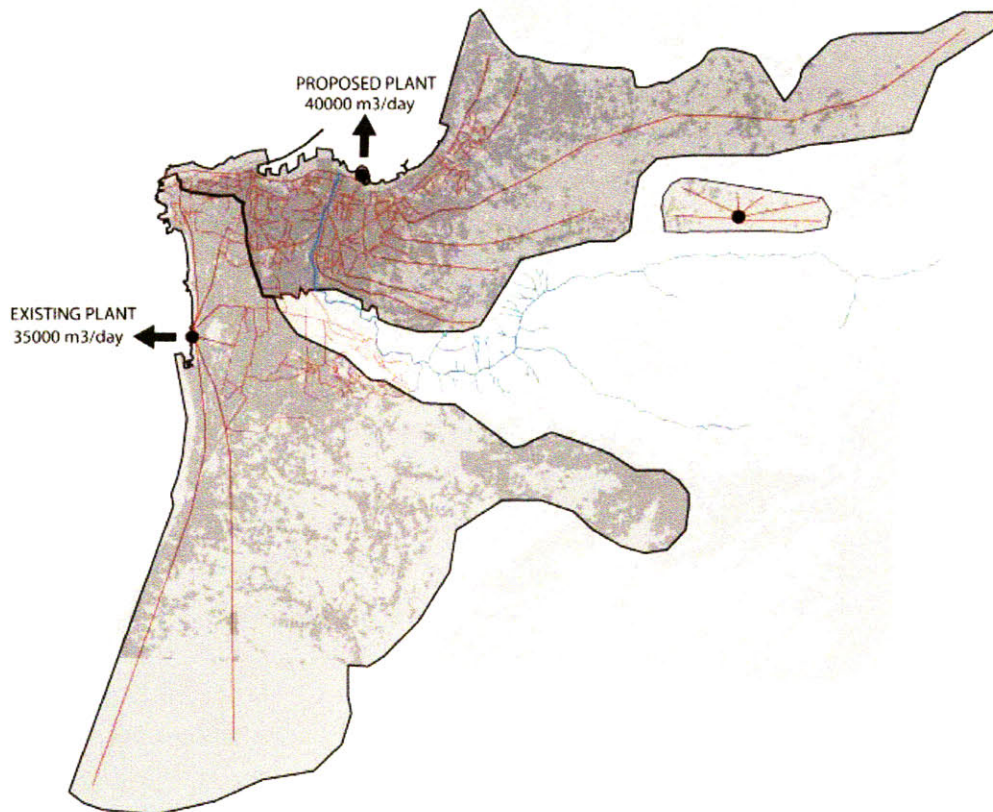
Water treatment

The southern part of Beirut is currently connected to an existing wastewater treatment plant which provides a preliminary treatment to an estimated population of 784,000²⁴.

On the other side, central and north-eastern parts of Beirut as well as parts of Metn, Baabda and Aley are still untreated and their wastewater is currently discharged in the Mediterranean without any remediation. As a part of an

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international agreement binding the government to treat waste water before discharging it in the Mediterranean, the High Council of Development and Reconstruction have elaborated a wastewater treatment project proposing to cover the mentioned zones. The project comprises main collectors that converge on Bourj Hammoud, where a wastewater treatment plant and associated outfall is to be constructed on the existing beach, designed for a future population of 891,000 people²⁵ (figure 1.21). Given the immediacy of these plans, the current agency is considering to occupy the last remaining natural site on the waterfront, Bourj Hammoud Beach²⁶.

Figure 1.21: Waste Water Treatment Plans for the Beirut Metropolitan Area

The proposed treatment plant would be located on Bourj Hammoud Beach and expected to treat the sewage of more than 50 municipalities of the Metropolitan Area, with a massive network of pipes of 17 kilometers total.

Furthermore, the agency hasn't mentioned any plans for reusing the treated water. Under the projected plans, most of Nahr Beirut upper basin's agglomeration will remain without a municipal treatment system, given the absence of funding. At present, the upper agglomerations are currently discharging most of their domestic waste water in the streams leading to the valley or in the ground. This fact will compromise the efforts to be undertaken in the lower zones by leaving Nahr Beirut Basin without an overall treatment strategy.

Nahr Beirut as a Transport Infrastructure

It is difficult to talk about the history and the present condition of Nahr Beirut without stressing the role of transport infrastructure and the Nahr's role as a threshold. The location of the river has subjected it through history to the forces of infrastructural development, starting by the Roman road system, which crossed Nahr Beirut at the emplacement of Bourj Hammoud Bridge to the most recent flyover, Yerevan Highway.

BEIRUT'S RAIL TIMELINE

Source: Børre Ludvigsen
<http://almashriq.hiof.no>

1891: French concession to build Beirut-Damascus railway awarded to the Societè des Chemins de fer Ottomans Economiques de Beyrouth-Damas-Hauran.

1895: Beirut-Damascus 1.05m railway opened in August.

1895: 1.05m coastal railway (Tramway Libanais) started which reached Maameltein by 1908.

1893: Concession granted for Damascus-Aleppo railway, later amended to Riyaq-Aleppo with a branch to Tripoli. Company name changed to Societè des Chemins de fer Damas-Hama et prolongements (DHP).

1941: British forces in Palestine start Haifa-Beirut railway instead of proposed Haifa-Riyaq line which was abandoned as too difficult.

1942: Regular military traffic Haifa-Beirut started on 24th August.

1942: Beirut-Tripoli completed December 18.

1961: CEL - Chemin de Fer de l'Etat Libanais formed.

1976: Beirut-Damascus closed by civil war.

1993: Commuter service Dowra-Jbeil closes.

1997: Last cement train from Chekka to Beirut.

2002: The Polish diesel locomotive for the Chekka cement train still runs in its shed at the Furn el Shebbak stockyards once a month.

The Rise of a Regional and National Rail Hub

Since the mid-19th century Ottoman, Beirut gained importance due to global exchange networks which favored maritime routes over continental routes of which the nexus was Alep. The port was a major asset and reason for the city's rise, inscribing it in an overlapping network of global economy, regional exchanges, and local markets²⁷. The development of infrastructure was crucial to assert this status as the door to the Middle East and the link between the Mediterranean and the Gulf region.

As such, the position of Nahr Beirut has made it a major infrastructure hub with national and regional importance. It was the hinge between the port, the coastal axis which connected Syria to Palestine passing by Beirut, and the continental axis which connected Beirut to Damascus, and the rest of Gulf (figure 1.22).

The terminals of the merchandise railway, the coastal rail, the Damascus-Beirut terminal and the tramway which disserved the major streets of Beirut were all located on the same site, Mar Michael Railway Station in the Quarantine area. The predominance of European interests, particularly French, promoted and financed a large part of Beirut's infrastructure, through a direct investment of Lebanese concessionary companies²⁸.

Between the two World Wars and during the mandate, the French authorities prioritized the development of rail and road infrastructure as a tool for modernization, through a strategic networking of the newly-created Lebanese territory. The country's two largest transportation railway stations -St Michael's Railway Station in Quarantine and Abed Station in Tahouita- were located along Nahr Beirut, reaffirming its role as a transport nexus (figure 1.23).

However, the rail system was not upgraded after independence, and the civil war completely rendered the system out of service. The legacy of this past still exist today through the large derelict industrial sites of Mar Michael and Abed Stations with 40 years of left out nature, abandoned industrial structures and

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Figure 1.22: Nahr Beirut Strategic Location as a Transport Artery.

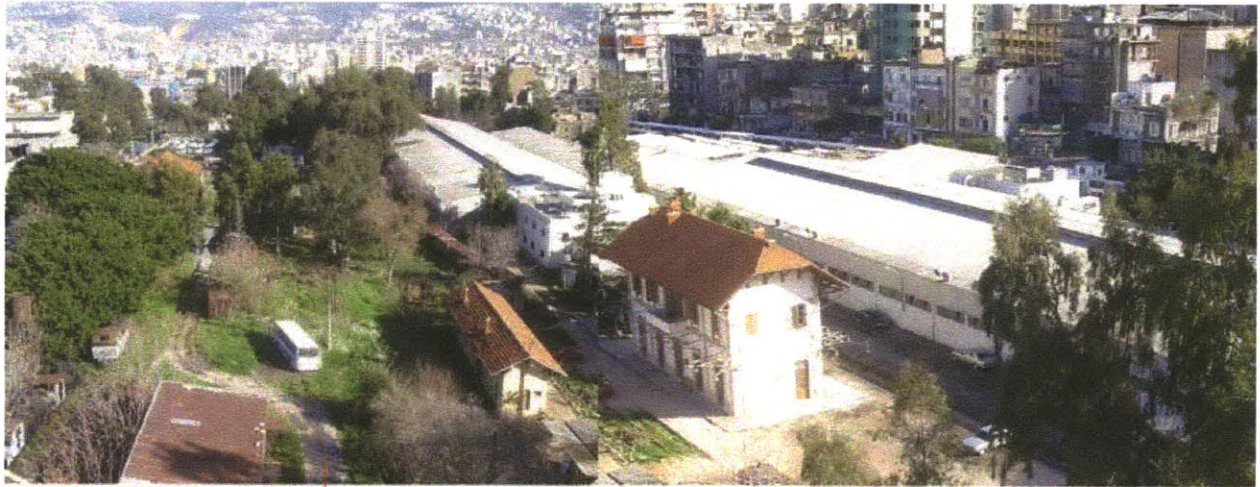
Nahr Beirut is a crucial link between the Mediterranean Basin and the Middle Eastern Region.



Figure 1.23: The Waterfront Zone in 1931.

Mar Michael Railway Station was the nexus of the coastal rail, the port rail, the hinterland rail, and the tramway.

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MAR MICHAEL STATION



ABED STATION



GEOGRAPHIES

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warehouses serving partially as old buses depots (figure 1.24). The railway tracks still exist within fragments of the Nahr district and constitute green linear arteries within the dense neighborhoods around them.

Road Infrastructure as a tool for modernization

Since Independence, the government worked towards modernizing road infrastructures as economic arteries which provide quick connection for merchandise trucks and ground shipping flows, in line with a trading and service-based national economy.

The creation of Israel in 1948 and the regional boycott of its port directed much of its activities to Beirut's port, and provoked its expansion to a 2nd, 3rd and 4th basins, all operating at their full capacity. Beirut became the main door to regional routes to the Arabian Gulf and Middle East. As such, the development of the boulevards and road network along the Nahr was an assertion of the state's commitment to infrastructural modernization.

Based on the Danger plan in 1931, the current National Coastal Highway was built in 1948 and was situated between the existing coastal road (today's Armenia Street) and the Coastal tramway line (today's seaside road). A concentric thoroughfare, Pierre El Gemayel Boulevard, more popularly known as Corniche El Nahr, was constructed between the lower topographic lines of the Achrafieh escarpment and the banks of Nahr Beirut.

Furthermore, a gradual bridging occurred on the river between 1940 and 1970²⁹: the Dora Bridge, the Bourj Hammoud Bridge on the old remnants of the Ottoman Bridge, the Jisr El Wati Bridge at Sin El Fil, and the Jisr El Bacha Bridge which was located meters away from the Ottoman bridge remains... All of these structures were utilitarian rather than designed, sometimes even replacing historic structures such as Bourj Hammoud Ottoman Bridge, which was a scenic riverside promenade for the Armenian community. The new bridges were engineered concrete sections without any attractive attributes. The 1954 masterplan defined most of the road network which exists today, based on Ecochard's 1940 plan for Beirut (figure 1.25).

A second study by Ecochard (1964) proposed a freeway which would serve as an exchanger between the Coastal National Highway and Damascus

**Figure 1.24 (opposite page):
Mar Michael and Abed Station**
After being two major rail stations of merchandises and transport, the two sites today feature lush greenery and are the last low density zones in Beirut, surrounded by dense residential neighborhoods.

NAHR BEIRUT AS A TRANSPORT INFRASTRUCTURE

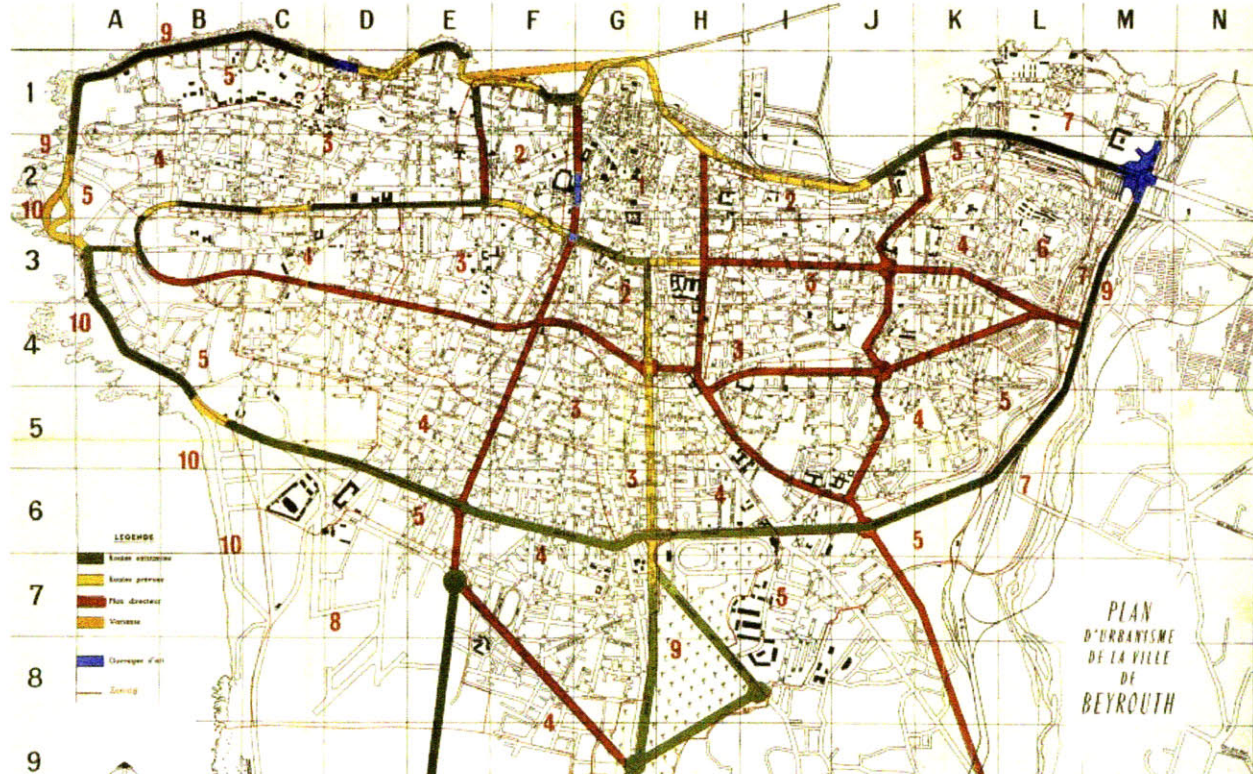


Figure 1.25: the 1954 Master-plan

The plan indicates the major road network. The plan was approved in 1952 and became official in 1954.

Road. The proposed highway would border the river's right bank and merge with Corniche El Nahr Boulevard (figure 1.26).

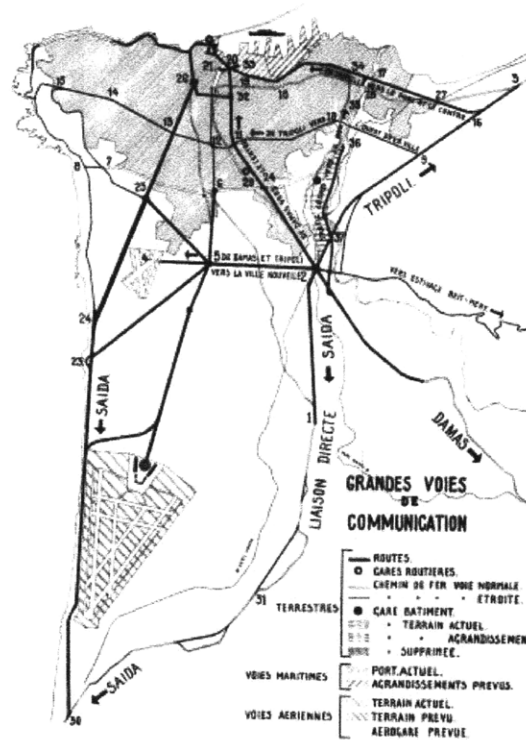
However, the canalization of Nahr Beirut in 1968 altered Ecochard's proposal, through the creation of reclaimed land, the fluvial domain. The altered highway became then completely detached from Corniche el Nahr, occupying a large chunk of the fluvial domain, with interchanges at the Coastal Highway and Hazmieh and specific exit points at the Port, Furn El Chebbak, Jisr El Bacha, and Hazmieh.

The Emile Lahoud Highway was completed in 1998, and its role was first and foremost to provide a quick connection between the port, the hinterland, and the region. The highway takes even more strategic dimensions, as it is currently the Port's executive access to all trucking and shipping activities. The port's second access which connects to the first basin is turning less operative, due to its adjacency with the high-end development of Solidere. As such, the public will is constantly pressuring for the relocation of heavy traffic flows to Nahr Beirut's exit.

After the war, car ownership increased dramatically and so is congestion on the major thresholds linking the suburbs to Beirut.

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NAHR BEIRUT AS A TRANSPORT INFRASTRUCTURE



In 1994, the Lebanese government commissioned a French planning agency, IAURIF to conceive a transportation masterplan for the Metropolitan Area (figure 1.29). The Masterplan comprised regional rail systems, metro lines, bus lines, and new regional connectors which would achieve an optimized mobility in Beirut³⁰. In a serious lack of commitment to the proposed public transport optimization policies, the government dedicated its funding to partially develop the proposed road network; as a way to meet the increasing demand.

As such, the obsolete coastal railway was removed and replaced by the current seaside road. In addition to serving the adjacent industrial district, the road supports a one-way traffic into Beirut for the first half of the day, and out of Beirut during the second half of the day, as a congestion mitigating measure. This seaside road ends on Emile Lahoud Highway, after crossing a ramp over the canalized river's walls (figure 1.27). As a part of the same mitigation agenda, the state executed a flyover connecting Beirut to the suburbs, Yerevan Highway, which created problematic adjacencies in the thick urban fabrics of Bourj Hammoud and Sioufi, with only meters of buffer from residential buildings on both sides (figure 1.28).

However, In the present day, it is currently very difficult to complete the

Figure 1.26: Ecochard's Proposed Road Network in his 1942 plan for Beirut.

The plan envisions Nahr Beirut's corridor as a heavy traffic artery which supports the port's ground shipping.

This vision perpetuated when conceiving the present day Emile Lahoud Highway.

Figure 1.27: Ramp leading to the Seaside Road.



NAHR BEIRUT AS A TRANSPORT INFRASTRUCTURE

masterplan's implementation: most of the vacant lands planned for expropriation in 1994 are completely urbanized. Thus, sticking to the IAURIF plan will result in an endless expropriation process, if not to say impossible³¹.

Given the current infrastructures surrounding the site, Nahr Beirut has emerged as a predominantly fast traffic conduct, a hostile pedestrian environment, a poorly accessed infrastructure and an urban entity disconnected from its adjacent neighborhoods (figure 1.31).

Nahr Beirut as a separation and a connection

While constituting a mental and physical separation for its adjacent neighborhoods, Nahr Beirut is also an artery of connection, due to its major transport infrastructures which makes it a threshold for commuters, residents and tourists (figure 1.30). This dual infrastructural character of the Nahr makes it an ideal site for the design proposal.

In every case, Nahr Beirut is a transition, rarely a destination.

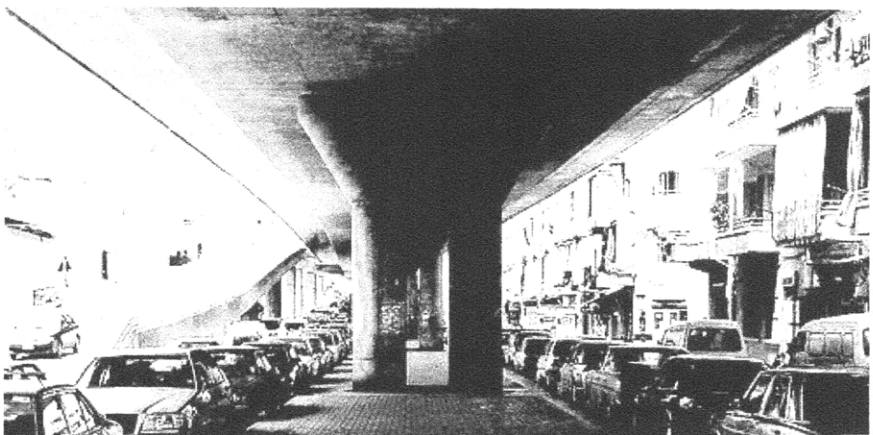


Figure 1.28: Yerevan Highway
the highway was carved in the dense fabric of Bourj Hammoud and is located meters away from residential buildings.

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NAHR BEIRUT AS A TRANSPORT INFRASTRUCTURE

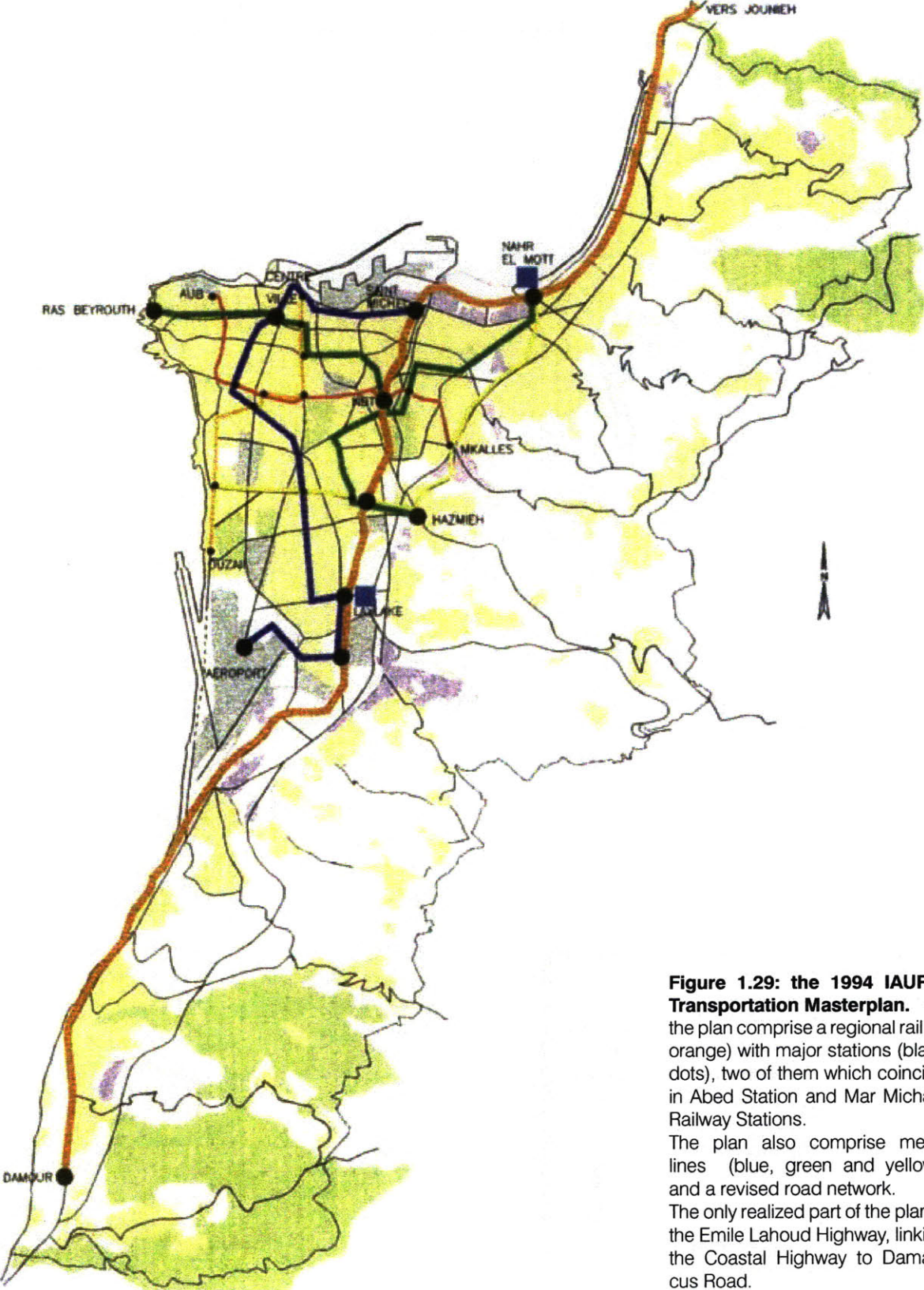


Figure 1.29: the 1994 IAURIF Transportation Masterplan.
 the plan comprise a regional rail (in orange) with major stations (black dots), two of them which coincide in Abed Station and Mar Michael Railway Stations.
 The plan also comprise metro lines (blue, green and yellow), and a revised road network.
 The only realized part of the plan is the Emile Lahoud Highway, linking the Coastal Highway to Damascus Road.

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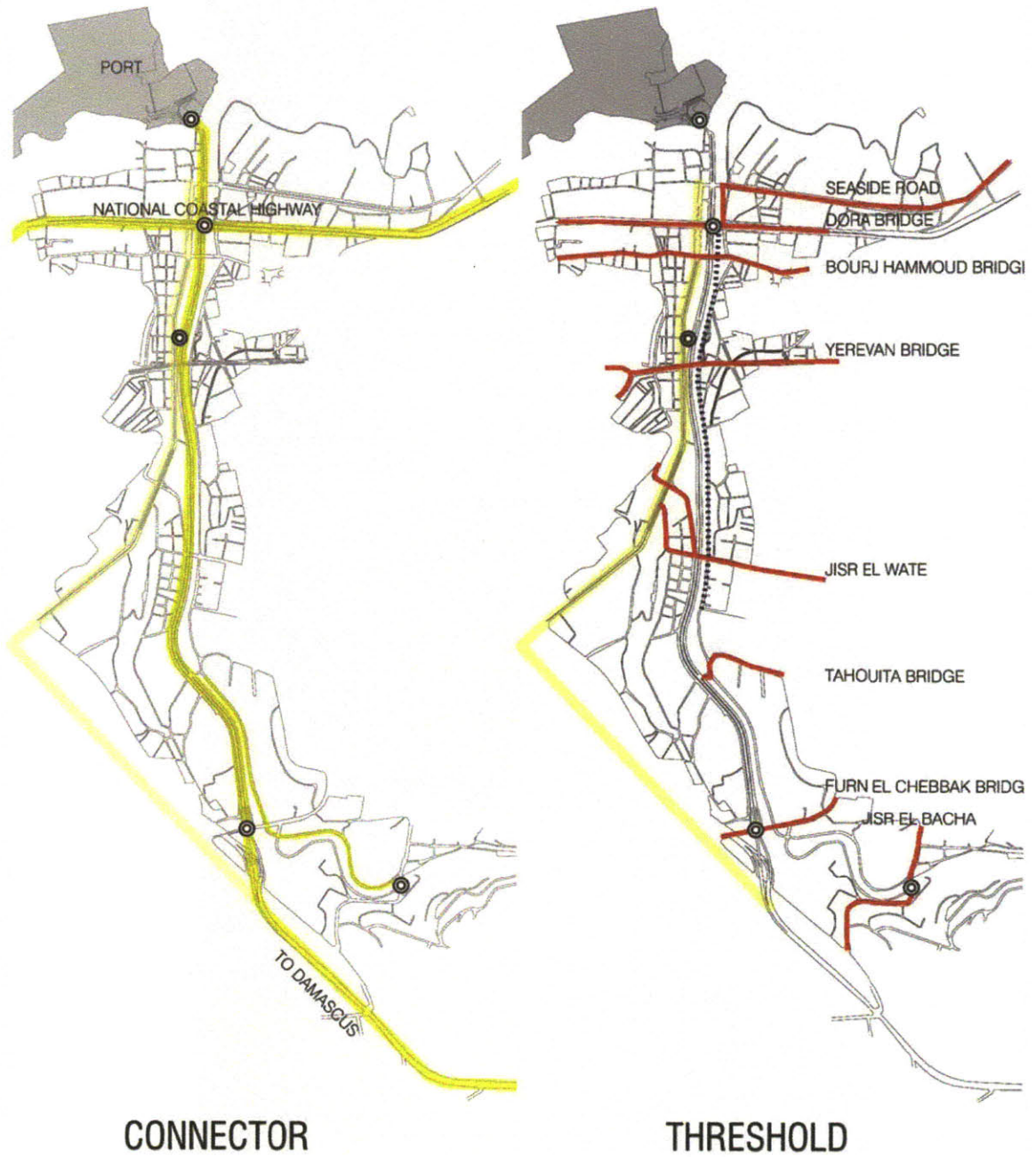


Figure 1.30 : Nahr Beirut as a Connector and a Threshold.

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NAHR BEIRUT AS A TRANSPORT INFRASTRUCTURE

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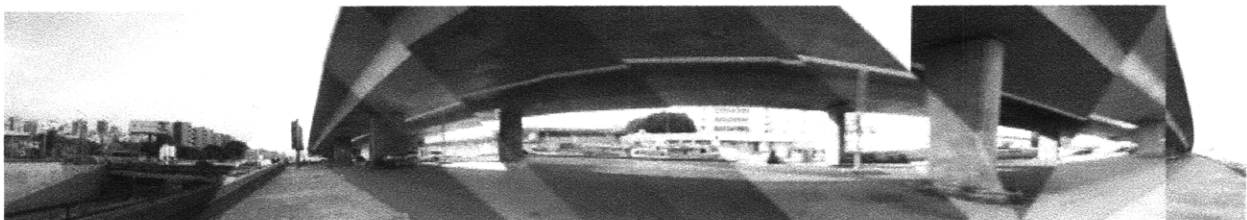


Figure 1.31 : Major Infrastructures along Nahr Beirut
1.Jisir El Bacha Interchange 2.Emile Lahoud Highway 3.Yerevan Highway 4.Jisir El Wate

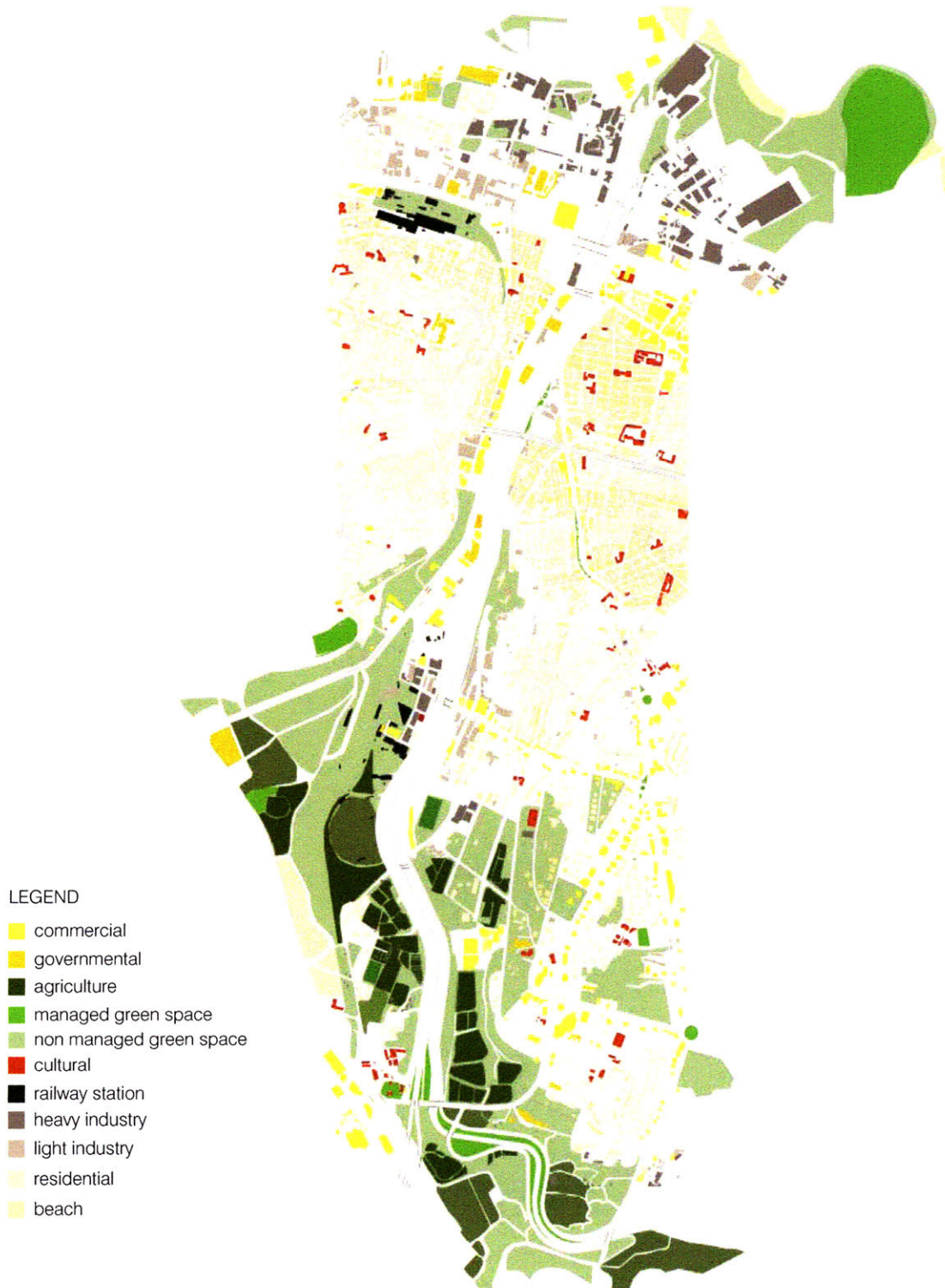


Figure 1.32: Building Land Use

GEOGRAPHIES
LAND USE

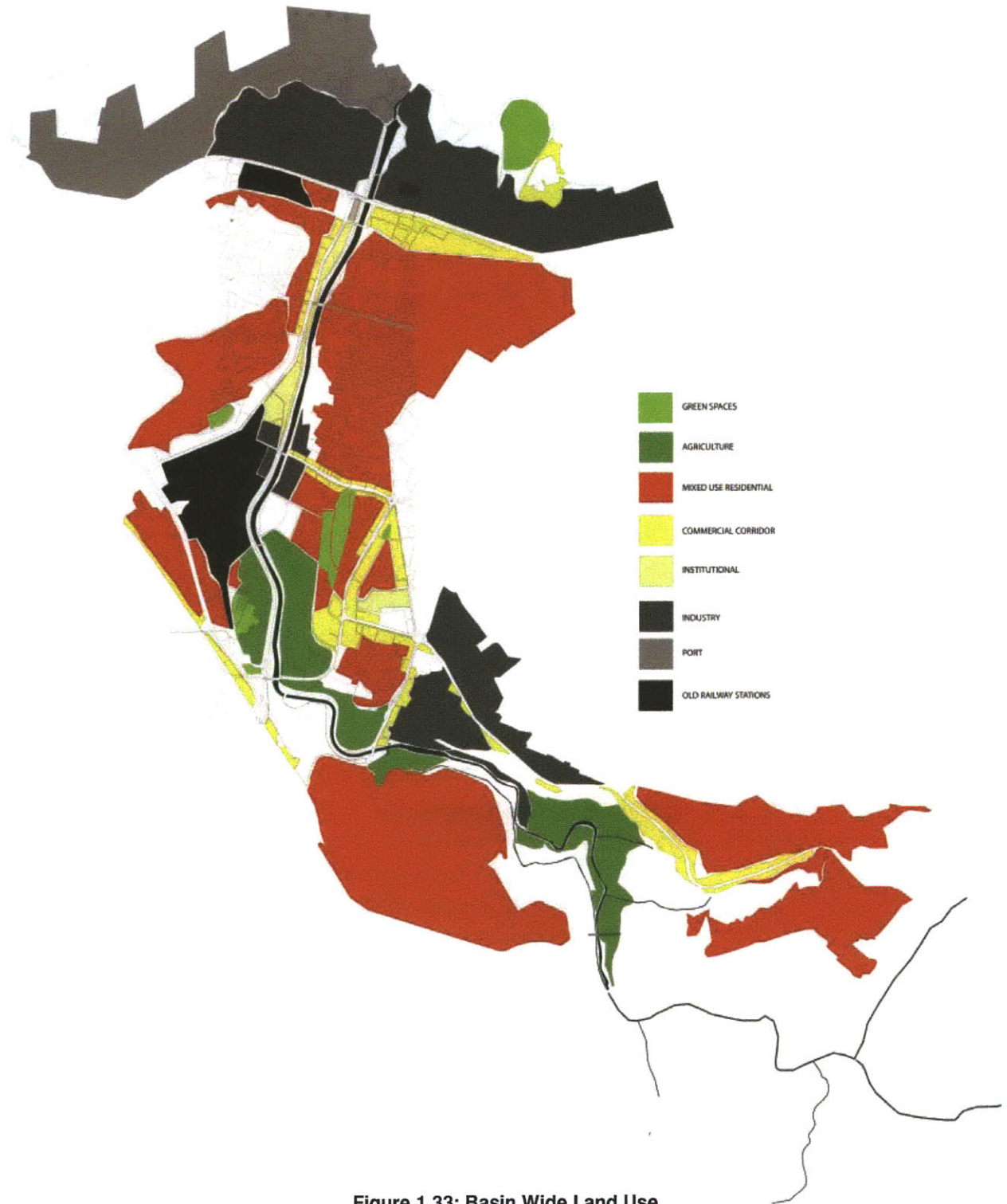


Figure 1.33: Basin Wide Land Use

LAND USE

An Enduring Industrial Corridor



Figure 1.34: Industrial Zones.

Starting the 19th century, the Waterfront zone of Nahr Beirut witnessed the burgeoning of warehouses and shipping services given its close location to the port, besides the first traditional industries and a small slaughterhouse³².

The traditional enterprises such as leather tanneries and silk factories later declined because of the colonial political economies which didn't promote industrialization³³. However during the following decades, investment and capital poured in modern industry and manufacturing due to the great depression, the WW2, and the resulting decline in trade. Industry seeking cheap labor and cheap land found in the Nahr District an ideal site where no serious regulations hindered its expansion³⁴. It also found a ready market very close by.

The first industrial district in Quarantine specialized in the manufacture of glass, furniture, tile and bricks, leather products, later replaced by the present day metal-based manufacturing, cereal silos, tanneries and artisanal industries³⁵. Starting the 1950s, The Waterfront district facing the Port evolved as a concentration of oil, gas and petroleum companies, slowly converting the residential land use into an industrial district.

The economical boom which started in 1945 manifested itself in the rise of construction sector, the increasing expansion of the Port, and the concentration of industry along Nahr Beirut³⁶. The industrial vocation of this corridor became evident due to its good access to the Nahr Boulevard. The flatness of the terrain, on the low areas between the Achrafieh and Sin-el-Fil hills made it a second-hand choice for residential occupation, thus its relatively low land prices³⁷.

Reflecting the concurrent building boom, construction materials and furniture factories extended southwards along the Nahr corridor, forming major industrial cities at Sin El Fil and Mkalles. In addition, Corniche El Nahr witnessed the rise of automobile companies' headquarters such as Fiat; Peugeot, coinciding with the first automobile commercialization wave in the Lebanese market³⁸.

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A Working Class Residential District

Besides its industrial character, Nahr Beirut has always been the reservoir of Beirut's working class.

Zoning did not restrict industry or residence in the Nahr District for fear of hindering the industrial push of 1946. Furthermore, the zoning ordinance of 1954 allowed an increased floor area ratio under pressure from speculators, builders lobbies, and influential Arab capital³⁹.

The direct consequences were a complete halt of low-cost and medium cost construction. Such halt tragically coincided with the large population migration to Beirut, and consequently provoked the appearance of slums as a major typology of Nahr Beirut's urban landscape⁴⁰. The government has failed to address the conditions of the working class neighborhoods.

Today, most of the neighborhoods are upgraded to better standards of built form and land use, due to their own municipalities' separate efforts. They each have town centers and commercial streets. Their dense urban fabric comprises integrated mixed uses, and their prevalent architectural typology is low and middle income residential buildings with commercial ground floors.

Agriculture as an Infill

In all of the current land uses, agriculture presents the weakest link. Initially, it occupied most of Nahr Beirut's coastal plain and large sides of the valley, with crops including deciduous fruits, vegetables, grains, and olives, developing two particular agrarian landscapes: patchworks and plastic tents in the plain and terraces in the valley.

After constituting the major landscape of the river, agriculture is succumbing incrementally to the pressing demand for housing and industry, and has become today a place holder for future real estate developments rather than a growing sector.

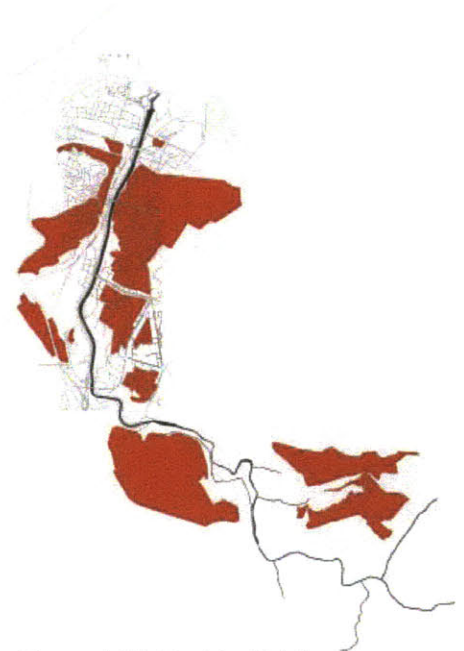


Figure 1.35: Residential Zones

Figure 1.36: Agricultural Zones



Present and Future Land Uses

Today, the land use of Nahr Beirut is still impregnated with its past land uses: It presents sequentially industrial concentrations at Mkalles, Sin El Fil, and the Waterfront, an institutional strip on Beirut's side, a fine grain of residential, light industry and commerce on Bourj Hammoud, Sin El Fil and Rmeil sides, an agricultural transition between Sin El Fil and Jisr El Bacha, and finally a valley which is terraced by agriculture on its slopes and urbanized by residential agglomerations on its ridges.

However, new trends are at play. The current pressures of real estate are already converting some industrial buildings to office spaces, artists' studios, commercial ground floors and art galleries in the Waterfront district, besides new residential and commercial buildings and an art center in Sin El Fil's industrial district. Given the heavy nature of the industry in the waterfront area, it is unlikely that such tendencies could obfuscate the industrial land use or hinder its expected future expansion, rather suggesting a delicate mix of industry and new uses. However, Sin El Fil represents a zone more prone to urban change, given the increasing residential pressure from its opposite side on the canal.

While the lack of infrastructure such as roads and sewers is still slowing the residential expansion on the current agricultural land, new residential buildings are built closer to the remaining fields, and at instances within them.

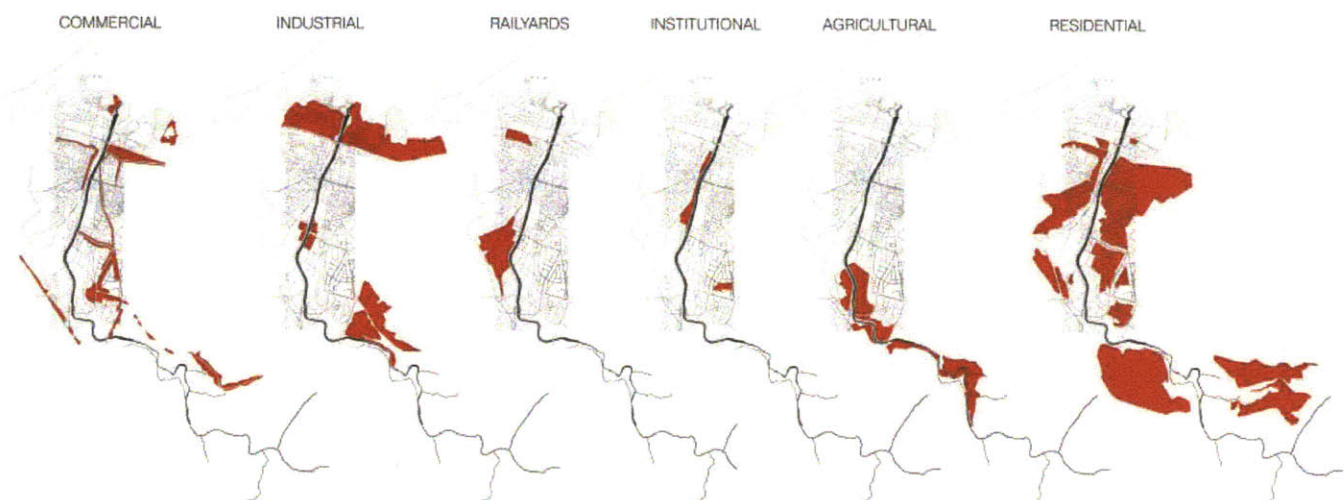


Figure 1.37: Existing Land Uses

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4



Figure 1.38: Existing Land Uses

- 1. Residential Neighborhoods of Karm El Zaytoun.
- 2. Agricultural Fields In Tahouita.
- 3. Industrial City of Mkalles
- 4. Mar Michael Railway Station

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A Multicultural Working Class Community

Nahr Beirut borders today multiple transnational and local communities. Starting 1933, Armenian refugees who escaped the death marches came to settle on the Nahr's banks at Bourj Hammoud and Rmeil⁴¹. In the following years, the Nahr rose as the nucleus of the Armenian diaspora. Because of their transnationalism and their new coming status, the Armenians nurtured a very strong sense of identity, strong community bondages and self-sufficiency⁴². While initially witnessing internal conflicts between the different Armenian political parties, the community later unified when facing the outer threat of the Lebanese civil war⁴³. Later on, this community exhibited social tolerance to the different ethnic groups which came to live afterwards in the district.

After the beginning of regional conflicts in 1948 and during the second half of the century, the Nahr became home to a multi-ethnic working class. Migrants and immigrants comprised Shiites, Palestinians, Iraqis, and Kurds in search for shelter or opportunities, and constituted the bulk of Beirut's working class. Middle class Maronites settled further away in the residential areas of Sin El Fil, Sioufi, Furn El Chebbak, and Hazmieh. Before the Civil War, the population along Nahr Beirut was around 250000 inhabitants. The tense social and political malaise which preceded the civil war reflected in the district, as larger sectarian ideologies were translated in local strives, nurtured by the amplification of deep social inequities and degraded living conditions⁴⁴.

During the Civil War, the social diversity was erased as the Nahr which was situated in the Eastern part of the city fell under the Christian Militias' dominion. The first two years of the war led to a quick depopulation and a homogenization. While the Armenians tried to stay neutral, massacres of Tel al-Zaatar and Quarantina caused the non-Armenians and non-Christians to flee.

During and after the war, second generation Armenians and Maronite Christians reshuffled out of the district through migration to new residential zones which were emerging in Tahouita, Hazmieh, Mansourieh, Zalka...

In the last decade, Lebanese Shiites have begun moving back to the district, coexisting with a diverse community which comprises Egyptian Muslims,

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Buddhists from Sri Lanka, Orthodox Ethiopians, Armenians and Lebanese Christians⁴⁵. While Armenians have actively stepped out in the Lebanese political and social life, the social relationships between local and other foreign communities is closer to a polite coexistence rather than a melting pot situation.

Today Bourj Hammoud, Rmeil and Sin EL Fil are densely populated communes with mixed residential district, local commercial and industrial enterprises. Reflecting the multi-cultural society, ethnic stores and markets have emerged and features imported goods from Armenia, Sri Lanka, and Philippines amongst others...

The different municipalities' services have also improved in the last few decades, raising the residents' quality of life to better standards, however they still miss constant needs like upgraded housing and a public space which hosts the different communities' public life.

Social Practices and the Image of the Nahr

Today, Nahr Beirut hold various meaning for the residents around it. It is a beautiful memory for some of the elders, a boundary of past conflicts for others, a boundary signifying the end of one's neighborhood, a discharge container for many, a playground for some young kids, but for most of the residents, it is simply concealed from their daily lives, and non-existent anymore.

Before the sixties, it held an important status as a water resource and a place where people could meet while doing their daily tasks. It was the stage of seasonal cultural events for some of the communities⁴⁶. Prior to the canalization and because of the overcrowding of informal housing on its borders, the Nahr became environmentally degraded due to the discharge of domestic sewers, tanning factories, and sanitation was critical and its pollution compromised its potential and changed its image. It became associated with decay, slums and health hazard⁴⁷

After its canalization, the river was socially, physically and mentally taken out of the public imagination, except for a couple of kids which still use it as a playground during summer (figure 1.40)

However, current public events have made their ways around the canal walls and are increasingly appropriating infrastructure as a stage for public

gatherings. That is the case of the informal public markets- the Sunday Market at Jisr el Wati and the vegetable market at Sin El Fil, which attract middle to low income classes (figure 1.40).

These practices translate the desperate need for public space on the neighborhood level, which justifies the fact that any available open space is used, even when it coincides under or next to infrastructural entities.

More formal event spaces include Forum de Beirut and Beirut Hall which are two major event halls which target a wide array of users when expositions or concerts are held. Other spaces like BO18, a famous nightclub built on the site of the former Palestinian camp in Quarantina and the Beirut Art Center in Sin El Fil attract other types of audiences. The waterfront also comprises isolated public instances like the fish market at the fishermen's port and the public markets of the Port which are located at the tip of the river (figure 1.40) In 2007, Nahr Beirut has become the site of the Beirut Marathon which is held every year, as the itinerary comprises the road section between Furn El Chebbak and the Waterfront (figure 1.39).

The following testimonials were collected by Haik Papazian, a resident of Bourj Hammoud. In each story, a different aspect of the river emerges, helping to understand its current and past status in the social life of the adjacent neighborhoods.



Figure 1.39: the 2007 Beirut Marathon Route

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Mohammad Hajj Hassan- 13 years old

Nabaa

We sometimes play football in the river during the summer when the river is dry. It's a great football field. Other than that, not much, we pass over it from time to time, and that's almost it. We see people riding bikes, or taking a walk. Haven't been there for a year now though, waiting for summer to start our next tournaments. I have some Armenian friends from school we play against. Last year we won, we'll have to see who's going to win this year.

Rabih Nour Eddine- 35 years old

Nabaa

The Sunday Market has been here ever since the war had come to an end. I've been renting out the same spot every week since I started. I sell all sorts of clothes and underwear for men and women. Before few years, there weren't all these bridges, so it was harder for people from either side to come if they didn't have a car. They used to be these wooden ladders on both sides of the river walls, and people used to go down, walk through the river on car tires, climb up and cross to the other side. But even though it was difficult to arrive, most of the people used to come every week. I have many customers, most of them from the middle and low class that come and buy things every couple of weeks. But things have changed now, the access is easier, and the market is more famous than ever.

Ghassan Hakami- 50 years old

Mkalles

The wall from Quarantine until Sin El Fil was constructed in 1968. That's when they had started most of the highway projects, and since then the floods were killing many people every year, something must have been done. The only solution back then was to build these concrete walls to prevent floods from occurring. In 1998, they built a wall all the way from Sin el Fil to Mkalles. Khatib & Alameh was given the project. They built another concrete basin and used tons of reinforcement for these new walls. They have never cleaned the river basin ever since. all the waste that is being thrown in the canal, and trees / objects being thrown by the floods have stayed there ever since. The river is facing a very dangerous environmental problem. Something must be done about this, but no one is doing anything... they're still discharging all sorts of waste in the river. Something must be done.

Nadim Khalil- 47 years old

Jisr EL Bacha

I opened this factory here before the war with my older brother. That's when all the other factories were being constructed on the left side of the river here in Mkalles. Then came the war, and people started to build haphazardly, and many factories were built on the side of the river. The law states that they should be built 20 m away at least. But that wasn't all. Most of the factories were cement factories, and they used to throw a lot of solid waste into the river. There were some other factories that used to throw chemical wastes in

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the river. If the river could have been used at least for irrigation, now it's so toxic that it's impossible to use it for anything. God knows what kind of toxic materials are in the river. Every year during winter, the river used to flood the factories, so in 1998, they built a continuation of the old wall, all the way to Mkalles.

Paramaz Haroutiounian- 57 years old

New Hadjen- Nahr Badawi

We used to live next to the church. We never used to go to Bourj Hammoud, unless to visit some relatives from time to time. The river helped in separating us from the Tashnags in Bourj Hammoud. In 1958, there still wasn't the motorway parallel to the river, the river used to extend from new Hadjen to Bourj Hammoud, and there was a low bridge from the days of the French Mandate. That year, there were conflicts between us and them and the bridge over the river was a battlefield. My uncle had died back then, I don't remember him much. They used to shoot each other with guns from both sides of the bridge. We used to live this adventurous life back at those days. Couple of years later, the situation became calmer, and we used to cross the river more often. But the tension was still there and the river was proof of its existence. When they built the walls for the river, confined it, built the motorway and the new bridge, they saved us from having another conflict. They separated us from each other even more. I hardly visited Bourj Hammoud after the war.

Sivart Apkarian- 62 years old

Karm El Zeytoun

My parents were living in Karm El Zeytoun. I was born in this street and have lived there until I got married and moved to the street across. My aunts and uncles all used to live in Bourj Hammoud. What separated us from each other was the river, but we used to cross it all the time. I used to go to my aunt's in Bourj Hammoud almost every day, play next to the river until it got dark. The sunset meant we had to cross the river and go back home once again.

Antoine Dagher- 65 years old

Sin EL Fil

I remember nature was all around the river. all sorts of plants, trees, fruits, flowers. It was beautiful, banana trees, lemon trees, tomatoes, effendis... one had everything he could think of. Like everyone else, we used to play in the river take our bath there, our mothers used to clean the clothes. We used to even drink the water from the river, irrigate the lands. There was the historical bridge, Jisr El Bacha, everyone was so proud of the place.

This was until the 60s... then, came the factories in Mkalles, and started discharging all sorts of wastes in the river. Things had already gotten worse before the civil war, but at least it was better than what it is today. But at least, the river basin was mud, water used to pass to the ground, and the pollution wasn't that much... But later on, after they built the concrete walls and made the concrete basin, things got worse. Life in the river died. Whatever the

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government has been doing ever since has made life even worse than what it used to be.

Avedis Hovhannessian- 76 years old

Quarantina

When our parents first arrived to Bourj Hammoud, they settled next to the river. There were small settlements on the riverbed in Sin El Fil, but our community was the largest. Construction in the city had already begun; people were buying lands, buying houses right next to the river. As all the other children we used to play with water. The sand of the river was very soft, we used to play with it, and our parents used it for construction. The water was fresh, different types of fish in it. We used to catch the fish to cook for lunch. My mother used to get so happy every time I used to catch one. We had just came from the Quarantina camps on the other side of the river, but life hadn't changed much, as we were still right next to the river. We never used to dare to go to the beach after it got dark. But during the morning, I and my father used to go where the river meets the sea, it was the most beautiful thing. My father had a small boat and we used to go fishing. Days and Years passed by, we grew old and so did the city. The river isn't what it used to be 70 years ago... every thing has changed ever since.

Sarkis Sarkissian- 63 years old

Bouj Hammoud

We were children. I used to live on the side of the river. My father had bought some lands next to it. The water used to reach to our houses. Everything around us was gardens, orange trees and other fruit trees on our side of the river bed. Bourj Hammoud was being constructed at that time, in the 30s. We used to do everything there. We used to play, try to catch snake fish, frogs... My mother used to get water from the river to cook for us. Our lives were based around the river. Every Friday, we used to take our weekly bath. It was the best thing to happen every week. The water was low. The adults used to plunge huge rocks for us to cross over; we used to cross over every week, go to Achrafieh and Sin El Fil to the specialized markets to get our needs. The market used to come to us on other days, all the vegetable farmers used to settle on the river bed, lay down their stuff and sell then. The tramway used to pass over the bridge. We used to hear the noise it makes and go out to check it out. My mother used to do the laundry with all the other women from our neighborhood. Saturdays were laundry days. Our mothers used to wash, and we used to play with the water. There was a low bridge connecting Boruj Hammoud to New Hadjen. It was a beautiful bridge with Victorian balustrades. They used to talk about an old roman bridge that used to exist in its place, but I can't remember it, I suppose it was torn down by a flood when I was very young. During the winter the water level used to rise and reach the level of the houses. Sometimes water used to come in our home.

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ENDNOTES

- 1 See Fawaz M. et Zein P. L'aménagement du Nahr Beyrouth. *Horizons Techniques du Moyen Orient*, no 5. pp.24-36. 1965
- 2 See Fawaz M. et Zein P. L'aménagement du Nahr Beyrouth. *Horizons Techniques du Moyen Orient*, no 5. pp.24-36. 1965
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- 5 See The United States Department of the Interior. Water resources investigations for the Nahr Beirut Basin, Lebanon: Reconnaissance report. The United States Department of the Interior—Bureau of Reclamation, Denver 1957.
- 6 See Gerard, Pierre-Charles. Les Transformations de l'Hydro-Systeme Fluvial de la Partie Aval du Nahr Beyrouth. in *Geospheres, Annales de Geographies*. Universite Saint- Joseph, Beyrouth, Vol. 21-22, pp.135-147. 2000-2001
- 7 See Davie, May. Maps and Historical Topography of Beirut. *Berytus*, vol. XXXV, pp. 141-164. 1987.
- 8 See Davie, May. *Beyrouth et ses faubourgs (1840-1940) :une intégration inachevée* /May Davie. Beyrouth: CERMOC, 1996.
- 9 See The United States Department of the Interior. Water resources investigations for the Nahr Beirut Basin, Lebanon: Reconnaissance report. The United States Department of the Interior—Bureau of Reclamation, Denver 1957.
- 10 See <http://www.waterofbeirut.gov.lb/monasabatframe.htm>
- 11 See <http://www.waterofbeirut.gov.lb/monasabatframe.htm>
- 12 See The United States Department of the Interior. Water resources investigations for the Nahr Beirut Basin, Lebanon: Reconnaissance report. The United States Department of the Interior—Bureau of Reclamation, Denver 1957.
- 13 See Davie May. *Beyrouth 1825-1975, un siècle et demi d'urbanisme*. Beyrouth, *Ordre des Ingénieurs et Architectes*, 2001.
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- 15 See Gerard, Pierre-Charles. Les Transformations de l'Hydro-Systeme Fluvial de la Partie Aval du Nahr Beyrouth. in *Geospheres*,

Figure 1.40: Urban Life Around Nahr Beirut

- 1 Family spending vacation on Bourj Hammoud Beach.
- 2 Public parade on Corniche El Nahr
- 3 Man biking across traffic on Dora Bridge
- 4 Decoration of the canal wall on Bourj Hammoud's side.
- 5 Fishermen's Port. In the background, on can see the landfill
- 6 Commercial Street Adjacent to Nahr Beirut's walls in the Bourj Hammoud section.
- 7 Souk el Ahad or Sunday Market, held weekly under the bridge at Jisr El Wate
- 8 Caption from the movie *Zozo*. The scene depicts kids playing in the river in the summer in 1987. This habit still persists among many kids of the adjacent neighborhoods.

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17 See CALAND, Jacques. Etude préliminaire du remembrement de la zone du Nahr-Beyrouth, volume III : dossier des plans. Beirut : National Lebanese Printing Press, 1965.

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19 Interview with Mr Antoine Salameh in January 2009.

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22 See Yamout, G. M., 2002, 'An Optimization Model for Water Supply Multi-Sectoral Allocation in the Greater Beirut Area', M.S. Thesis, Faculty of Engineering and Architecture, American University of Beirut, Beirut, Lebanon.

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27 Davie May. Beyrouth 1825-1975, un siècle et demi d'urbanisme. Beyrouth, Ordre des Ingénieurs et Architectes, 2001.

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30 See CDR. Plan de transport du Grand Beyrouth. IAURIF-SOFRETU-TEAM INTERNATIONAL.1995.

31 Interview with Professor Youssef Fawaz in January 2009

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- 32 See Ruppert, Helmut. Beyrouth, une ville d'orient marquée par l'occident /Helmut Ruppert ; traduit et présenté par Eric Verdeil. Beyrouth : CERMOC, 1999.
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- 34 See Riachi, Georges. The Structure and Problems of Beirut. Horizons Techniques du Moyen Orient, no 1. pp.29-33. 1965
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- 37 See Ruppert, Helmut. Beyrouth, une ville d'orient marquée par l'occident /Helmut Ruppert ; traduit et présenté par Eric Verdeil. Beyrouth : CERMOC, 1999.
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- 39 See Davie May. Beyrouth 1825-1975, un siècle et demi d'urbanisme. Beyrouth, Ordre des Ingénieurs et Architectes, 2001.
- 40 See Riachi, Georges. The Structure and Problems of Beirut. Horizons Techniques du Moyen Orient, no 1. pp.29-33. 1965
- 41 See Davie May. Beyrouth 1825-1975, un siècle et demi d'urbanisme. Beyrouth, Ordre des Ingénieurs et Architectes, 2001.
- 42 Interview with Arpi Mangassarian in January 2009
- 43 See Davie May. Beyrouth 1825-1975, un siècle et demi d'urbanisme. Beyrouth, Ordre des Ingénieurs et Architectes, 2001.
- 44 See Davie May. Beyrouth 1825-1975, un siècle et demi d'urbanisme. Beyrouth, Ordre des Ingénieurs et Architectes, 2001.
- 45 See Daily Star Article, Times are changing in Bourj Hammoud. Beirut, 14 March 2009 (People and Places)
http://www.dailystar.com.lb/article.asp?edition_id=1&categ_id=1&article_id=100051
- 46 Interview with Haik Papazian in January 2009.
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2

THE INFRASTRUCTURAL LANDSCAPE

DEFINITION

CONTEXT

INFRASTRUCTURAL LANDSCAPE AS A CIVIC AND ECOLOGICAL AGENT

NAHR BEIRUT AS AN INFRASTRUCTURAL LANDSCAPE



Figure 2.0: Emile Lahoud Highway.

THE INFRASTRUCTURAL LANDSCAPE DEFINITION

DEFINITION

The infrastructural landscape is a public built infrastructure which holds a civic role as well as a performative role. The performative role conjoins the built infrastructures with the natural infrastructures, and the civic role consists of revealing this urban-natural symbiosis by layering public programs within the infrastructure.

The infrastructural landscape then becomes a cultural agent contributing to the city's environmental consciousness, beyond any political appropriation and or esthetical values.



CONTEXT

In the contemporary city, the performative aspects of public infrastructure such as sewers and stormwater drains have increasingly been concealed¹.

In the case of Beirut, the city's road and water infrastructures were viewed by engineers and politicians as physical containers which first and foremost should be organized to provide efficient delivery of services, transport flows and water. This one-sided utilitarian approach did not leave room for such infrastructures to embody or play any civic function beyond their performative aspects. The design of such structures- namely the channel, the highway and the bridges reflected such values, and conceived solely on technical criteria, with a total exemption from having to function socially, esthetically and ecologically (figure 2.1).

As such, the built infrastructure erased the natural infrastructure of the river and the riparian habitat instead of working with them. In the name of efficiency, sanitation and flood mitigation, such public works annihilated the cultural ecosystem which allowed previously the interaction of people with the existing habitats.

To add to that, the current natural systems of Beirut which are objects of preservation are museumified instead of being employed to work within the larger network of the city. Their access is denied to the people, by fear that the public would damage such natural sites².

In this context, one question arises: why the infrastructural landscape as a civic realm is relevant and why is it needed in the context of Beirut? In order to fully understand this phenomenon and answer this question, one must understand how the infrastructural landscape emerged as a theoretical and design paradigm. In the light of this reading, one can come back and argue the relevance of its application as a viable alternative for Nahr Beirut.

Figure 2.1: Nahr Beirut as a physical container of water and transport



THE INFRASTRUCTURAL LANDSCAPE

INFRASTRUCTURAL LANDSCAPE AS A CIVIC AND ECOLOGICAL AGENT

INFRASTRUCTURAL LANDSCAPE AS A CIVIC AND ECOLOGICAL AGENT

It is useful to begin with a reading of the infrastructural landscape as mentioned in Kathy's Poole's revealing article, Infrastructure in the ecological city, which inspired the premises of the thesis.

In her article, Poole advocated for a new interpretation of common infrastructures in the city to allow them to regain their civic and environmental significance. By civic, Poole means a realm which is conceptually and physically common to all residents, a collective consciousness which transcends the desires of a group to support the common good.

According to her, the city is composed of two main apparatus: The first is the natural systems which are the original and enduring spatial, temporal and climatic components that engage cultural entities. The second is the infrastructural systems such as sewers, streets, water supply, waste disposal and electricity, which constitute the structure, the function and the dynamics of a city. Both systems form the "built natural infrastructure", the cultural infrastructure of the city.

"These elements of infrastructure are the most important physical interconnection for all residents which permeate the city and citizens-physically, governmentally, socially and mythically... Furthermore these infrastructural systems are inextricably tied to the natural systems that supply them: the topography, the hydrology, and the material resources. By extending our contemporary understandings of infrastructure to include the city's natural ecology- and by reuniting the built and natural- we may find new and renewed understanding of the civic realm".

The article delves into historical precedents of the infrastructural landscape, as a way to uncover the civic role which these common structures had in the 19th century.

Indeed, in the 19th century American cities, what started as problem-solving approaches to the issues of sanitation and public health soon expanded to include larger social issues. Infrastructural reforms encompassed all citizens regardless their socioeconomic status, and their scale of intervention covered sometimes the whole city, acquiring thus a civic significance.

Infrastructural administrations were carefully voided of any political influence, to maintain the neutral identity of the city's infrastructural services, which became considered as a right for every citizen. Such values were reflected

THE INFRASTRUCTURAL LANDSCAPE

INFRASTRUCTURAL LANDSCAPE AS A CIVIC AND ECOLOGICAL AGENT

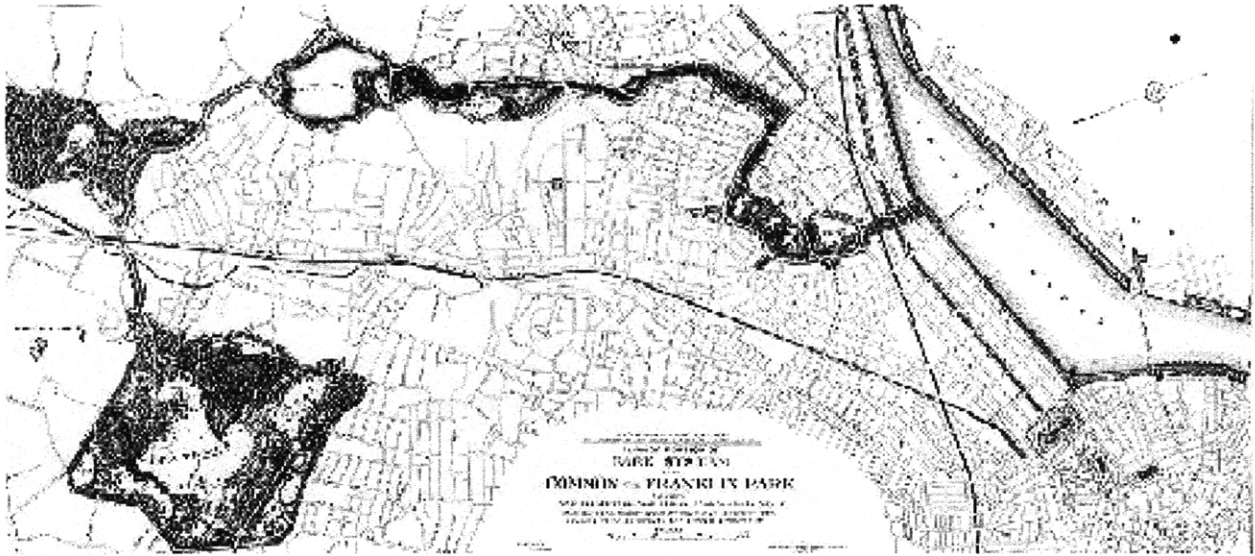
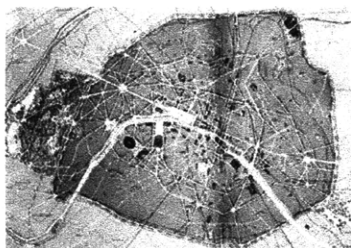


Figure 2.2: Olmstead's park system in Boston.

in Frederick Law Olmstead's park system in Boston (figure 2.2, 2.11), which played dual roles as a water cleansing organism and a civic space benefiting all citizens of the city. In this period, new ideas of spatial technological skills were applied in the design of physical infrastructures, stressing the metaphor of the machinery of the city as urban water systems grew more complex³...

Figure 2.3: les Promenades de Paris

The ensemble Tuileries/Champs Elysées was a key element in the system of public space of Paris in the 19th century, conceived as promenades by the prefect Haussmann and the engineer Alphand under the Second Empire.



In the case of 19th century Paris, the infrastructural development led by Haussmann exceeded pure rationalism and economics to offer civic benefits which engaged the public sphere. Between 1852 and 1869, Haussman's reshaping of Paris comprised a new system of sewage infrastructures which improved urban sanitation conditions as well as allowing the rise a new public order and a new social consciousness among Parisians (figure 2.3). Like Boulevards and the Promenades of Paris, sewers were used as a linkage to reconnect the city (figure 2.4).

Unlike the American apolitical experience, Haussman reinvested Paris' infrastructures with a radical political vision, while keeping the ability and sensibility to address both the technological rationality and the emotive considerations about the city-nature relationship.

Such concepts were abandoned in the 20th century, as the modernist infrastructural applications adopted avant-garde positions in technological advancement and standardization of infrastructure. The prevailing discourse of the 1950s embodied the ideas of technology, technique and the efficient machine, however let go the critical balance with the ecological emotive

THE INFRASTRUCTURAL LANDSCAPE
INFRASTRUCTURAL LANDSCAPE AS A CIVIC AND ECOLOGICAL AGENT

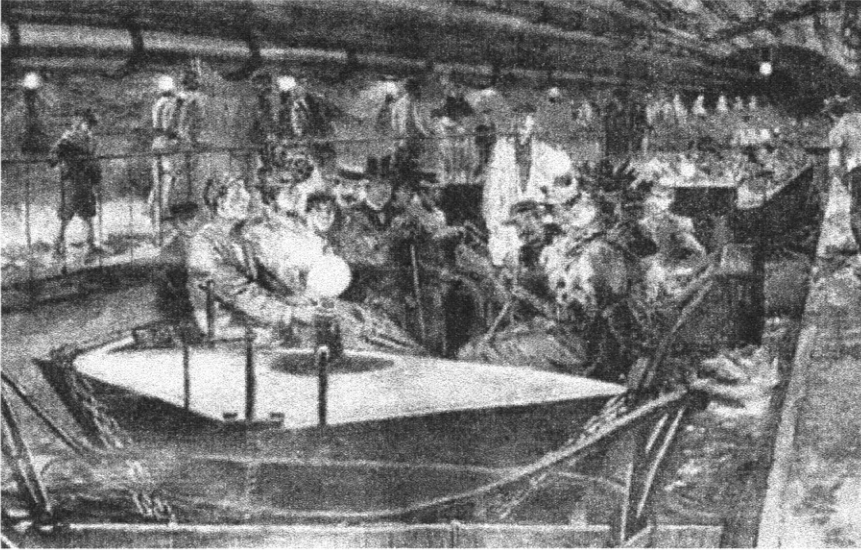


Figure 2.4: A boat trip through the Paris sewer (1896)



Figure 2.5: The Los Angeles River



Figure 2.6: Nahr Beirut

THE INFRASTRUCTURAL LANDSCAPE INFRASTRUCTURAL LANDSCAPE AS A CIVIC AND ECOLOGICAL AGENT

considerations.

What ensued afterwards was the legacy of a mechanized infrastructure: standardized drainage, canalized rivers (figure 2.5, 2.6), normalized public works, and disconnection between the natural systems of the city such as rivers and its municipal water infrastructures such as storm water drains and potable water networks....

The danger in such approach was that the politics of efficiency became beyond question and standardization was the ultimate expression of democracy. Indeed, such idiom was – and still is- the most pervasive mentality for public works projects in Lebanon.

Nahr Beirut is only seen as a municipal infrastructure for the ways it flows as a service rather than a river. It is a service that is related to a municipal unit but it has no relationship to the public realm.

Here I second Poole in advancing that urban designers should instigate a new vision of the value and purposes of infrastructure. This can be done by first reclaiming the territory of infrastructure as significant to design content, and secondly becoming familiar with the formal and technical language which designers traditionally abdicated to civil engineers, by understanding the processes and ecological consequences of hydrology, rational formulas, sewage treatment, solar technology and road construction...

Only then, we can revalue the contemporary approach for engineering infrastructure, subtracting it from the *“tyranny of efficiency, technical experts, and neutrality; and to reinvest common structures with the mythic content that allows connections between inert object and civic imagination and between human and natural systems.”*

The question Poole raises is how can an infrastructure be both civic and ecological? Approaching it one criterion at a time, civic infrastructure should be able to function with larger natural systems: the geology that provides the raw materials, the hydrological processes of water supply and sewage, the vegetation and wildlife. On the other hand, ecological infrastructure must go beyond only respecting and enforcing the bio-physical attributes of a place. As Poole puts it, *“there is a shortfall in regarding ecology only for its scientific aspects- the data, the rational explication, and the spatial implications of such knowledge. For “civic” demands not only rational understandings but emotive and subjective interpretations as well.”*

THE INFRASTRUCTURAL LANDSCAPE

INFRASTRUCTURAL LANDSCAPE AS A CIVIC AND ECOLOGICAL AGENT



Figure 2.7: Fresh Kills Park in New York.

In order to achieve the civic and ecological role of an infrastructural landscape, Poole advocates that we should unearth and make visible the hidden systems of hydrology, energy, waste and biology, exposing their latent potential and making them meaningful in substance and physical presence.

However, we should avoid that this act becomes purely symbolic. Indeed many structures like trees on boulevards and fountains become simple significance of natural features, while completely detached from the original ecosystems. To prevent it from becoming more of urban furniture, the formal expression of the infrastructural landscape should reveal first and foremost its functionality and its processes with natural and urban systems.

Besides her historical precedents, Poole's arguments could be situated in fragments of the many reclamation projects currently taking place in Europe and the US- Fresh Kills Park in New York (figure 2.7), Zollverein Emscher Park in the Ruhr (figure 2.8) among others, and fewer projects dealing with rivers rehabilitation.



Figure 2.8: Zollverein Emscher Park in the Ruhr, Germany.

THE INFRASTRUCTURAL LANDSCAPE INFRASTRUCTURAL LANDSCAPE AS A CIVIC AND ECOLOGICAL AGENT

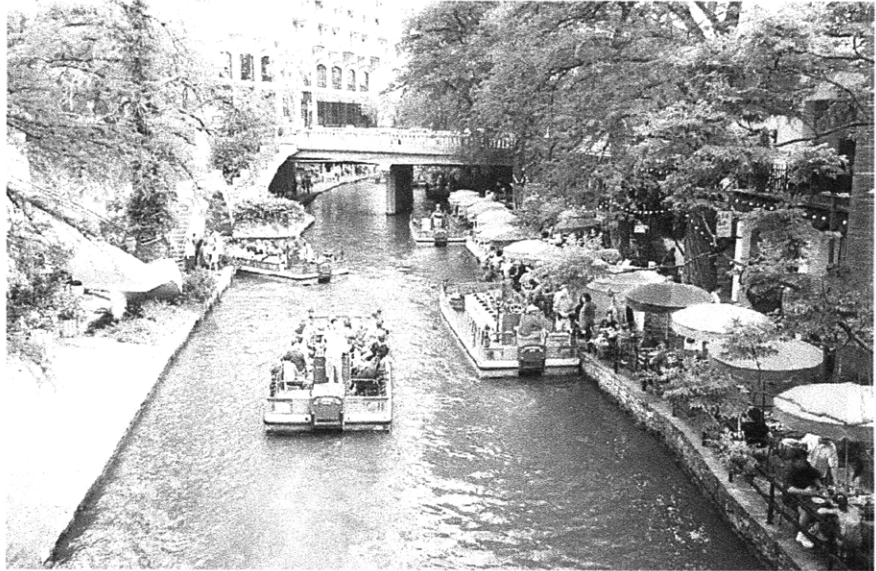


Figure 2.9: San Antonio River Walk, Texas, USA

Figure 2.10: Cheonggyecheon River, Seoul, Korea



Looking at cases which are close to Nahr Beirut, it is worthwhile noticing that such projects could easily drift to a sole civic role regardless the importance of their ecological role.

For example, the Cheonggyecheon River Restoration Project in Korea (figure 2.10) was a mere translation of civic space which missed an opportunity for a real hydrological role. The water pumped in the river comes from another stream, and doesn't relate to any hydrological process of the stream in question⁴. Even though it is intermittent like Nahr Beirut, the need to have water in the river all year long wasn't combined to any reclamation of waste of storm water, and thus became completely symbolic. More responsive,

THE INFRASTRUCTURAL LANDSCAPE

INFRASTRUCTURAL LANDSCAPE AS A CIVIC AND ECOLOGICAL AGENT



Figure 2.11: The Fens, Boston, USA

the project of San Antonio River Walk reflected an ecological sensibility to the topographic differences between the river and the highway, maintaining the microclimate which derives from such conditions, while advocating for a civic and economic rehabilitation⁵. However, the river flood mitigation system was concealed: a hidden storm water drain beneath the river was containing the river's real flow, while the channel above it contained a fraction of the flow necessary to reconstruct the civic promenade (figure 2.9). This mechanism disconnected the river's real processes from what is visible, creating a fake condition.

THE INFRASTRUCTURAL LANDSCAPE NAHR BEIRUT AS AN INFRASTRUCTURAL LANDSCAPE

NAHR BEIRUT AS AN INFRASTRUCTURAL LANDSCAPE

The reexamination of Nahr Beirut as an infrastructural landscape first recognizes that all spaces are valuable in Beirut, and not just the privileged spaces of the center, and therefore this artery must be inhabited in a meaningful way. This requires engaging with the channel, the highways, the spaces underneath bridges, the obsolete industrial sites. It requires reclaiming the landscape generated by waste- namely the waterfront landfill, the quarries in the valley and the solid waste of the industrial areas. It requires re-thinking of the urban form of the built environment, and how it can start to face the river instead of turning its back on it.

And finally, it re-engages the ecological processes such as stormwater, floods, and wastewater as well as the re-introduction of an ecological connection between the valley and the waterfront.

Besides its much needed regenerative role, the relevance of the infrastructural landscape to Nahr Beirut's context is also because of its civic significance, and its potential to engage the social and cultural needs of the communities around it.

Quality and availability of water is something valued by all citizens, and so is urban nature as a place of recreation. These concerns transcend cultural barriers across all social groups in the Lebanese society.

Introducing the infrastructural landscape on the Nahr could then be the project which transcends jurisdictional boundaries and becomes an opportunity for the different communities to work together and become involved in determining their built environment. The infrastructural landscape would be the tool to reclaim the "right to environment", especially in the context of the elitist appropriation of green spaces in Beirut.

From this position, Nahr Beirut can unite citizens across cultural barriers and an ecological understanding can contribute to a common cultural history.

THE INFRASTRUCTURAL LANDSCAPE

NAHR BEIRUT AS AN INFRASTRUCTURAL LANDSCAPE

ENDNOTES

- 1 See Poole, Kathy. Civitas Oecologie. Infrastructure in The ecological city. The Harvard Design Review 10 Civitas/ What is City, 1998.
- 2 That is the case of Solidere Gardens in Downtown Beirut and the Pine Forest which has been closed to the public. See Now Lebanon's "the Pine Forest" article at <http://www.nowlebanon.com/NewsArticleDetails.aspx?ID=8511>
- 3 As mentioned in Kathy Poole's article.
- 4 See PARK Kil-Dong, Seoul Metropolitan Government, Korea. Cheonggyecheon Restoration Project. http://www.wfeo.org/documents/download/Cheonggyecheon%20Restoration%20Project_%20Korea.pdf
- 5 See Zunker, Vernon G. A Dream Come True: Robert Hugman and San Antonio's River Walk. San Antonio: V.G. Zunker, 1983

3

SITE

INVENTORY

Waterfront

Urban Zone

Agricultural Transition

Valley

ISSUES

Water

Transport

Public Space

STRATEGIES

Water

Transport

Public Space

INVENTORY

As a result of its urban and natural land uses, Nahr Beirut comprises four main zones: the Waterfront, the Urban Zone, the Agricultural Transition, and the Valley (figure 3.1).

Normally a coastal watershed takes miles to transition between the four mentioned sequences¹. However, in the case of Nahr Beirut, this transition is done on a very short distance, 6 km, resulting in abrupt passages from one zone to another, which is evident on the sectional changes (figure 3.2), the urban form, and the resulting urban landscape.

As such, one of the design challenges is how to deal individually with such four zones, and how to link them together.

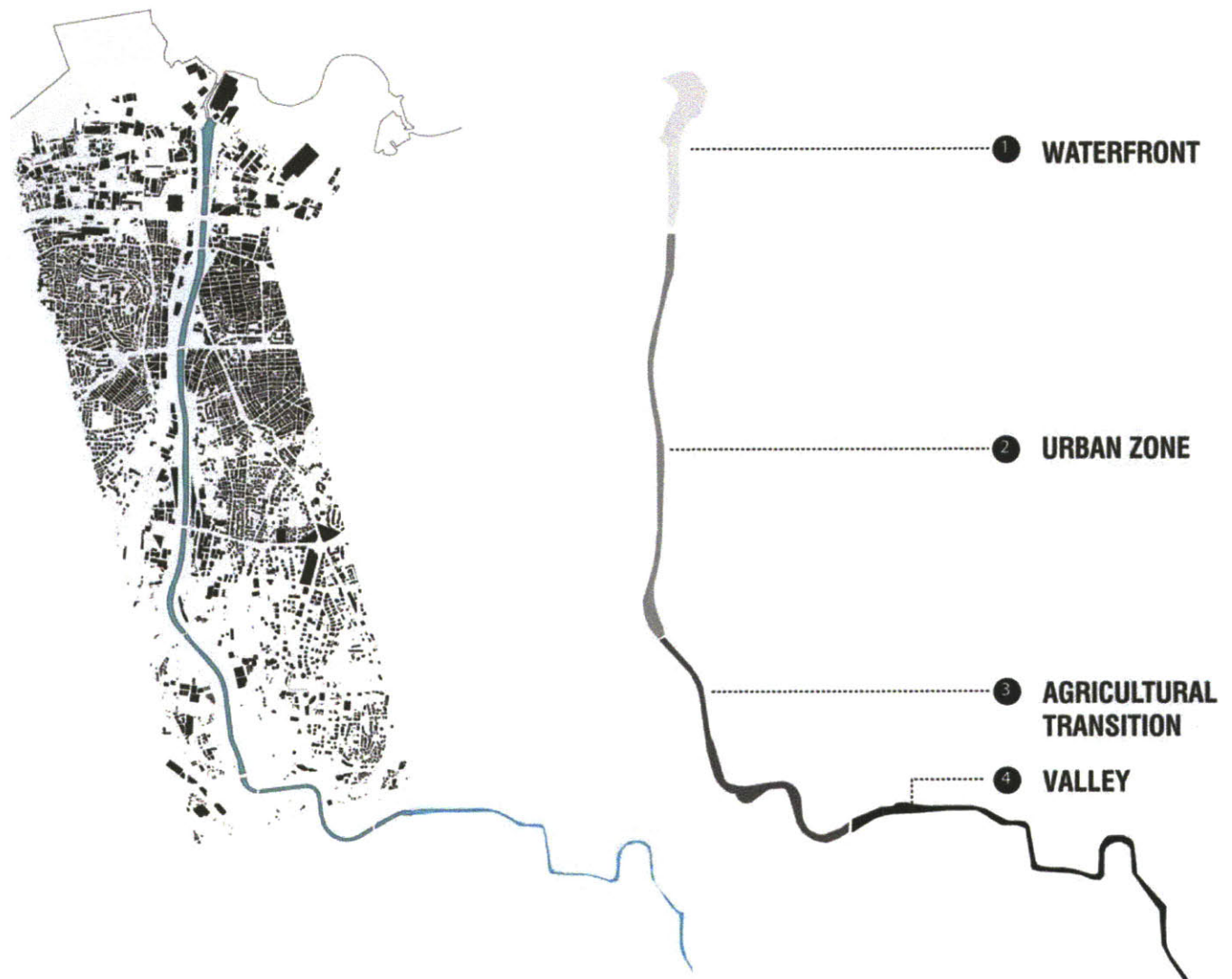


Figure 3.1: The Four Zones of Nahr Beirut

INVENTORY

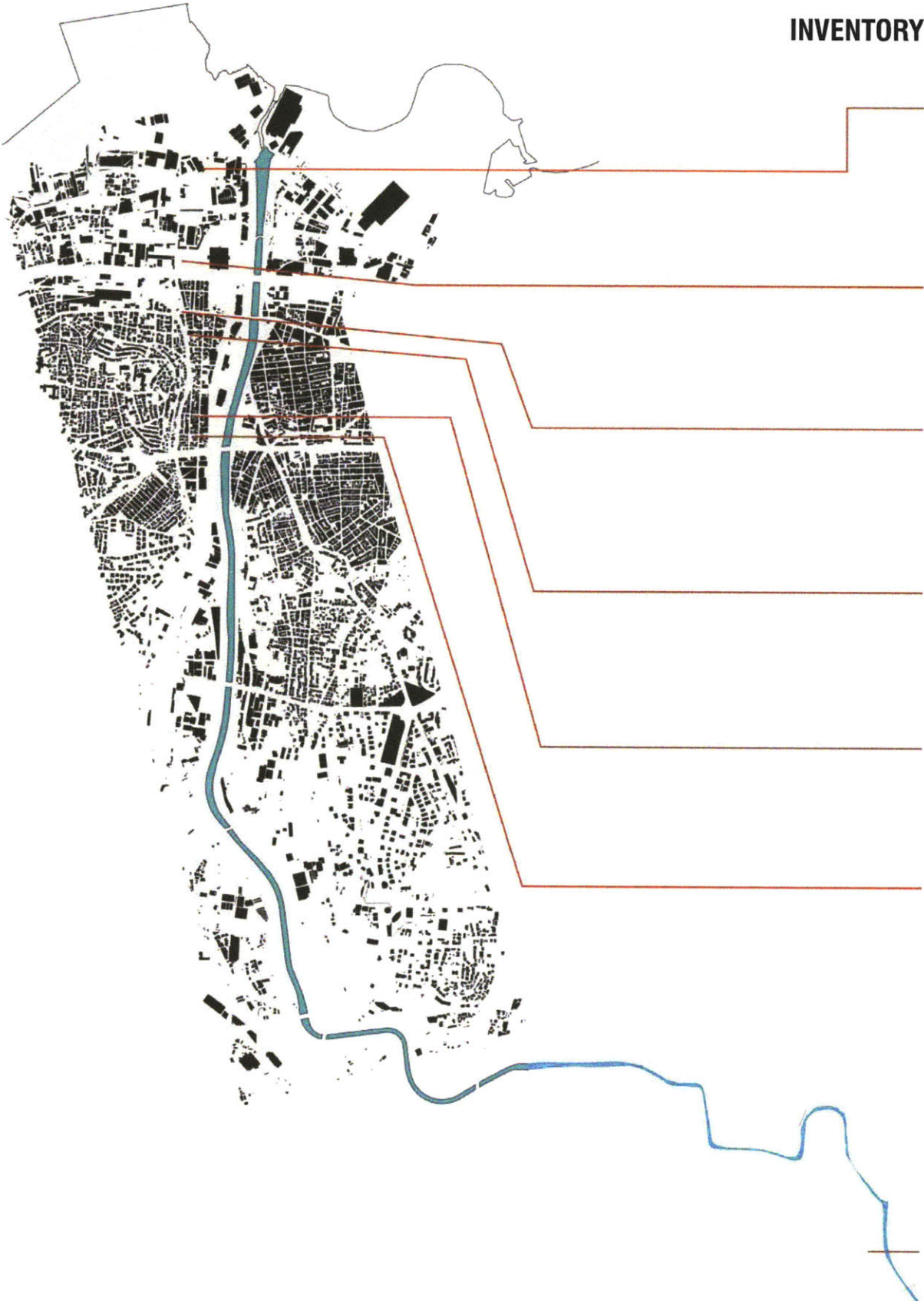


Figure 3.2: Sections Inventory of Nahr Beirut

INVENTORY

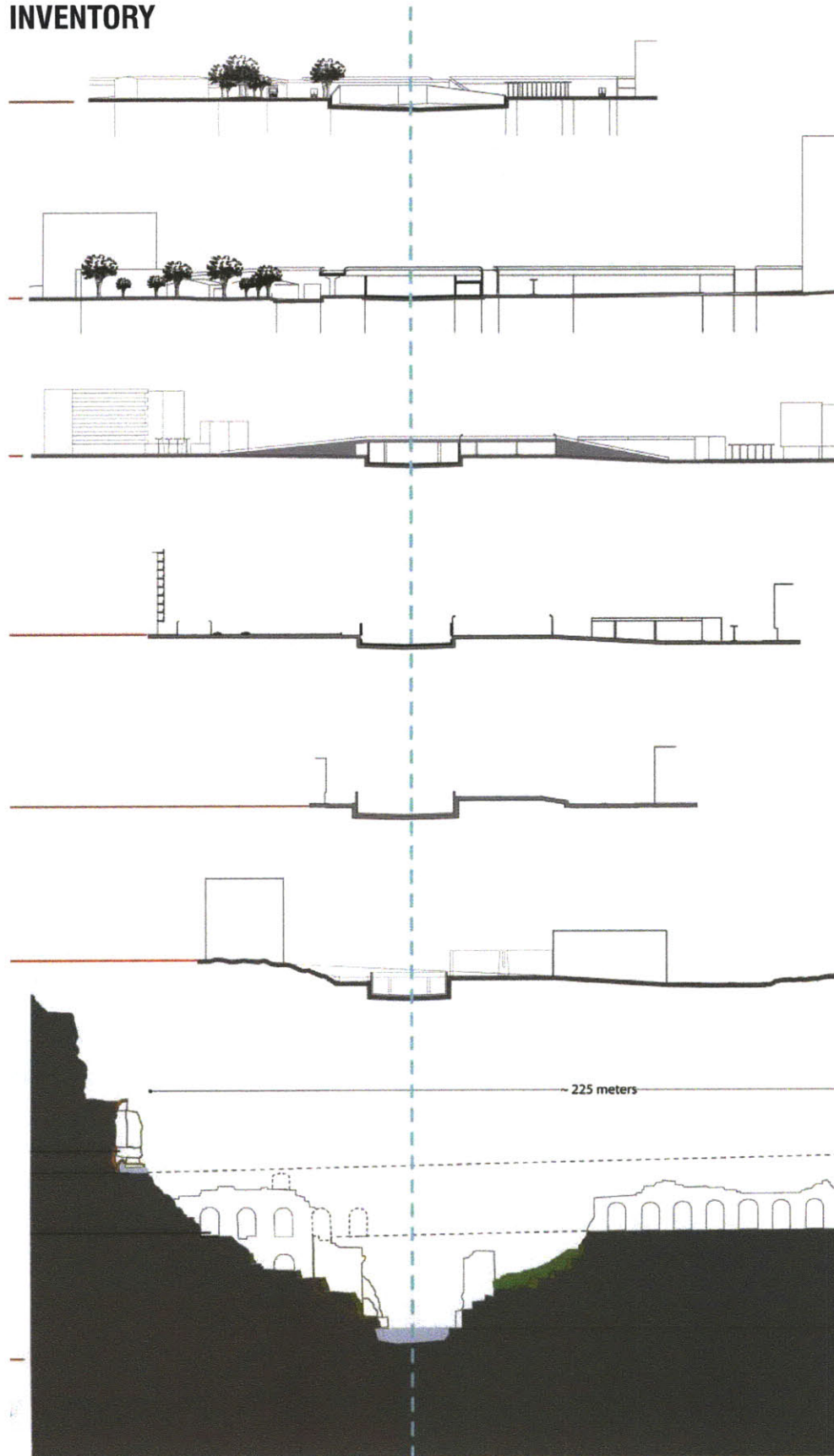
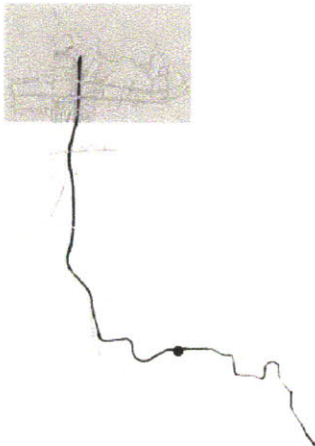




Figure 3.3: Waterfront Zone. The waterfront is isolated from the city by the industrial stripe showing in the back. **1**



Figure 3.4: Waterfront Zone. The fishermen port is in the foreground while the landfill is in the background. **2**



Waterfront

The waterfront zone comprises a predominant industrial land use (figure 3.3). The public domain line is clearly defined by the property walls which separate the existing factories from the water. The existing waterfront is occupied by a 30 year old landfill, an old fishermen port (figure 3.4), a beach and estuary (figure 3.5). which are polluted by the industrial outfall canals, a waste treatment plant and the port's markets. The slaughterhouse is located at the intersection of the port and the industrial zone located at its back. The channel's profile in this section is 43 meters wide and slowly narrows towards the tip with an average height of 3 meters (figure 3.6) . It extends over the first 2.4 kilometers with a 1.5 % slope². The maximum water velocity for this section is 5.7 (for an 1100 cubic meters/second flood).

**INVENTORY
WATERFRONT**



Figure 3.5: Waterfront Estuary

3

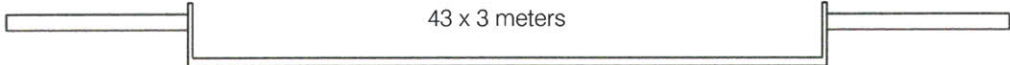


Figure 3.6: Waterfront Channel Profile



Figure 3.7: Waterfront Plan



Figure 3.8: Urban Zone.

1

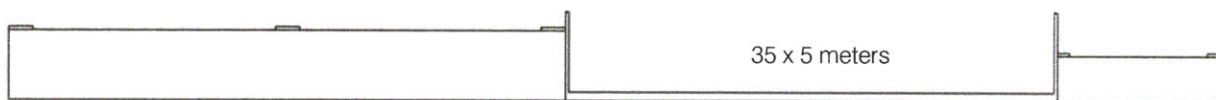
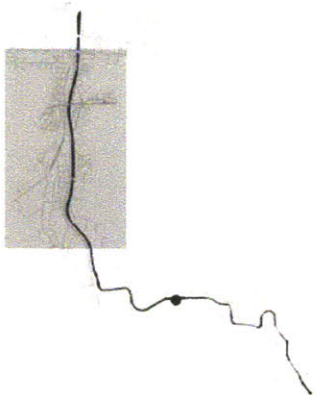


Figure 3.9: Urban Zone Channel Profile

Urban Zone



The urban zone comprises dense residential neighborhoods on Bourj Hammoud and Sin El Fil side (figure 3.11), and an institutional stripe on Beirut side (figure 3.10), behind which are located the residential neighborhoods of Achrafieh.

The channel in this section is sandwiched between the regional highway on Beirut's side, and a local road on the opposite bank (figure 3.8). Its profile is 35 meters wide by 5 meters high, and extends on 1.65 km with 3.5% slope³. The maximum water velocity for the urban zone reaches 8.2. (figure 3.9)

INVENTORY
URBAN ZONE



Figure 3.10: Urban Zone- Beirut Side

2



Figure 3.11: Urban Zone- Bourj Hammoud Side

3

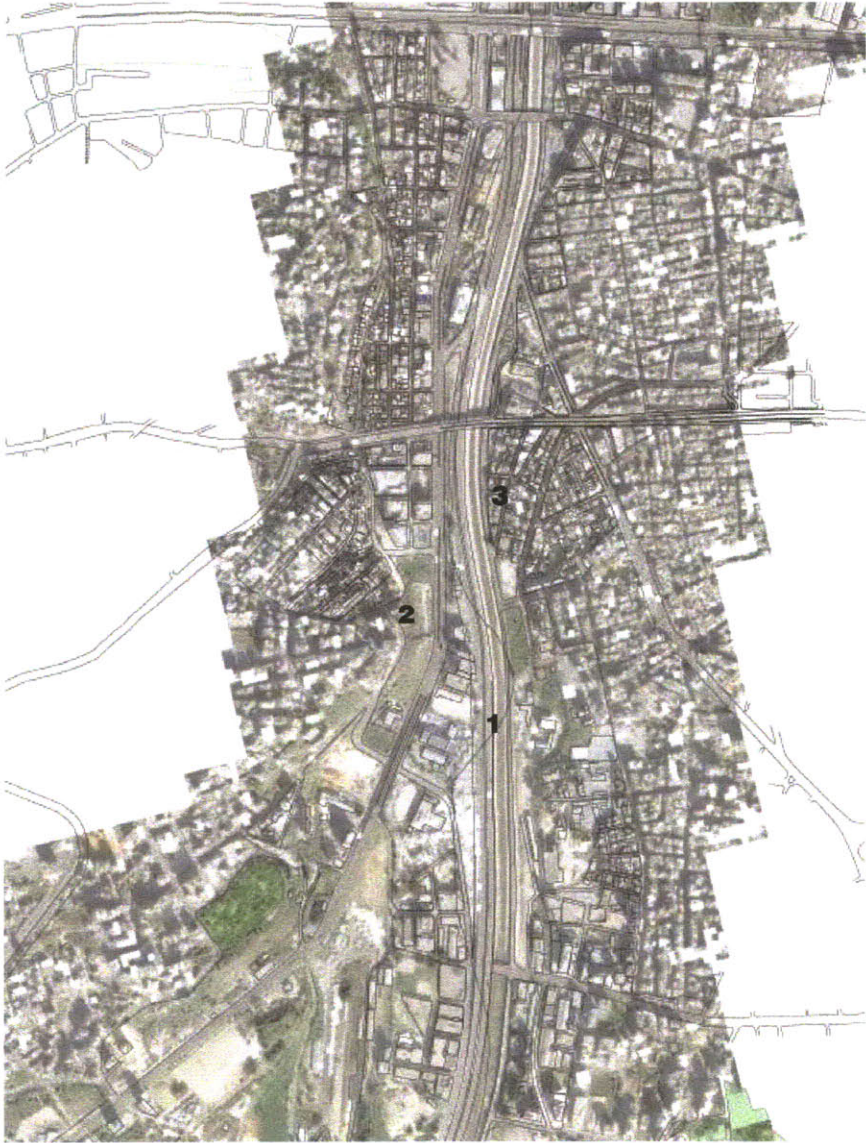


Figure 3.12: Urban Zone Plan



Figure 3.13: Panoramic of the Agricultural Transition

1

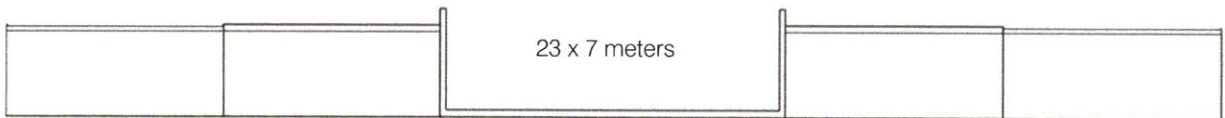
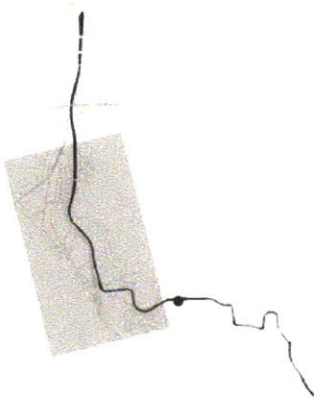


Figure 3.14: Agricultural Transition Channel Profile

Agricultural Transition



This section is mostly open space agricultural fields which represent with the railway stations the last substantial open space in Beirut (figure 3.13). The channel in this section becomes narrower and the walls higher, with a width of 23 meters, a height of 7 meters (figure 3.14), and a slope of 6.5%⁴. Starting this section, the channel is flanked on both banks by stripes of vegetation, buffering the adjacent roads and extends this way until the end of the channel in the valley section. The regional highway diverges from the channel in this section through a major interchange at Furn El Chebbak. As such, secondary roads continue between Sin El Fil and Jisr El Bacha, and provide entrances and exits to the regional Emile Lahoud Highway.



Figure 3.13: Panoramic of the Agricultural Transition



Figure 3.15: Agricultural Transition Plan

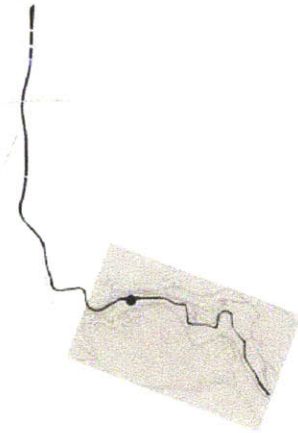


Figure 3.16: Jisr El Bacha Ottoman Bridge.



Figure 3.17: The Roman Acqueduct.

Valley



At the beginning of valley, the channel is completely excavated in the ground while in the waterfront it was built from the ground up (figure 3.16). The channel crosses between the Mkalles industrial city and the Hazmieh residential neighborhoods and ends before the wide agricultural plain (figure 3.19). From there, the valley begins its canyon-like profile with the river running at the bottom and residential agglomeration situated at the top of the ridges (figure 3.18). Archeological remains are abundant in the valley section and comprise the remains of the ottoman bridge, Jisr El Bacha, the roman acqueduct (figure 3.16, 3.17), roman cisterns, old mills, and the roman temple of Bacchus, next to Deir El Kalaa.

The valley landscape alternated between natural woods, agricultural terraces and occasional villages.



Figure 3.18: Nahr Beirut at Dachouniyyeh.



Figure 3.19: The end of the canal at Mkalles.

1. WATER ISSUES

On the hydrological level, the river is flanked by three main issues: Intermittent flow, flooding and pollution.

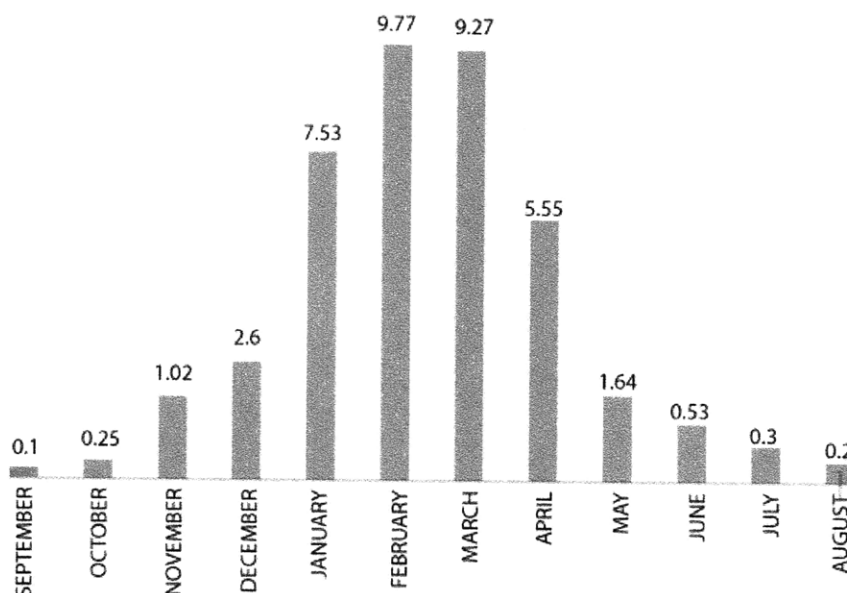


Figure 3.20: Nahr Beirut Flow

Intermittent Flow

Nahr Beirut is intermittent by nature (figure 3.21, 3.22). Its current tributaries are alimeted fresh water sources, storm water and snowmelt and waste water discharges. As such it currently represents strong flow variations fluctuating between 16 cubic meters per second in the wet season and 0.1 cubic meters per second in the dry season (figure 3.20).

This variation has been further accentuated after the permanent deviation of its fresh water sources, in order to supply drinking water to the Metropolitan Area and upstream agglomerations.

The drastic hydrological contraction between winter and summer reverberates on the water supply of the metropolitan region. In fact, Beirut experiences one of the highest rainfall quantities of the Middle East in winter and severe water supply shortages in summer.

ISSUES
WATER



Figure 3.21: Wet season Condition



Figure 3.22: Dry Season Condition

Flooding

The maximum flood limit for Nahr Beirut is 1571 cubic meters per second spanning over 30 hours⁵.

The channel is dimensioned in all its profile variations to contain a flow of 1100 cubic meters per sec (figure 3.23).

As such its current form does not adapt to the average winter flow of 10 cubic meters per second, and it still does not meet the full flood capacity. Furthermore, the bottleneck effect which occurs at its tip increasing flooding risks. Such case has already happened in 2005, when a 100 years flood broke the bridge located at its tip and flooded the slaughterhouse and port⁶.

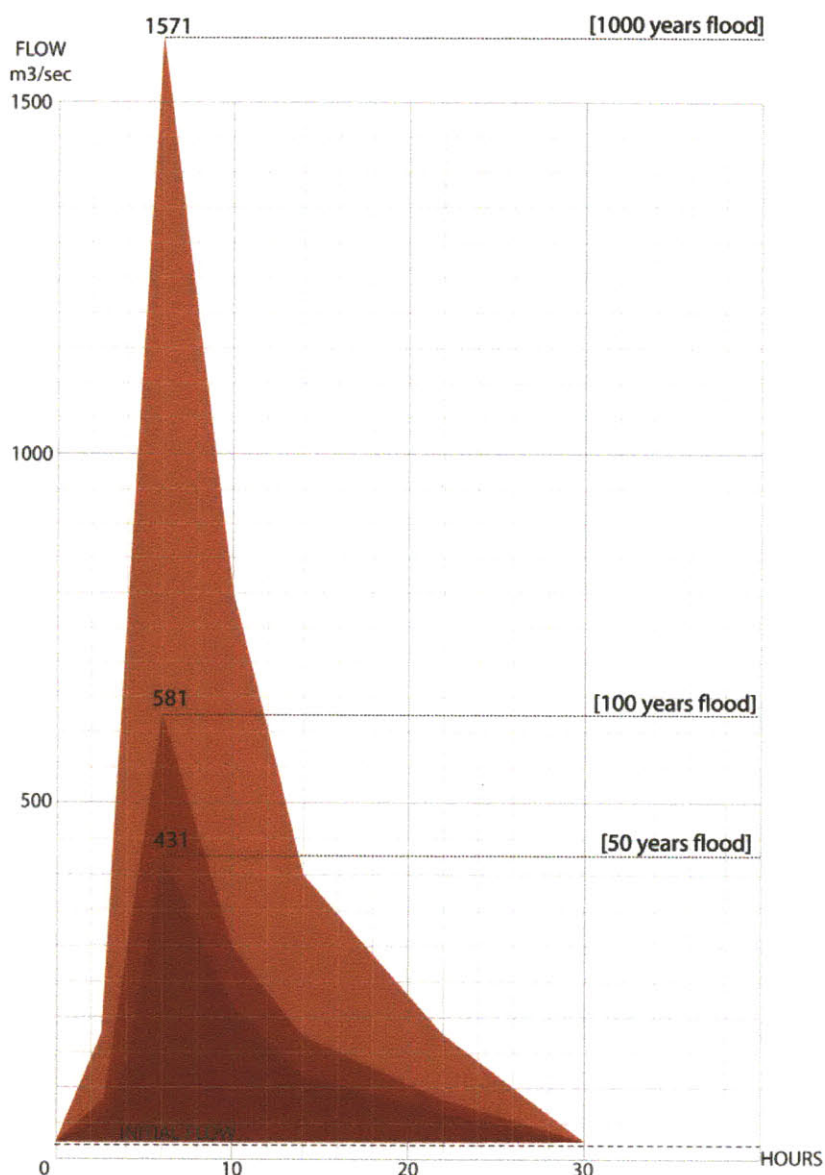


Figure 3.23: Nahr Beirut Flood Cycles

ISSUES WATER

Pollution

Pollution on Nahr Beirut varies with the nature of the landuse on its banks. (figure 3.24) There are three main sources of pollution along the canalized section of the river (figure 3.25): industrial effluents from the three industrial cities, sewage, and pesticides from the agriculture irrigation water. This fact is mostly evident in the summer, when the river primarily becomes an open air sewer, due to the complete absence of water. Furthermore, the river receives solid waste discharges from the construction material factories in Mkalles, and organic remains from the slaughterhouse in Quarantina. In the valley, the river receives domestic waste and wastewater discharges which intercept the sources of Nahr Beirut and contaminate both surface water and groundwater tables⁷.



Figure 3.24: Pollution on Nahr Beirut

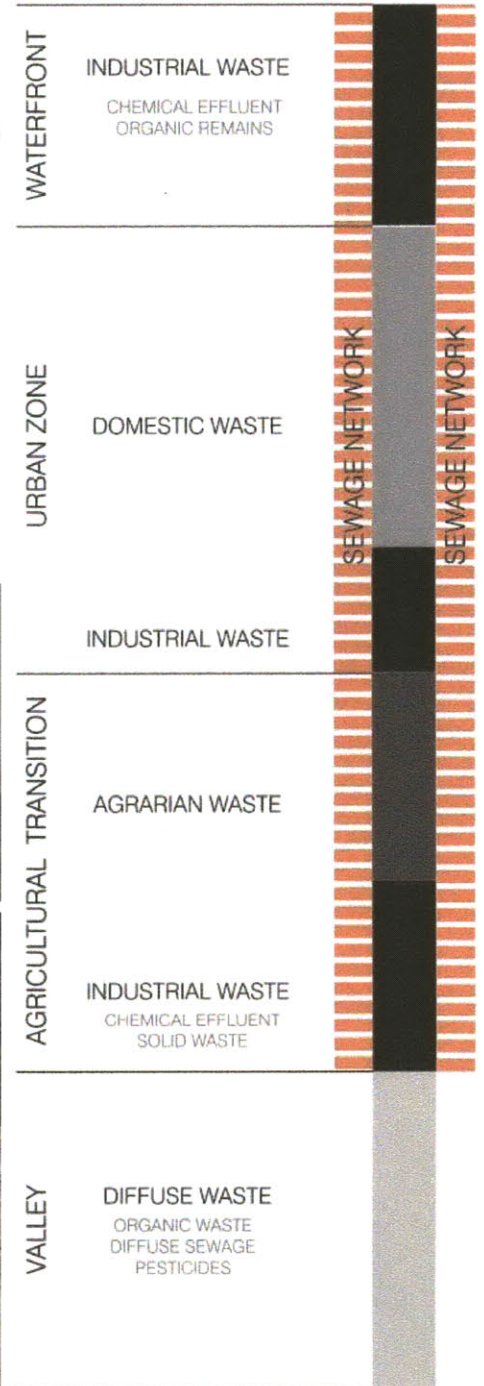
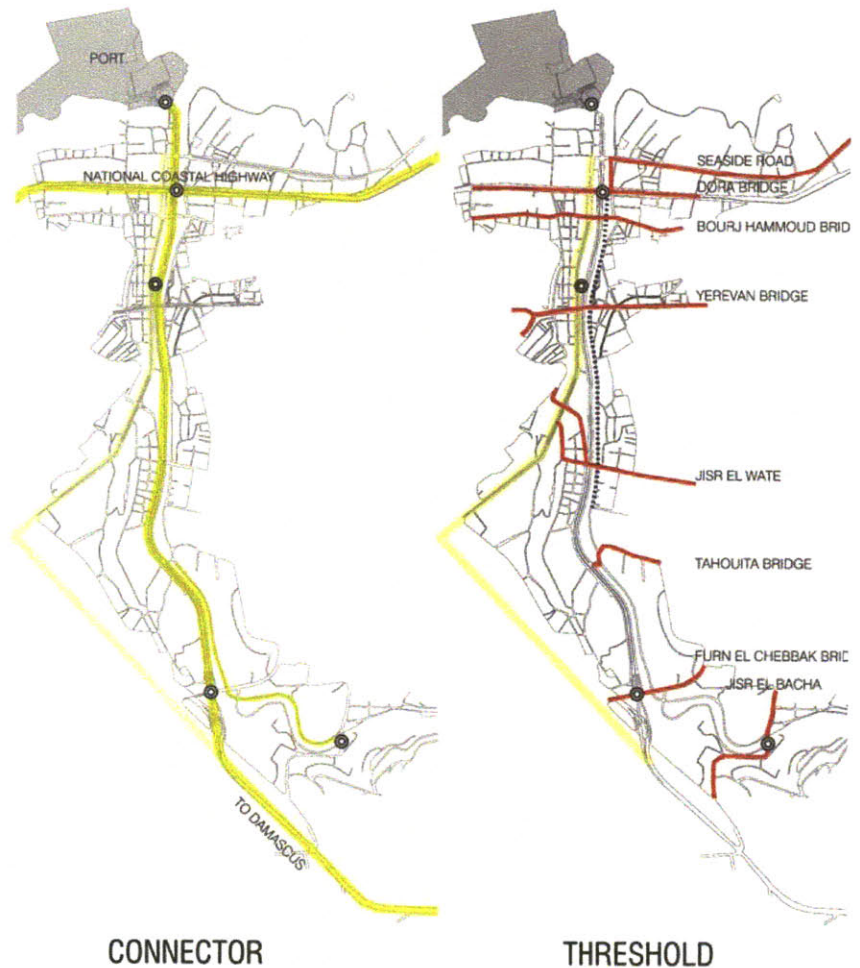


Figure 3.25: Pollution by Type and Zone

2. TRANSPORT ISSUES

The Emile Lahoud highway is a vital transportation and economical artery, since it links Beirut to Damascus, and the port to regional markets (figure 3.9). However it resulted in a complete isolation of the river from Beirut (figure 3.10). Looking at the transport flows which currently occur along the Nahr (figure 3.11), we can see that despite being a connector for regional commuters and comprising many thresholds which link the city proper to the suburbs, Nahr Beirut has limited access points and fosters a very hostile walking environment, which makes the short distance pedestrian trips quasi-impossible.



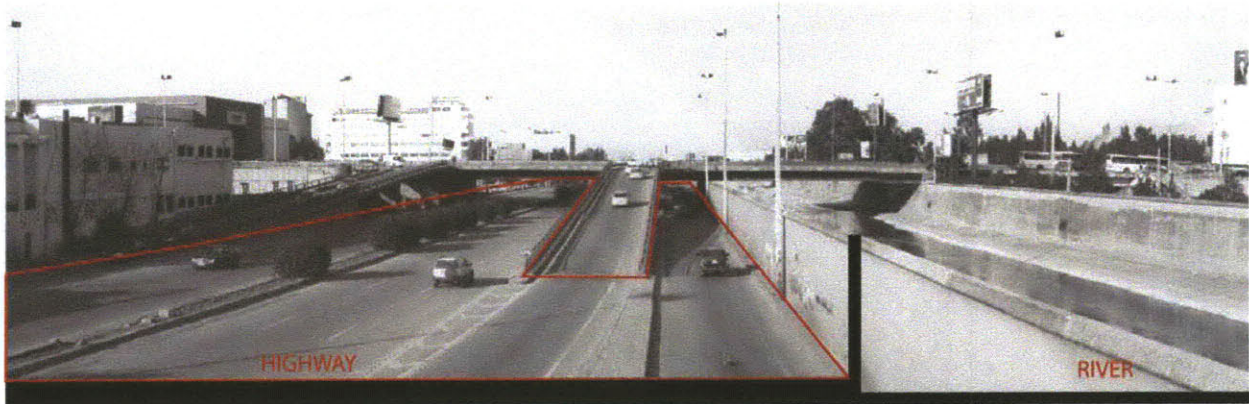


Figure 3.26 (above)
Situation of the highway and the river.



Figure 3.27 (center and opposite page center)
Transport Layers on Nahr Beirut.

Figure 3.28 (opposite page, left): Major Interchanges on Nahr Beirut

1. Dora Interchange
2. Yerevan Highway Ramp
3. Furn El Chebbak Interchange
4. Jisr El Bacha Interchange

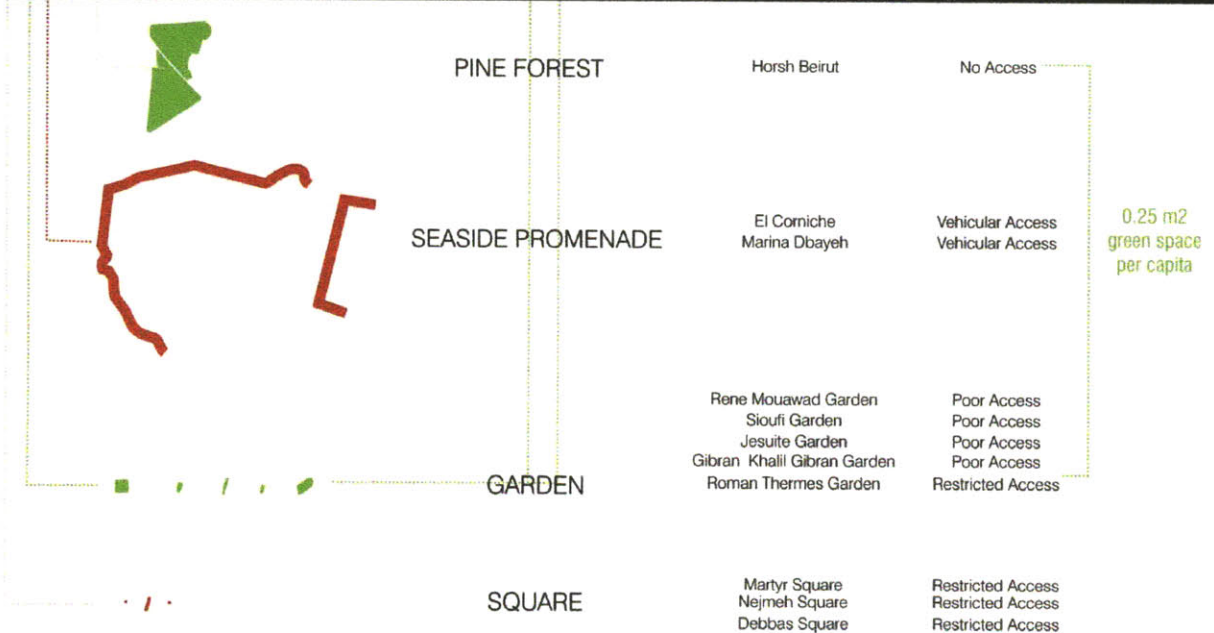


Figure 3.29: Public Space in Beirut

ISSUES PUBLIC SPACE

3. PUBLIC SPACE ISSUES

As previously mentioned, there is a severe lack of public space in Beirut, and more specifically green space (figure 3.29). Beirut has one of the lowest ratios of accessible green space per person which equals less than 0.5 square meters per person⁸ (figure 3.30). Furthermore the current green spaces of the city are sterilized, exclusive and all suffer from poor access... To make up for this lack, an interesting tendency is currently at play in Nahr Beirut's adjacent neighborhoods: people are appropriating infrastructure as the stage of their communal activities (figure 3.31). As such, children playgrounds are set adjacently to Yerevan flyover, a Sunday Market is held under Jisr El Wate bridge, card games occur under a bridge, and the river is used as a football field in summer.

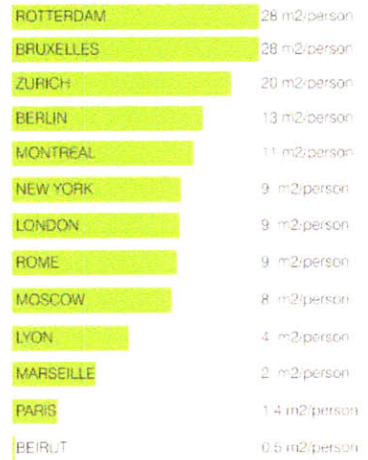
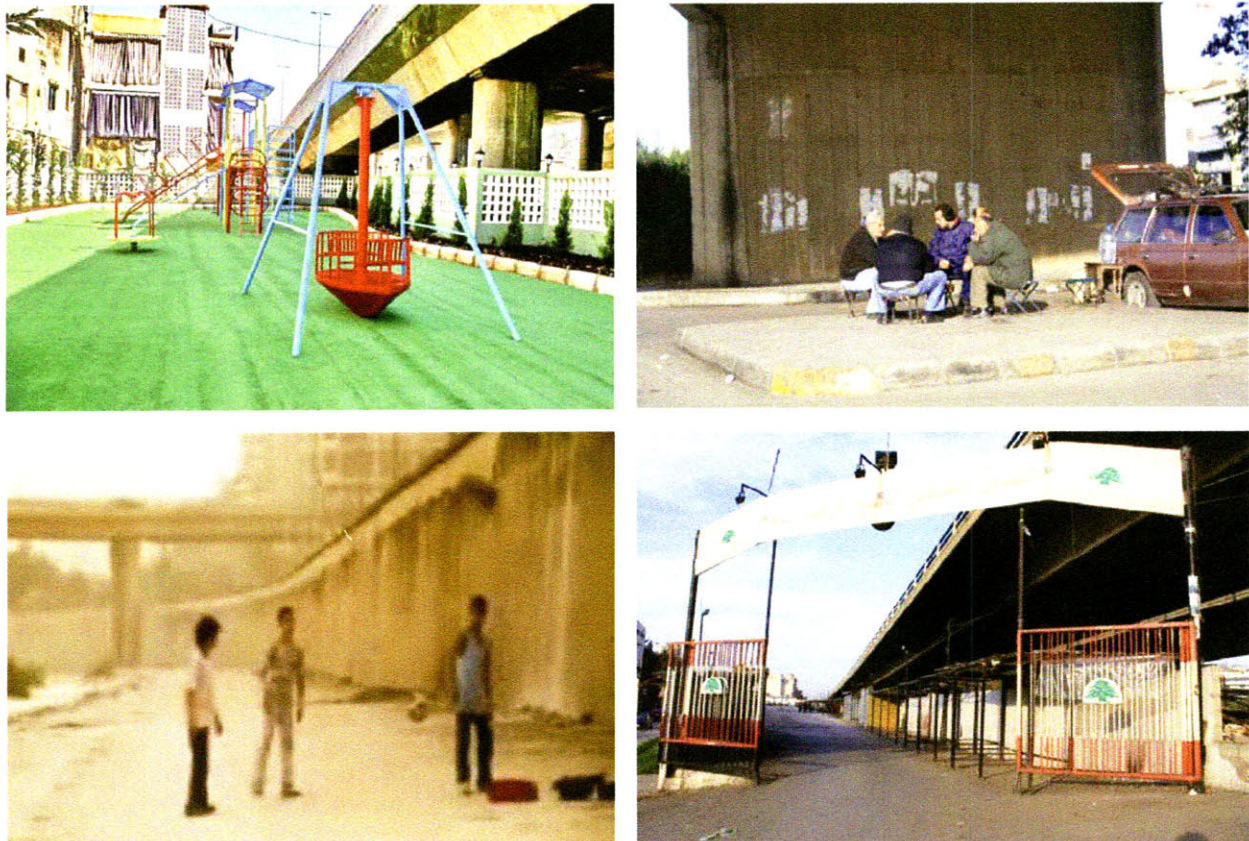


Figure 3.30: Accessible Green Space per Person.

Figure 3.31: Infrastructure as a Public Space



WATER STRATEGIES

In this hydrological context, the thesis endorses Beirut's need to treat its wastewater and to consider non conventional sources of water such as wastewater reclamation, storm water reclamation and rainwater harvesting in order to meet its water supply shortages. As such, the major water strategies comprise:

Flood Mitigation and Storage

Water Treatment and Reclamation

Ecological Reconnection

Flood Mitigation and Storage: a multifunctional water system.

The channel is currently the only element of flood mitigation and faces the danger of a flow rate superior to 1100m³, with no water storage and no treatment capacity.

For these reasons, the strategy advances the deployment of a multifunctional water system along the river (Figure 3.32).

The proposed system will consist of multi-functional structures that can take a variety of design forms including:

- a. Off-channel flood storage reservoirs: These are generally open earthen reservoirs but can be engineered
- b. infiltration beds: these can receive runoff from surrounding areas as well as channel flows, and are often gravel fields
- c. Large dry wells: these are cylinders filled with gravel, but perforated on the sides and base to recharge groundwater
- d. Off-channel flood cisterns that hold water for reuse.
- e. Sediment Traps.
- f. Diversion Fields.

The system will receive, store, and treat storm water and urban runoff and then reuse the reclaimed water for irrigation, metropolitan water supply and to alimnet the flow of Nahr Beirut in the dry season.

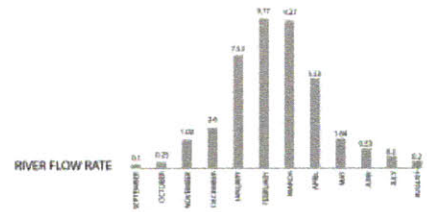
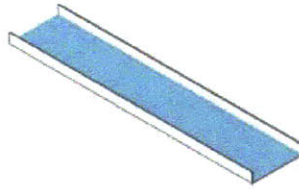
The role of such system comprise flood mitigation meeting the maximum flood level, flood storage, flow regulation to an average of 2.5 cubic meters per second, thus allowing decanalization of Nahr Beirut. The soil finishing of some water structures will allow public programs to happen on top of them such as playgrounds, dry gardens and fresh water fish lakes.

Taking in consideration the government's apprehensions, the water storage structures will have modest capacities with a maximum of 20000 cubic

STRATEGIES WATER

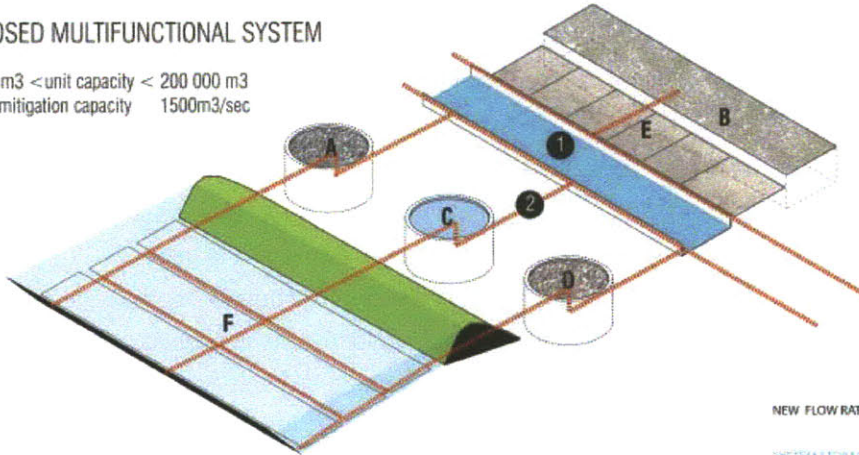
EXISTING SYSTEM

storage capacity 0 m³
 flooding mitigation capacity 1100 m³/sec



PROPOSED MULTIFUNCTIONAL SYSTEM

100 000 m³ < unit capacity < 200 000 m³
 flooding mitigation capacity 1500 m³/sec



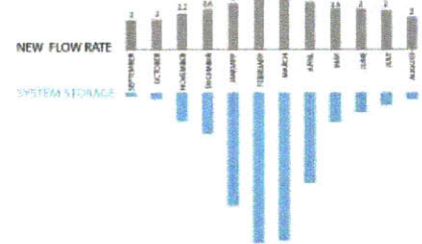
FLOOD MITIGATION
 FLOOD STORAGE
 FLOW REGULATION
 STORMWATER TREATMENT
 PUBLIC SPACE

1 DECANALIZED CHANNEL

2 STORMWATER CONNECTING NETWORK

3 MULTIFUNCTIONAL MITIGATION STRUCTURES

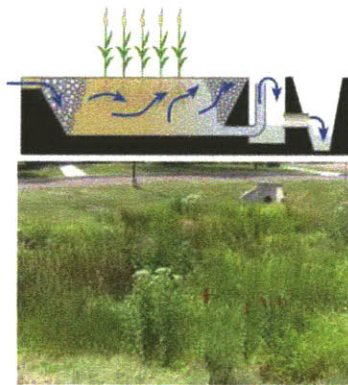
- A. Off-channel flood storage reservoirs
- B. Infiltration beds
- C. Dry wells
- D. Off-channel flood cisterns
- E. Sedimentation traps
- F. Diversion Fields



meters each, and should any of them experience a structural failure, their flow won't constitute any danger for the urban area. Learning the constraints of sedimentation from the French experience in the Dachouniyeh Dam, the structures will always be placed off the river axis except for the Jisr el Bacha reservoir, and the sediment traps in the valley section. The sediments will be an economical benefit for the neighboring construction materials factories which will continuously remove them from the traps.

Beyond a flood of 1100m³, the agricultural fields will be used as large diversion fields. The new canal would be equipped with two stormwater drains which connect the whole system together and act as an additional mitigating measure.

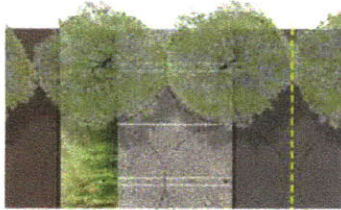
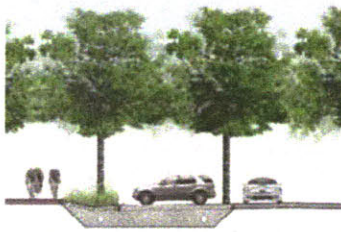
Figure 3.32: Multifunctional Water System



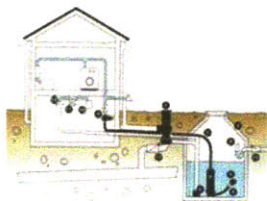
CONSTRUCTED WETLANDS



TREATMENT & STORAGE
PONDS



RUNOFF MITIGATION



RAINWATER HARVEST

Figure 3.33: Water Quality Optimization Measures

Water Treatment and Reclamation: Urban versus Rural System

Governmental water treatment projects are exclusively targeting the lower basin at the moment, while the upper basin is not included in any plans or funding⁹ (figure 3.34.). This fact would leave the valley prone to a diffuse pollution which will undermine the treatment efforts in the lower basin. As such, the proposed strategy uses two different systems of water treatment and reclamation which adapt to the urban and the rural zone. (Figure 3.35)

In the urban zone, there will be a mechanized treatment strategy which comprises treatment plants for primary and secondary wastewater treatment, wetlands and fish ponds for tertiary treatment (Figure 3.36). The strategy proposes smaller catchment zones for the proposed waste water treatment plants. This way, it will be possible to locate the proposed plant on a vacant lot in the industrial stripe, leaving the waterfront open for public programs¹⁰. The river will be the conduct through which water is pumped for treatment and then redistributed to the various recipients. This strategy will meet the current water supply shortages of the capital by providing up to 40000 cubic meters of reclaimed water per day¹¹.

In the valley, there will be a small scale, small budget and village based bioremediation strategy which harvests rainwater through communal reservoirs and domestic tanks, and treats each village's wastewater through constructed wetlands before it intercepts the river's tributaries and/or seeps to the groundwater tables (figure 3.37). This strategy would give autonomy to the upper basin based on low budget remediation and harvesting methods.

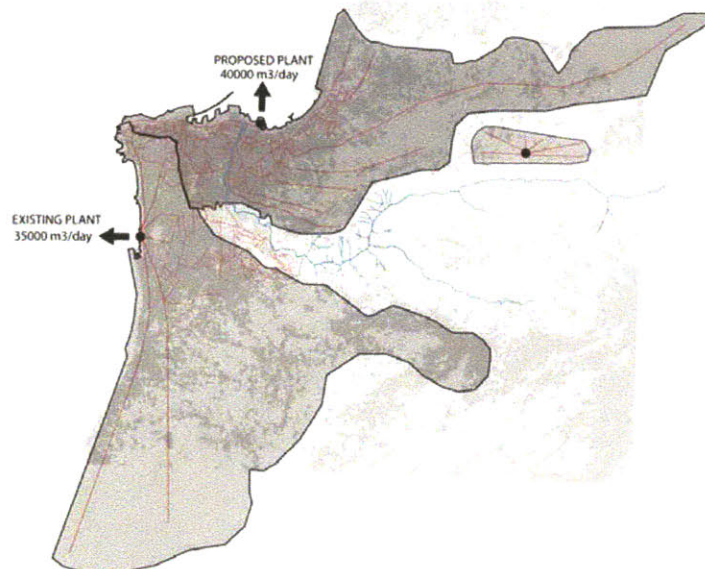


Figure 3.34: Government's Proposed Water Treatment Plan.

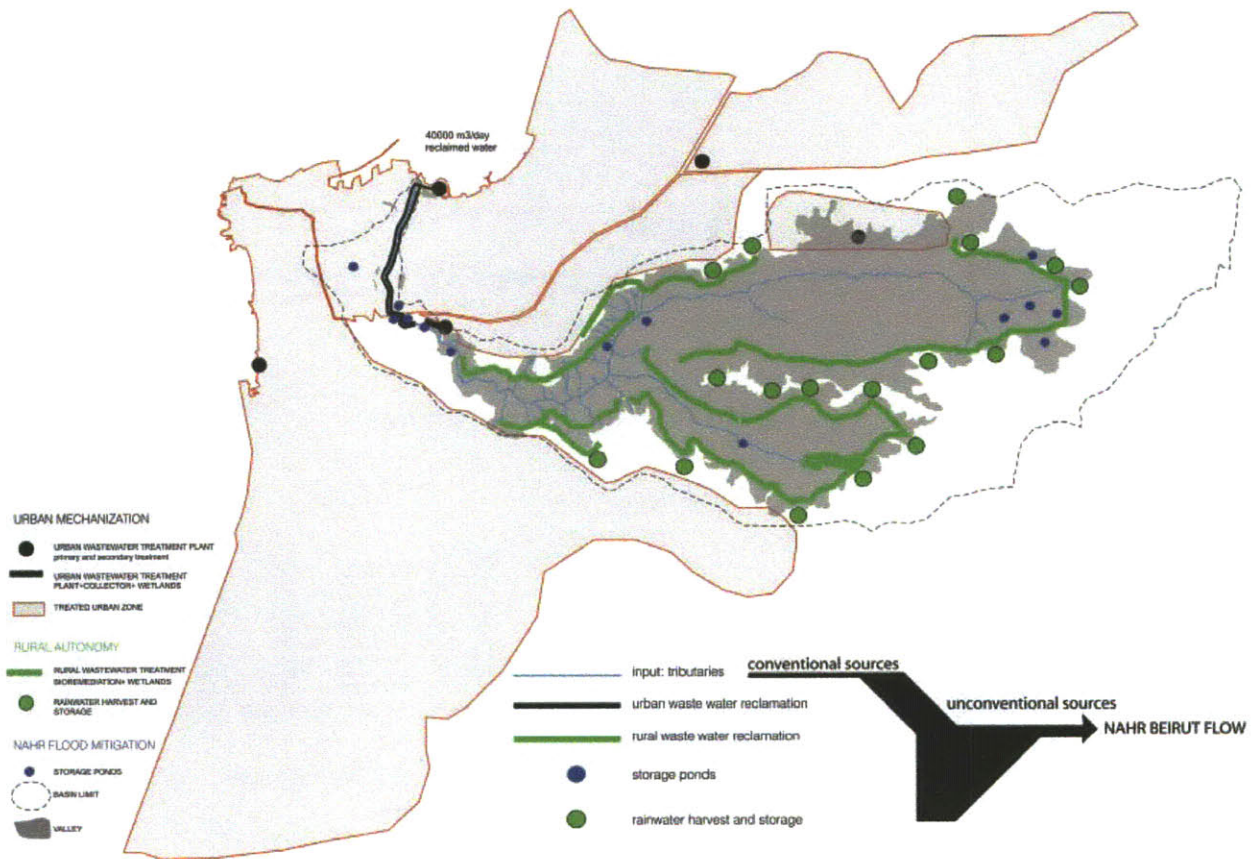


Figure 3.35: Proposed Water Treatment Strategy on the Basin Scale.

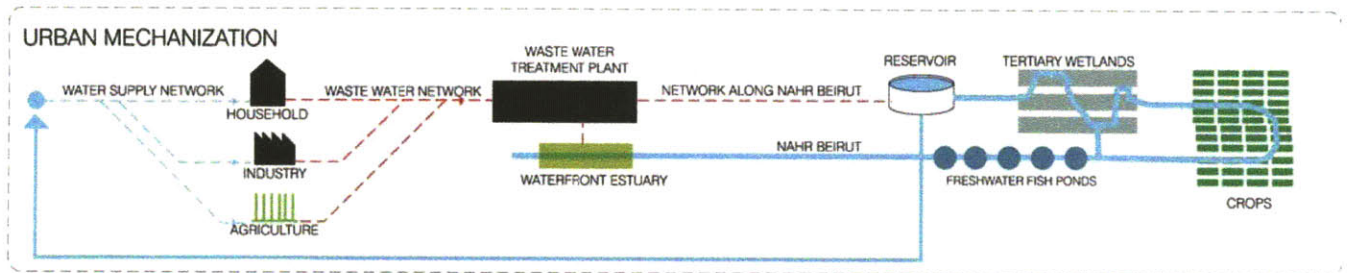


Figure 3.36: Urban Treatment Strategy

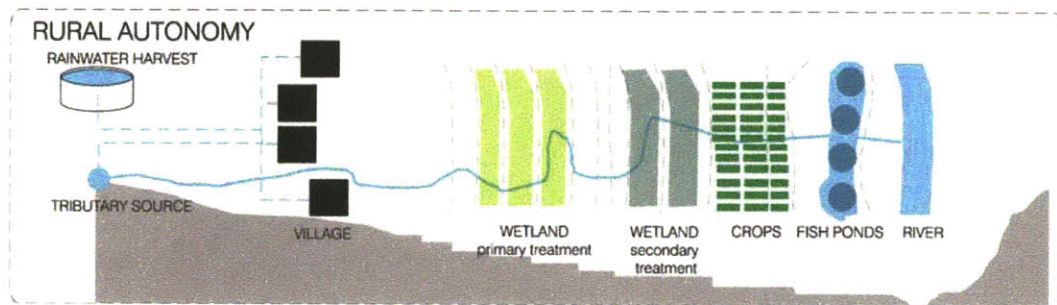


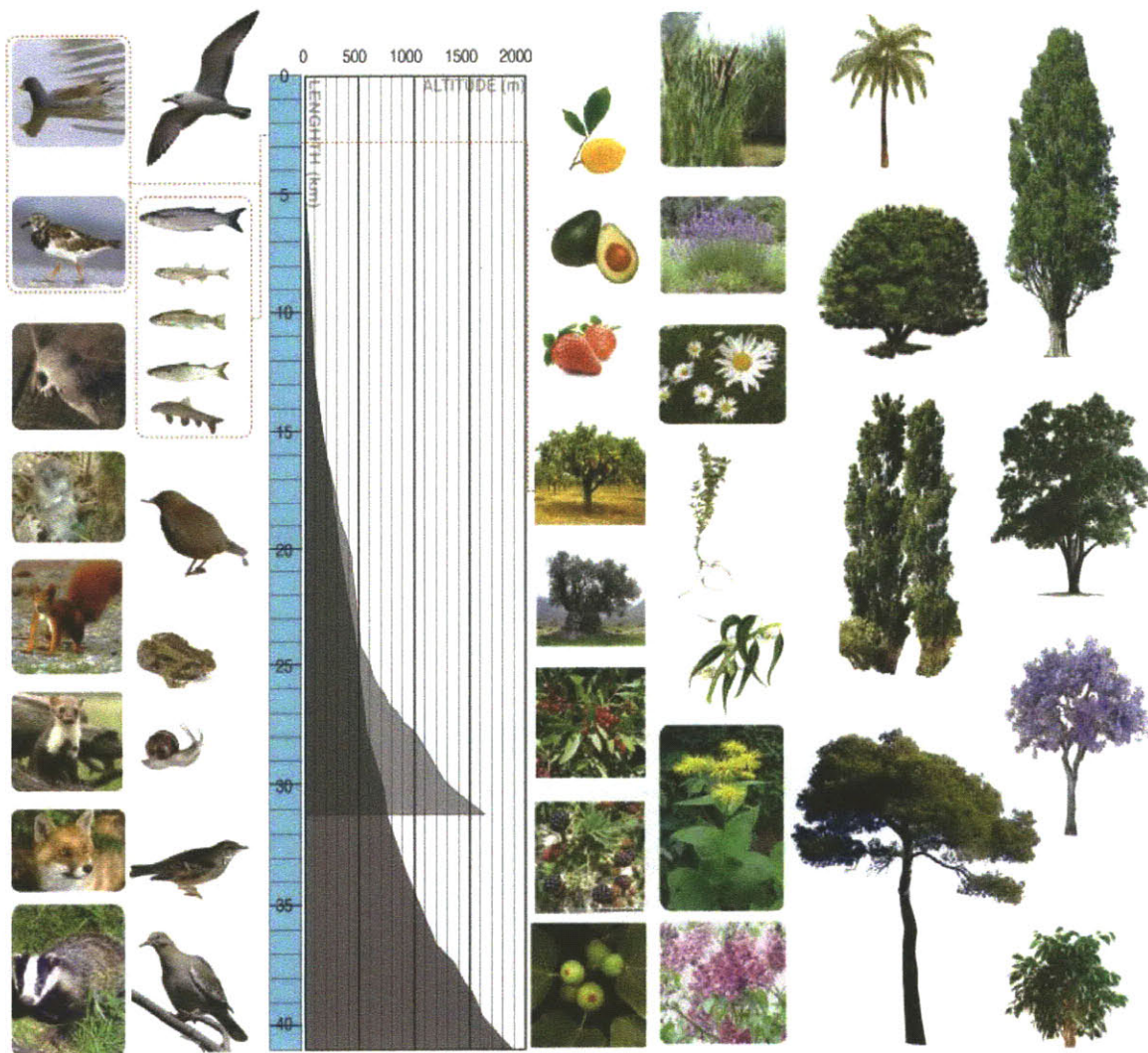
Figure 3.37: Rural Treatment Strategy

STRATEGIES WATER

Ecological Reconnection

This strategy initiates a new riparian ecosystem in the channel to connect the valley and the waterfront habitats. Using a local repertoire of species, the strategy will introduce new flora and fauna in the stream like riparian trees and fresh water fish as the last step of treatment and reclaimed water purification (figure 3.37). The current channel section provides a microclimate given its depression from the level of the adjacent highway and its current walls. The design proposed to remove the existing walls but replace them with vegetation screens which keep the current microclimate effect and isolate the river from the highway noise. The design also proposes to use gabion walls which allow the establishment of habitats within their skin. At the waterfront, the design proposes to lower the level of the river and bring the estuary inside the channel all along the waterfront section.

Figure 3.38: Existing and Proposed Habitats.



TRANSPORT STRATEGIES

The thesis has considered the Emile Lahoud Highway as a constraint to work with, given its economical and transit importance. However, the design hasn't compromised its intentions to provide a better access to and between the river banks, and a better urban form for the river. As such the transport strategies comprise:

Infrastructural Manipulation- Making room for the river

Transversal connection-Reconnect the two banks through pedestrian bridges

Longitudinal Connection- Reconnect the four zones with expanded road network, rapid bus lines, shuttles and pedestrian trails

Infrastructural Manipulation- Making room for the river¹²

As previously mentioned, the water strategies comprise removing the river walls due to the proposed multifunctional water system.

As such, this strategy removes some ramps which was used to go over the walls and use their footprint to widen the river banks

This will be the case at the at the seaside road's interchange bridge and Jisr El Bacha interchange

At the seaside road, the reclaimed 6 meters' wide lane will be converted to a green stripe extending the pedestrian paths to the waterfront (Figure 3.40).

At Jisr El Bacha, the proposal proposes one entrance and one exit from the highway instead of the existing two. The lane which is immediately adjacent to the river will be converted as an extension to the riverside promenade, linking the canalized section to the natural river of the valley section (Figure 3.39).

Figure 3.39: Proposed Intersection at Jisr El Bacha Interchange.

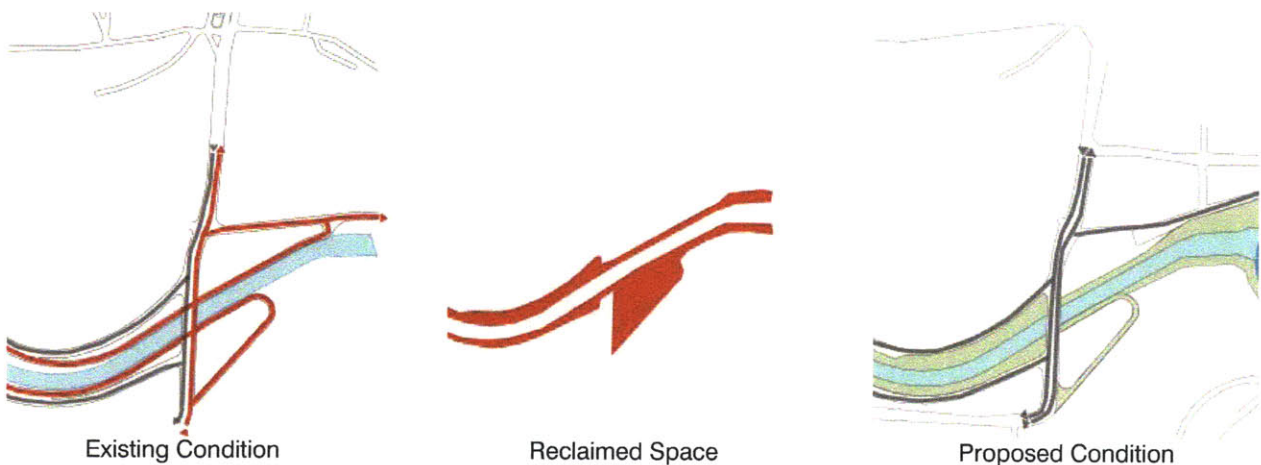
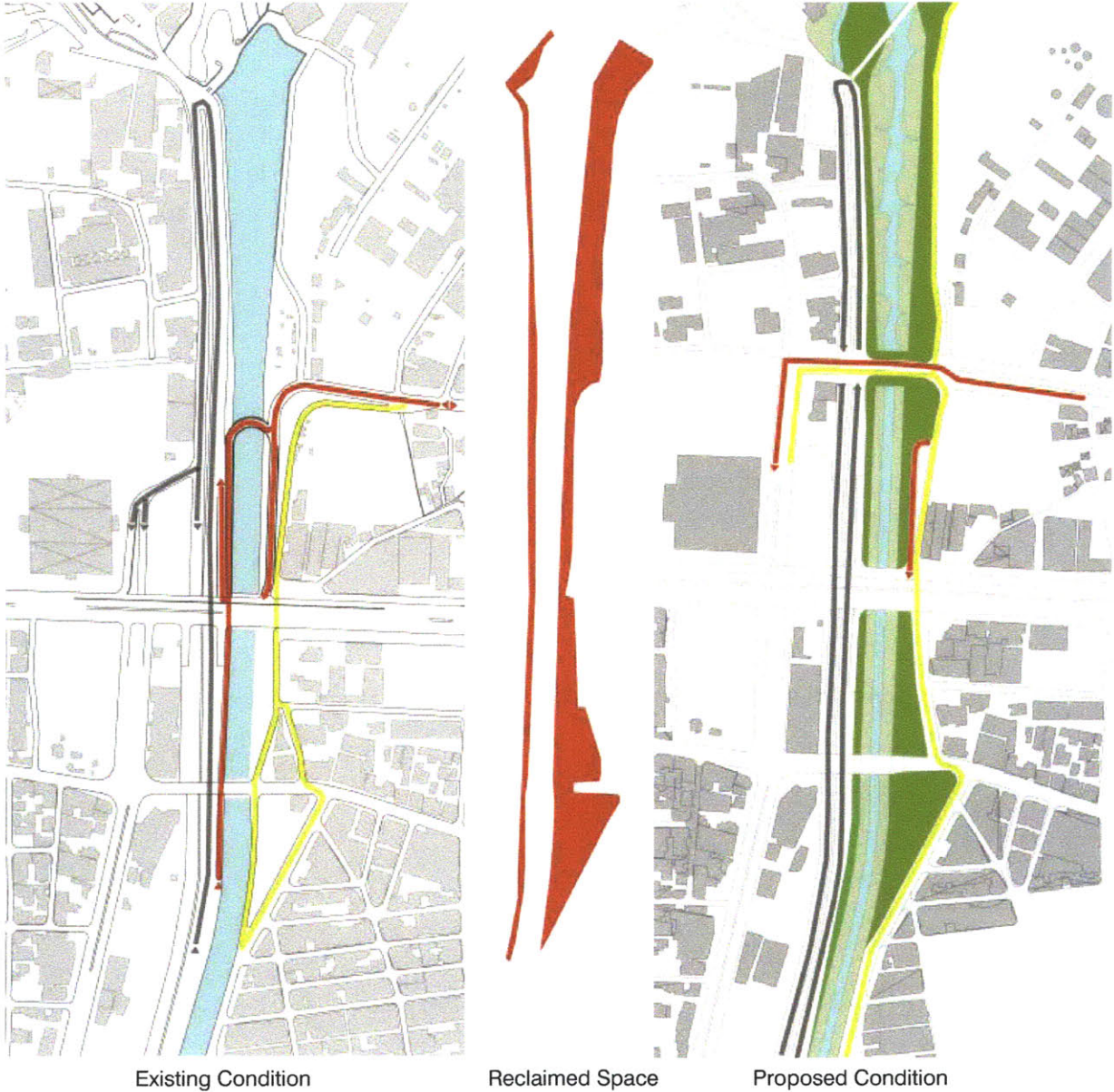


Figure 3.40: Proposed Intersection at Seaside Road Interchange

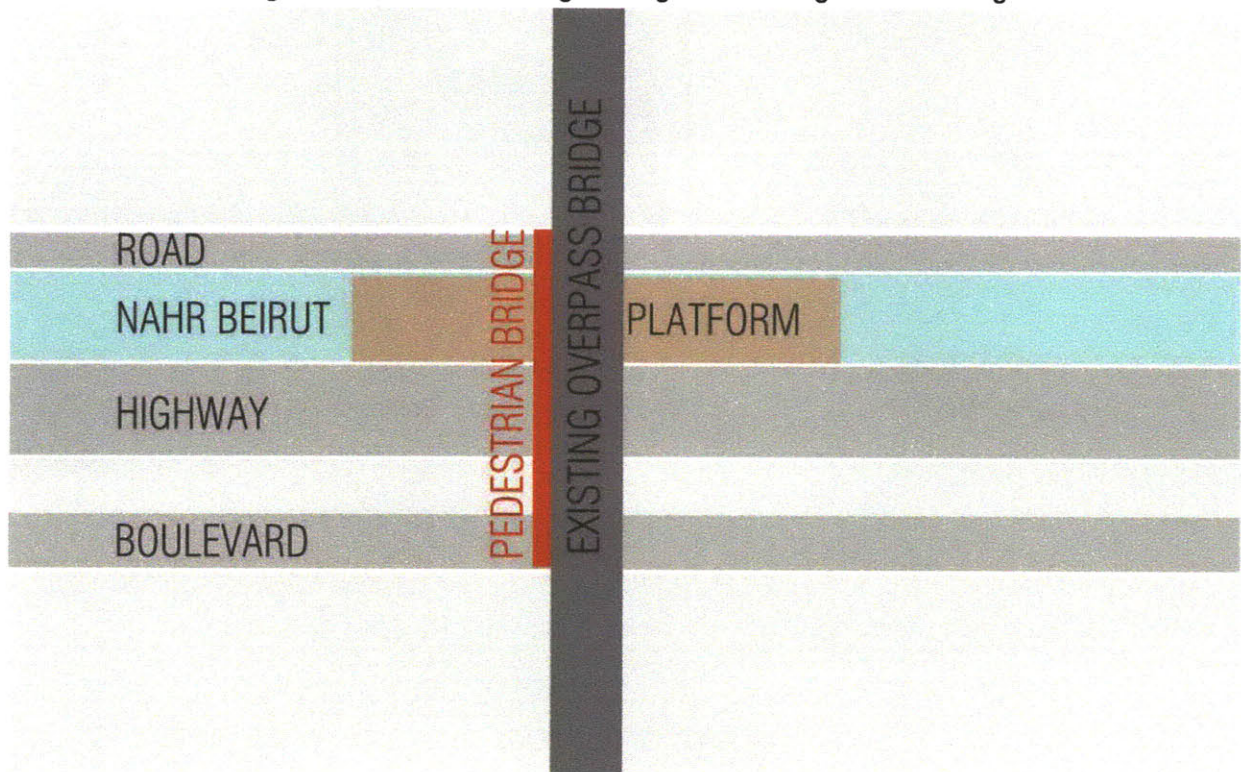


Transversal connection- Reconnect the two banks through pedestrian bridges

The proposed transversal connection will be optimized through the public platforms which connect the two banks at the main bridges. Strategic pedestrian bridges will be deployed on the whole length of Nahr Beirut, with different typologies. They will always coincide with public transport stops and key programs, and allow the creation of pedestrian autonomy.

In one typology, the bridges will coincide next to a vehicular bridge which does not comprise pedestrian sidewalks, and connect to existing bus routes which run on the bridges (figure 3.41). A second typology will comprise a bridge connection between two green spaces (figure 3.42). Another typology which occurs in the agricultural section, in which the bridge becomes an extension of the biking network which spans over the highway and river (figure 3.43).

Figure 3.41: Pedestrian bridge linking to an existing vehicular bridge.



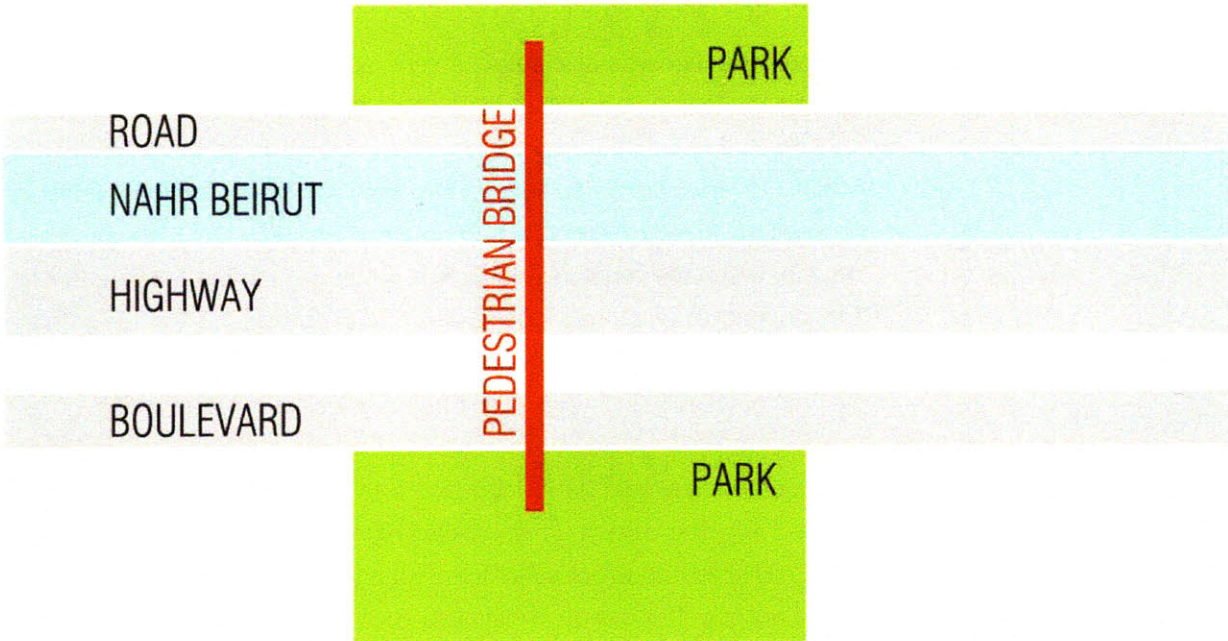
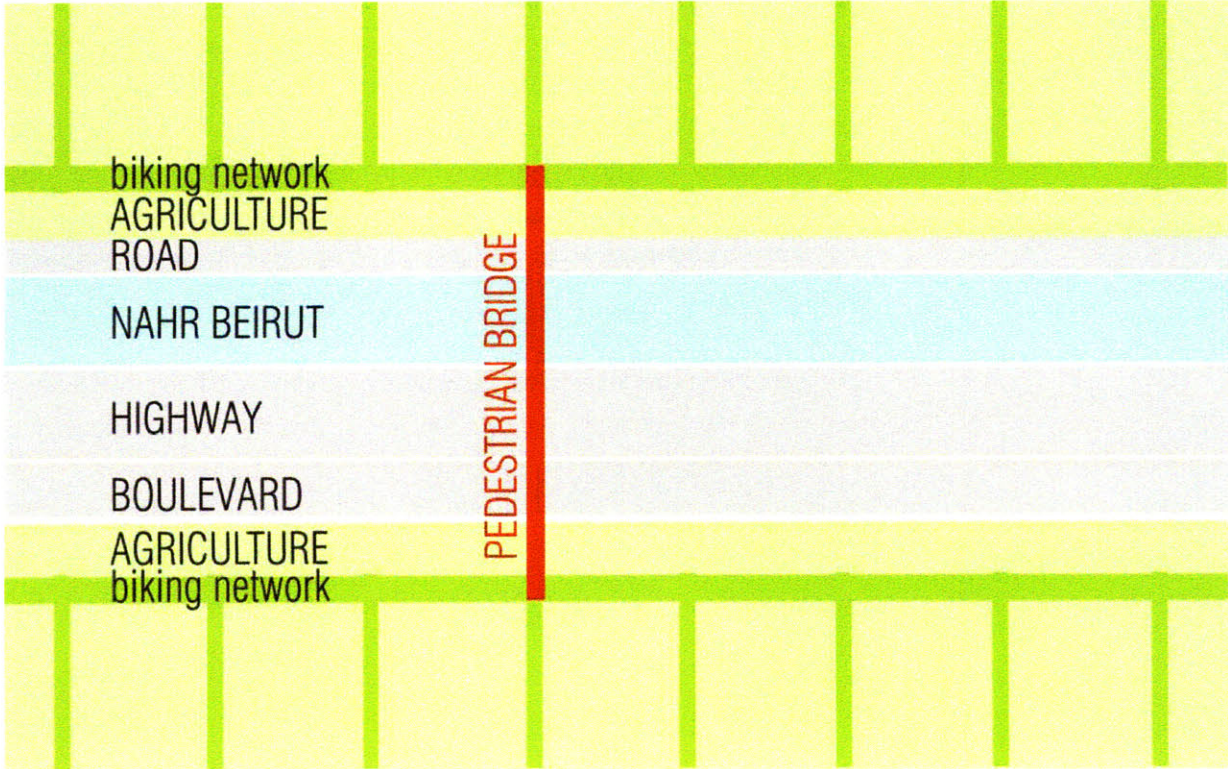


Figure 3.42: Pedestrian bridge linking two green spaces

Figure 3.43: Pedestrian bridge linking two agricultural networks



Longitudinal Connection- Reconnect the four zones with expanded road network, rapid bus lines, shuttles and pedestrian trails

The proposal consists of creating a vehicular and pedestrian continuity to connect the four main zones.

A first move would be to extend the road network to provide vehicular continuity. Currently, the road which borders Nahr Beirut on the suburb side stops between the vegetable markets in Sin EL Fil and the Tahouita Bridge. The proposal extends the road in a way also to enlarge the river bank. In the same line, new roads are proposed at the waterfront and the valley, extending the road network to the new public programs inserted in both zones.

A second move would be to introduce a rapid bus line along Nahr Beirut (figure 3.44). The current Emile Lahoud Highway is one of the rare arteries of the city which does not suffer from congestion and traffic because of its limited access. The design invests into such quality by proposing the rapid bus route on this highway, running between the port and Jisr El Bacha. The service will connect to existing bus routes' crossings and provide transfer stations at those particular points. Other stops will coincide with pedestrian bridges, public programs along the site. At both ends of the proposed bus route, there will be transfer points to the shuttle services of the valley and the waterfront. Public Transport in Beirut is informal because it does not have any particular stop and is more prone to the request of the passengers. By formalizing transit and building bus stops, the proposal aims for materialized nodes which improve the public transport service while becoming markers along the Nahr.

The final move provides a continuous pedestrian trail within the river space, completing the pedestrian and vehicular linkage between the four zones.

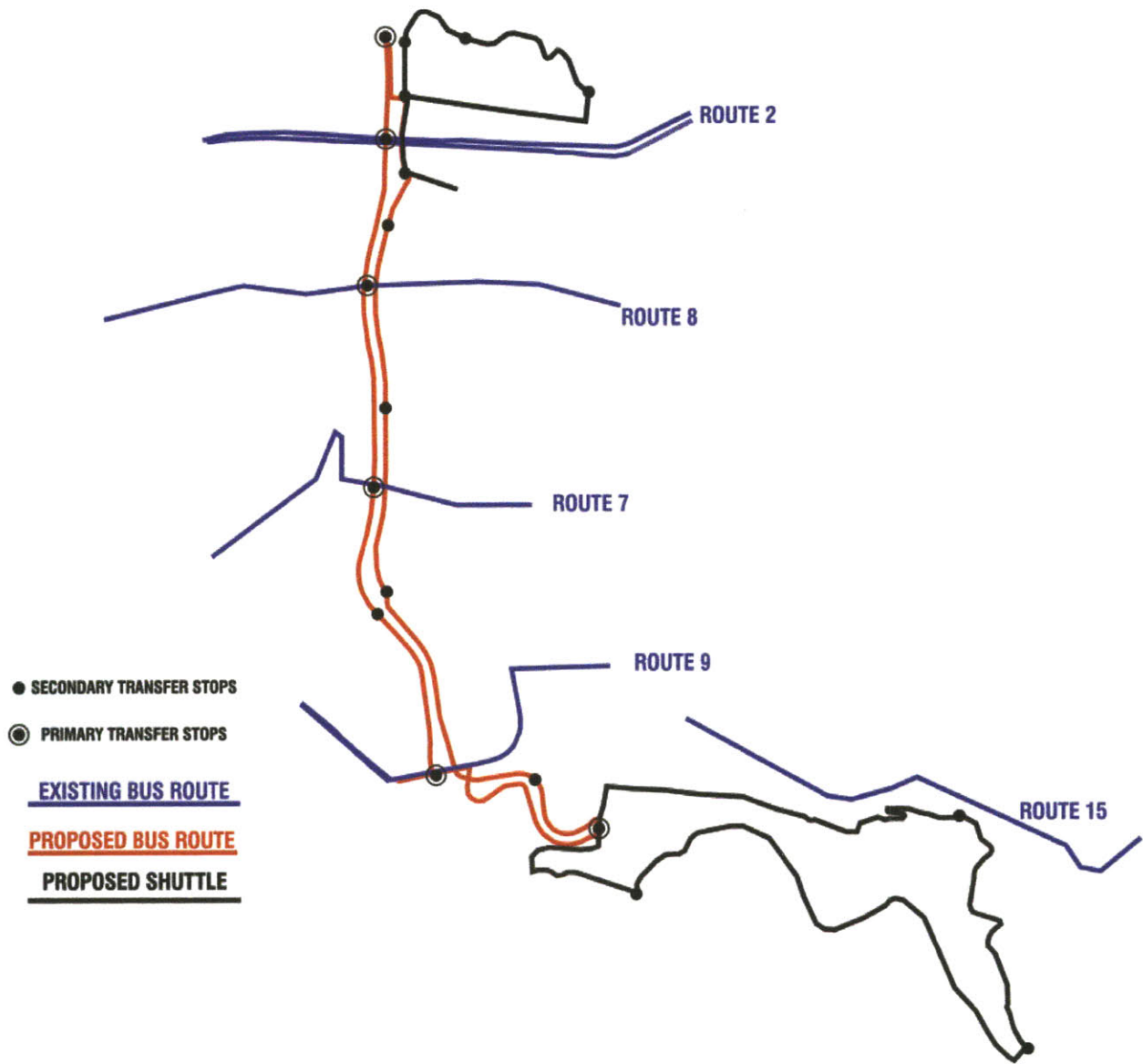
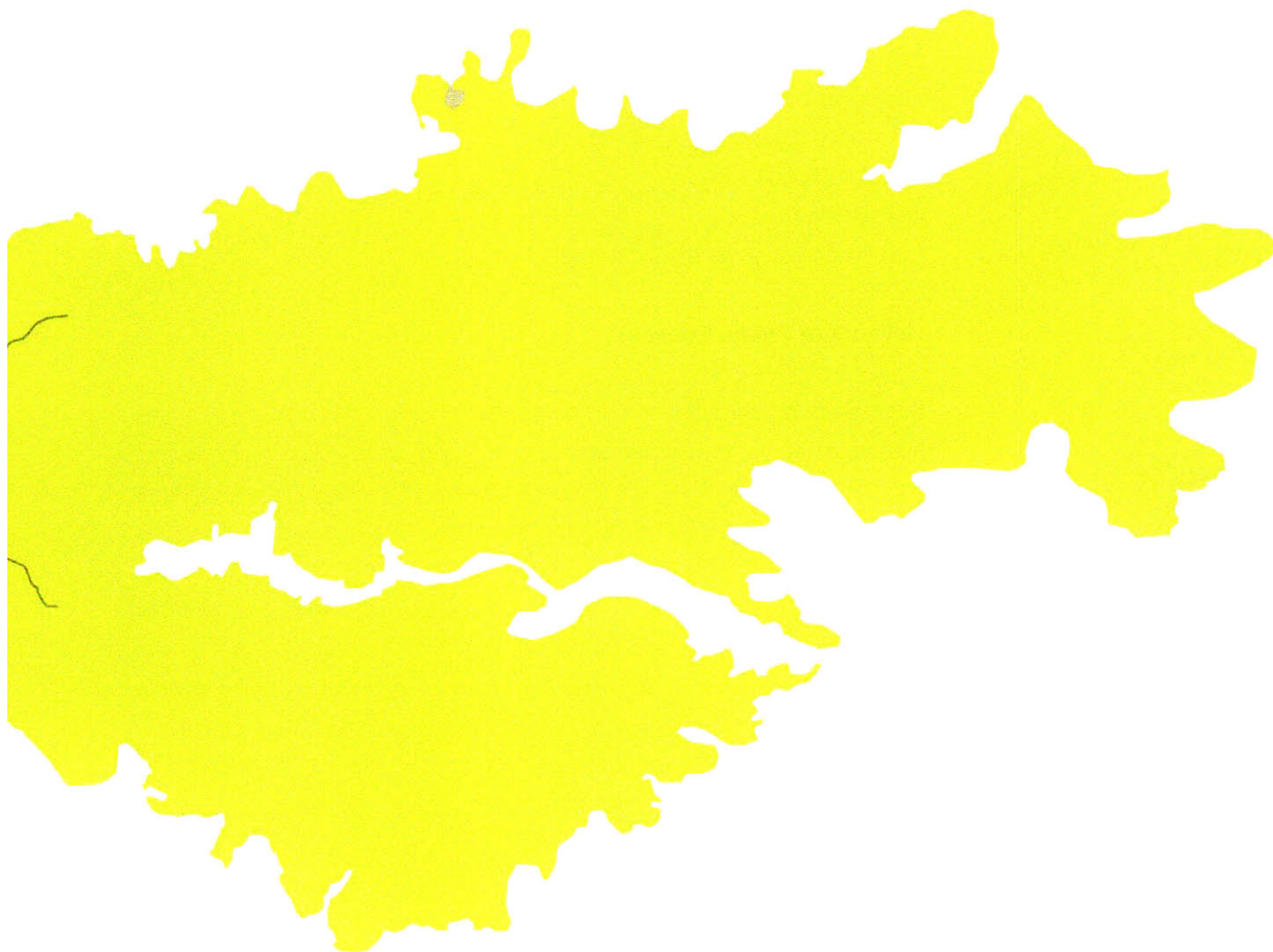


Figure 3.44: Proposed bus and shuttles routes providing the longitudinal connection along the river.

**STRATEGIES
PUBLIC SPACE**



STRATEGIES
PUBLIC SPACE



PUBLIC SPACE STRATEGIES

Nahr Beirut is located at the core of Greater Beirut and at the intersection of Lebanon's two main road axes. It spans across many neighborhoods of the city within walking distance from its banks. It situates between two major natural habitats, the valley and the waterfront, and within a considerable network of post-industrial sites. This central location suggests that Nahr Beirut as a district is an ideal site to host civic programs and restorative ecological programs.

The public space strategies comprise:

network of public spaces

Densify the Edge

Use infrastructure as a public space

Network of Public Spaces

Because of its original land use as a railway corridor, Nahr Beirut contains two large rail yards and former stations which are the last properties of substantial size which remain underdeveloped. Furthermore, the waterfront landfills which developed during the war form a considerable open space terrain.

All of these factors have given Nahr Beirut valuable features that are worth of development each in its own terms.

As such the first strategy consists of establishing a public space network in which Nahr Beirut inscribes in, acting both as a green lung for the capital and for the adjacent neighborhoods(figure 3.45).

STRATEGIES
PUBLIC SPACE



Figure 3.45: Network of Public Spaces

Densify the Edge

Currently, most buildings turn their backs to Nahr Beirut; forming an undefined edge. In the agricultural section, the edge is totally lost.

The design proposes to densify the edge differently in the different sections. This will be done through buildings infill in the urban zone and waterfront (figure 3.46). In the agricultural section and the valley, the edge is recreated through vegetation with linear groves bordering the highways, and parking bosques (figure 3.47).

In an elaboration of the buildings' architectural strategy, the existing buildings will be required to rework their back elevation to face the river, maintain the street line and sidewalk setbacks.

The architectural language of new buildings will vary according to their urban position: As such, when located on infill lots, the buildings would act as background buildings, with a formal function to maintain and define the edge. At a strategic location or in presence of a complete void, the proposed buildings would demarcate as monuments hosting public programs. When confronted to heavy infrastructure, the building will become a public structure. This would be a pedestrian bridge, a canopy, or structure hosting public events. Such structures will be used to formalize current informal markets like Souk El Ahad (Sunday Market) and Souk El Khodra (Vegetable Market). They will become tensile shading supports, market stalls, public gradins, and urban furniture like benches, storage and public toilets.

Use infrastructure as public space

Finally, this strategy translates into design the theories about the infrastructural landscape; which were elaborated in chapter 2 and currently exist in the social practices of Nahr Beirut district.

As such, each proposed public space will have a dual role: civic and performative. This strategy will be embodied in the design of the river trail (figure 3.48), platforms (figure 3.49), the multifunctional water system, the wetland parks, the agricultural grid, and the urban parks at the Waterfront, Mar Michael, Abed and Jisr El Bacha.

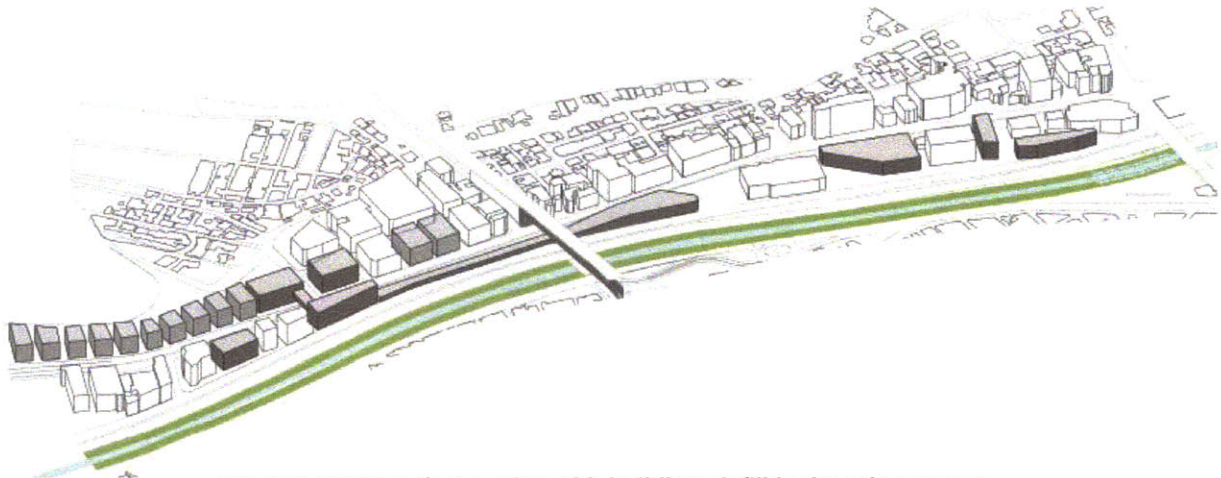


Figure 3.46: Density the edge with buildings infill in the urban zones

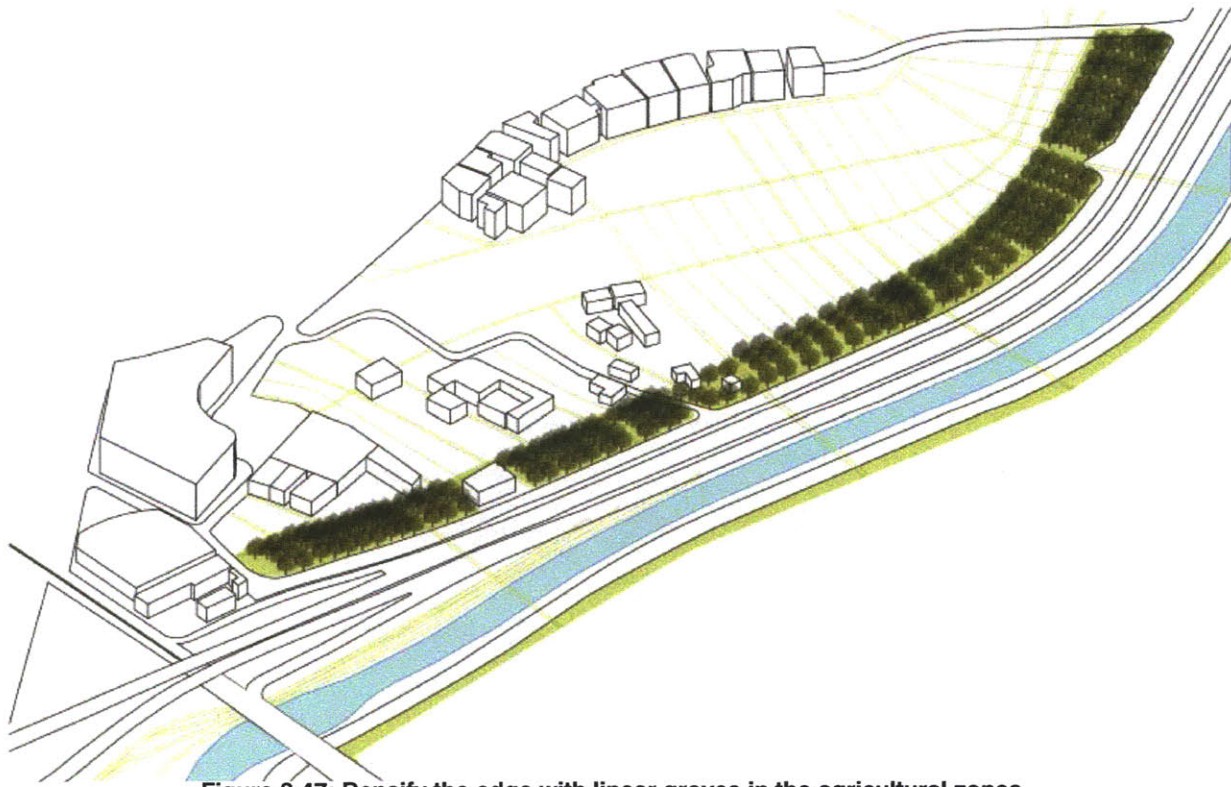


Figure 3.47: Density the edge with linear groves in the agricultural zones

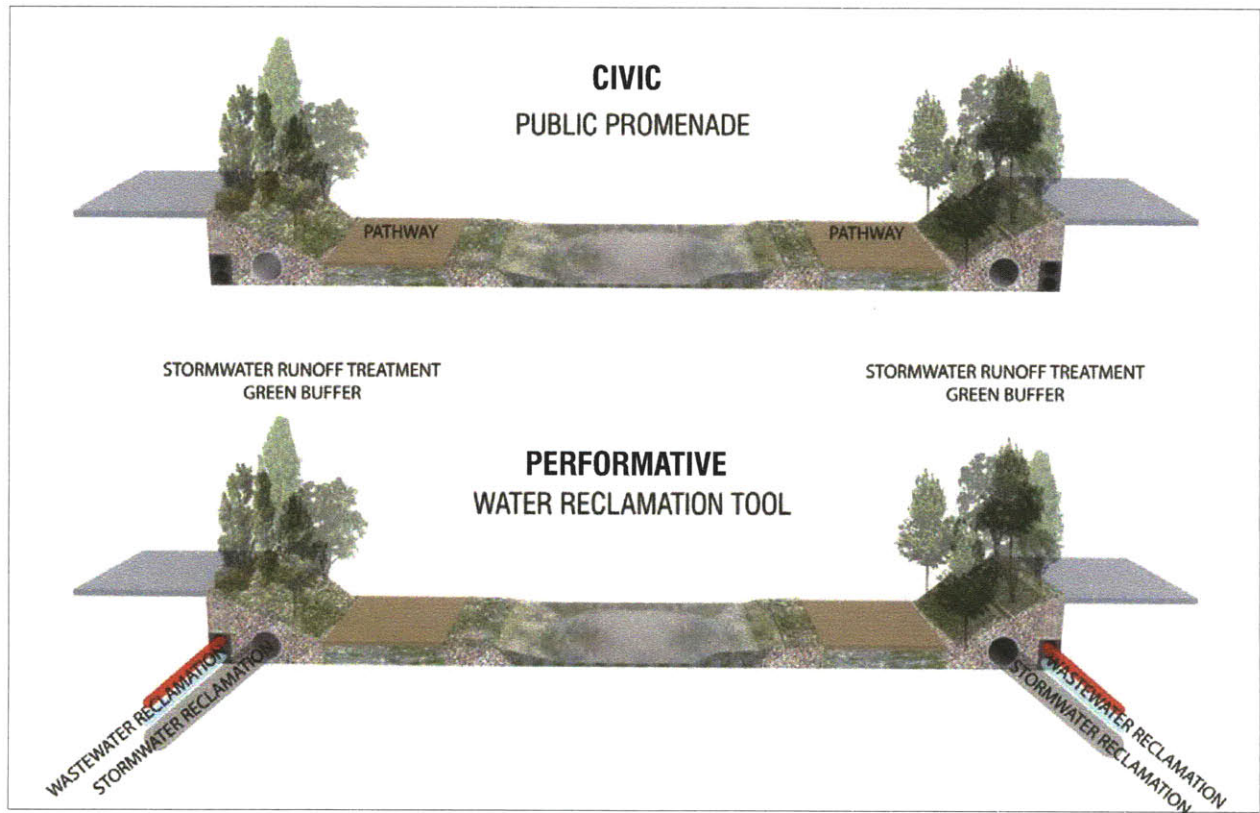


Figure 3.48: Nahr Beirut as a performative and civic space.

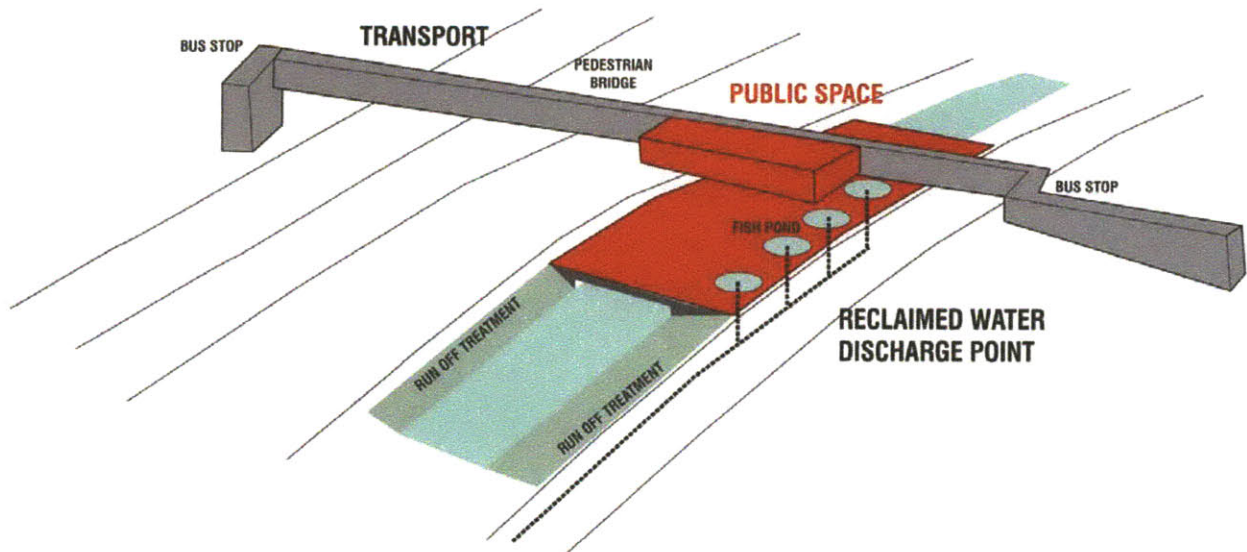


Figure 3.49: Platform combining water, transport and public space functions.

STRATEGIES PUBLIC SPACE

ENDNOTES

- 1 See Gerard, Pierre-Charles. Les Transformations de l'Hydro-Systeme Fluvial de la Partie Aval du Nahr Beyrouth. in Geospheres, Annales de Geographies. Universite Saint- Joseph, Beyrouth, Vol. 21-22, pp.135-147 2000-2001
- 2 As specified in Fawaz M. et Zein P. L'amenagement du Nahr Beyrouth. Horizons Techniques du Moyen Orient, no 5. pp.24-36. 1965
- 3 As specified in Fawaz M. et Zein P. L'amenagement du Nahr Beyrouth. Horizons Techniques du Moyen Orient, no 5. pp.24-36. 1965
- 4 As specified in Fawaz M. et Zein P. L'amenagement du Nahr Beyrouth. Horizons Techniques du Moyen Orient, no 5. pp.24-36. 1965
- 5 As specified in Fawaz M. et Zein P. L'amenagement du Nahr Beyrouth. Horizons Techniques du Moyen Orient, no 5. pp.24-36. 1965
- 6 See Daily Star Article "Storms cause flood damage along Beirut River". Daily Star, Beirut, 25 January 2005.
http://www.dailystar.com.lb/article.asp?edition_id=1&categ_id=1&article_id=12055
- 7 See Rizk, H and Adjizian-Gerard, J. Identification des sources de pollution dans le bassin- versant du Nahr Beyrouth. in Geospheres, Annales de Geographies. Universite Saint- Joseph, Beyrouth, Vol. 21-22, 2000-2001
- 8 See BEYHUM, Nabil. Plan vert pour Beyrouth. Urbanisme. no 291, nov.-déc. 1996.- pp. 13-16
- 9 See CDR website. www.cdr.gov.lb
- 10 The CDR has planned to treat the sewage of more than 50 municipalities in the Metn, plus the capital's sewage water in a large treatment facility which will occupy most of Bourj Hammoud beach. Interview with Arpine Mangassarian on January 2009.
- 11 The number is taken from the total expected treated wastewater from the CDR website. www.cdr.gov.lb
- 12 This strategy needs to be complemented by origin-destination trips data, in order to elaborate a detailed design of the new intersections.

4

PROPOSAL

BASIN SCALE

Multifunctional Water System

Water Treatment System

Transport System

Public Space System

ZONE SCALE

Waterfront

Urban Zone

Agricultural Transition

Valley

CHANNEL SCALE

Waterfront Profile

Urban Zone Profile

Agricultural Transition Profile

IMPLEMENTATION

Figure 4.1: Multifunctional Water System - Normal Layout

The multifunctional water structures are situated in the waterfront, urban zone, agricultural transition, and the valley. In the Waterfront Park, Abed Station Park and Jisr El Bacha Linear Park, the water bodies are year-round aquaculture lakes. In the waterfront case, the fresh water fish ponds are at once the water treatment final step and hold water for stream habitat maintenance.

The agricultural transition comprise off-channel flood storage reservoirs, cisterns, infiltration beds and dry wells which inscribe in the agricultural grid, and include various finishing like sand, gravel, and soil suitable for playgrounds and agriculture. They are connected to Nahr Beirut through a pipe network which allows the control and fluctuation between the structures and the channel flow. The agricultural grid is also the irrigation network which feeds from the embedded structures.

The valley comprises two typologies: off-channel flood cisterns that hold water for reuse in irrigation, and sediment traps which an extension of the river banks. Those latter are located at the beginning of the channel and have a dual function: prevent sedimentation to extend in the channel and provide materials for the construction materials' factories situated in the nearby industrial city. As such, these traps will be cleaned out continuously by the factories.

MULTIFUNCTIONAL WATER SYSTEM
Normal Layout

BASIN SCALE

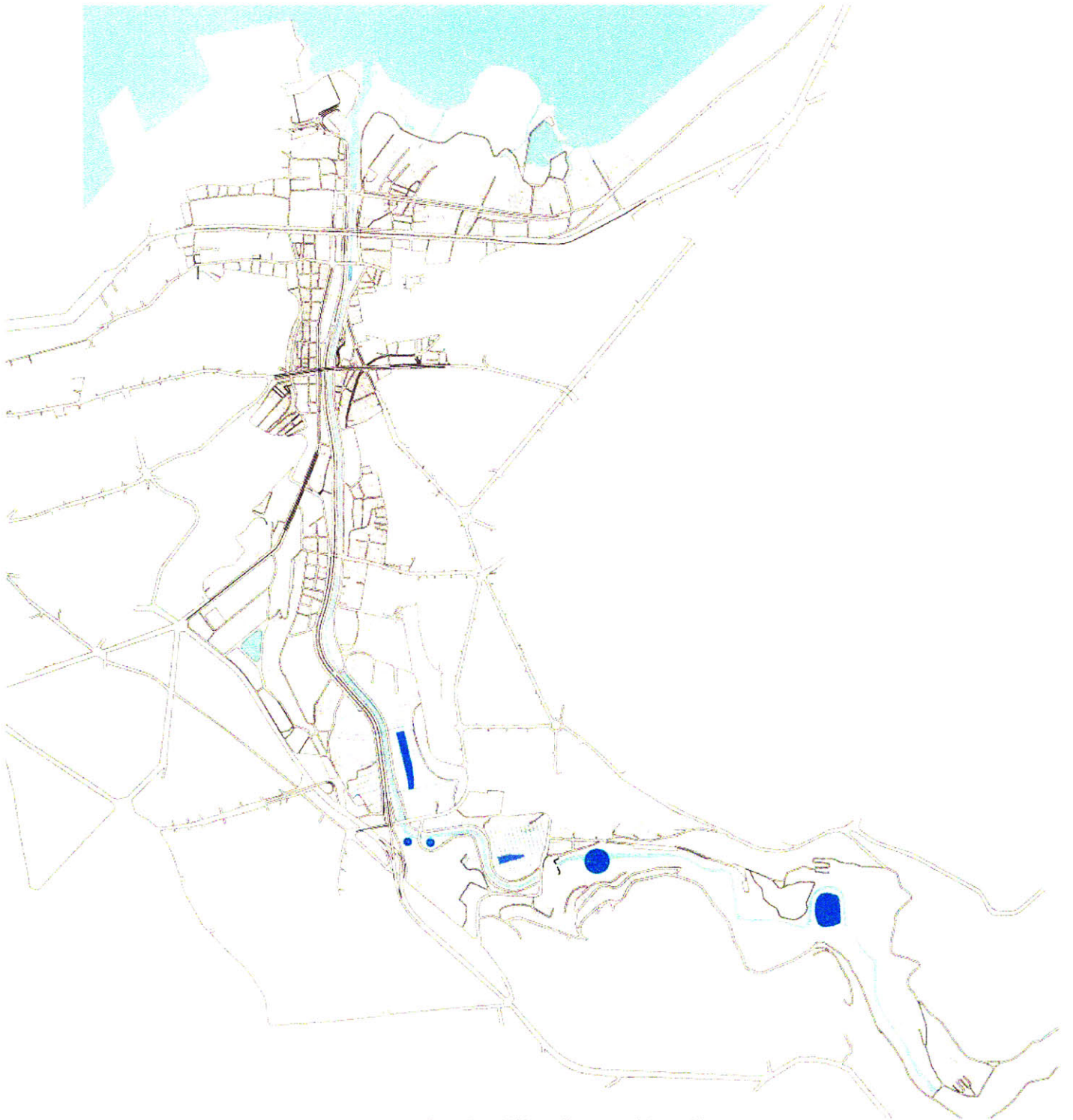


Figure 4.1: Multifunctional Water System - Normal Layout

Figure 4.2: Multifunctional Water System - Flooding Layout

In the unfrequent case of a flood with a flow superior to 1100m³/sec, the agricultural fields will used as diversion fields. The landformation of the linear groves have turned such fields into giant open air rooms which will be inundated up to a 3 meters height, in case of severe flooding,

MULTIFUNCTIONAL WATER SYSTEM
Flooding Layout

BASIN SCALE



Figure 4.2: Multifunctional Water System - Flooding Layout

Figure 4.3: Water Treatment System

The proposed wastewater treatment plants (1) are located in the industrial zones of the Waterfront and Jisr El Bacha. In the case of the waterfront, the treatment plant will be an infill on a vacant parcel in the industrial stripe. Part of the water is treated on place; after the primary and secondary treatment, the water is directed into wetlands (3), fish ponds then into the estuary. The rest of the water is pumped upstream via a network embedded in the canal to receive further treatment in a wetland park. Then the water is directed into water storage reservoirs for reuse, and into the channel. The discharge points are fish ponds (4) coinciding with public platforms.

In the case of Jisr El Bacha, the treatment plant is located on the site of an old quarry, filling the void created in the site. Given the steep topography, the wetlands are terraced, reconstruct the existing topographical section of the site. At the end of the treatment, the water is directed into Jisr El Bacha Reservoir, a freshwater fish lake, for the last step of the treatment.

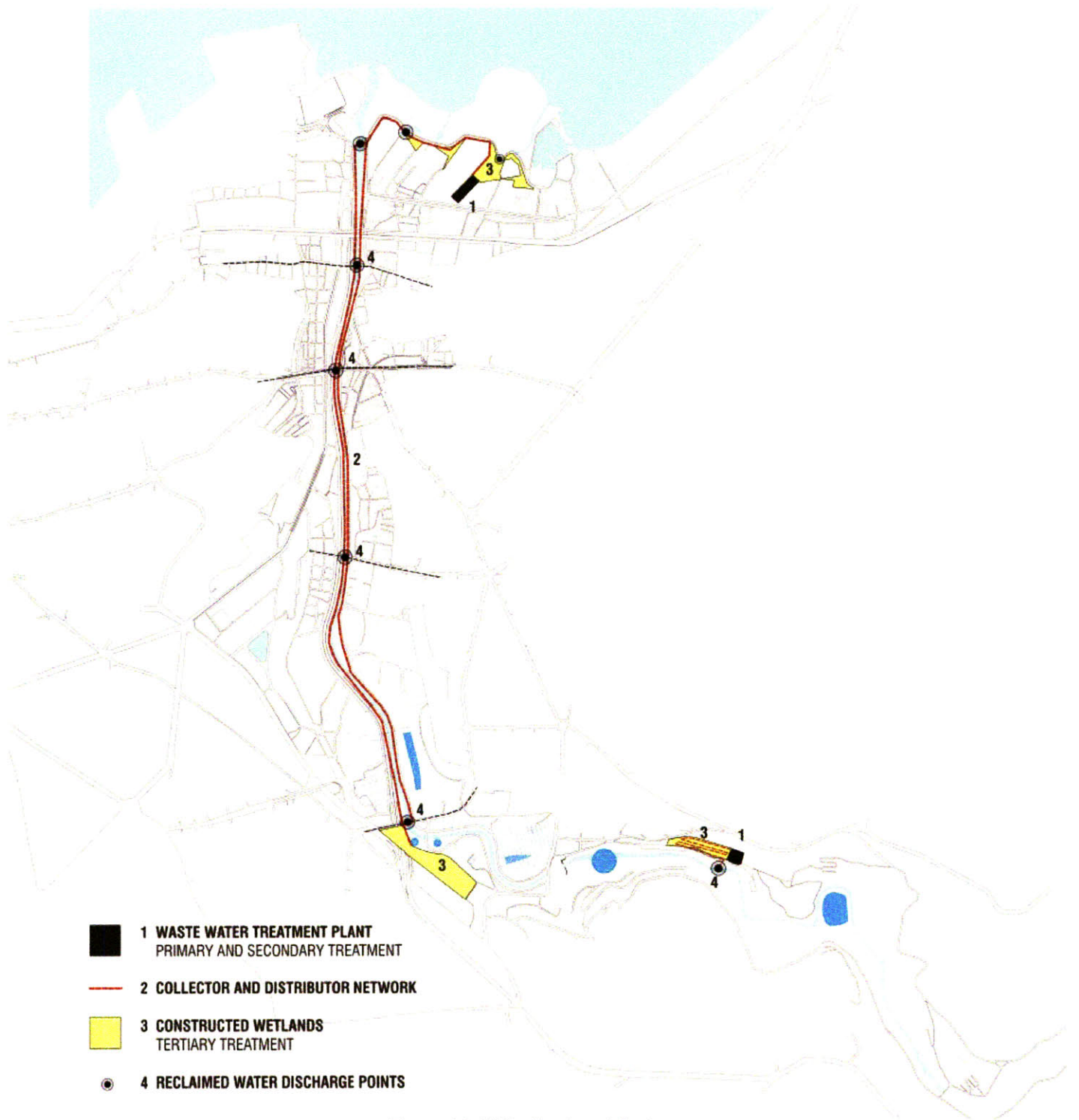


Figure 4.3: Water Treatment System

Figure 4.4: Transport System - Mobility

A new bus route runs along Nahr, providing a rapid service which takes advantage from the lack of intersections and congestion. The proposed transfer stations coincide with major vehicular bridges, existing bus routes, and proposed pedestrian bridges. The bus route starts at the Port and ends in Jisr El Bacha. At both ends, two shuttle services will connect the middle zones to the waterfront and valley sections, overlapping with public transport stops, pedestrian bridges, and neighborhood squares.

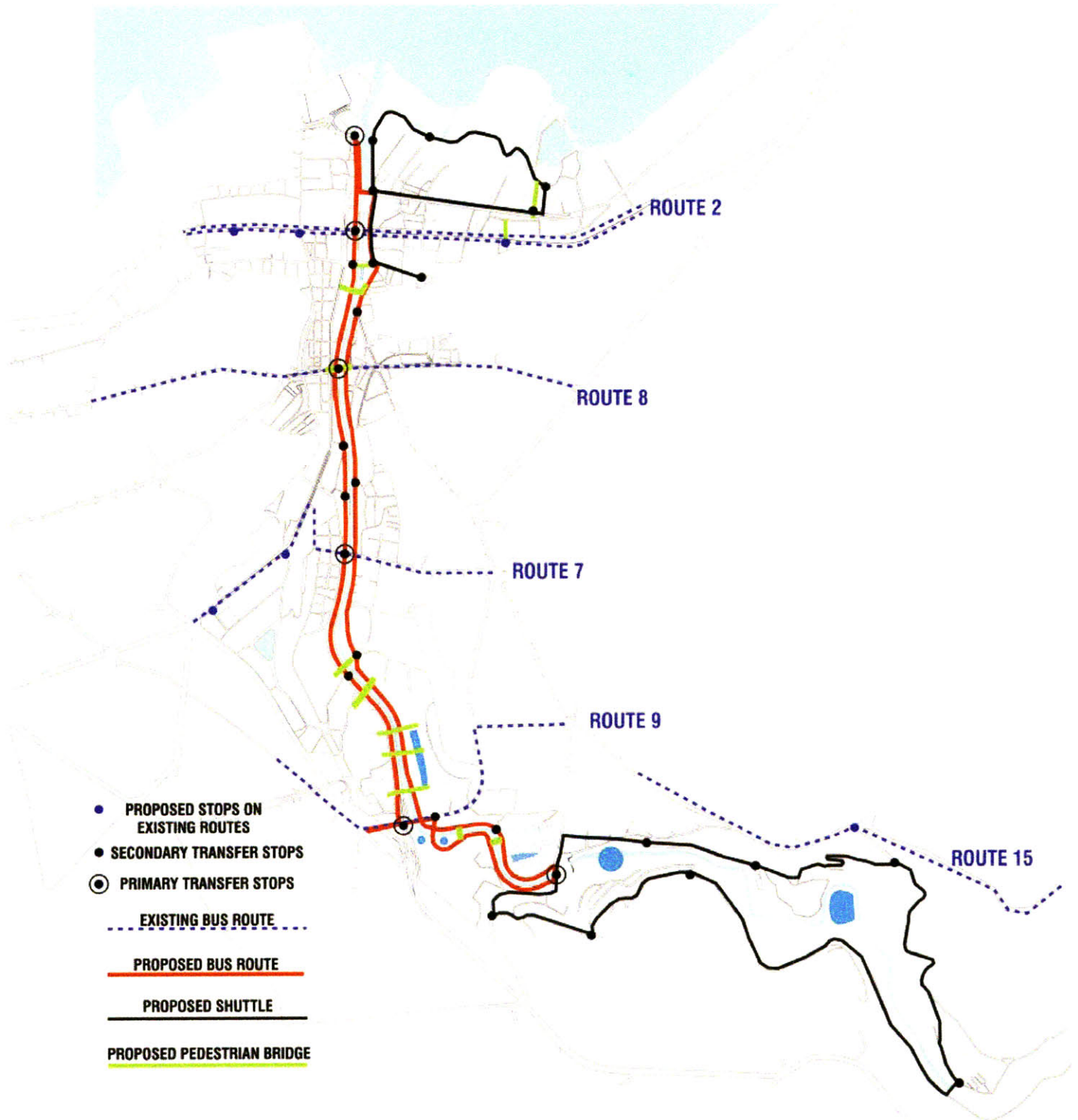


Figure 4.4: Transport System - Mobility

Figure 4.5: Transport System - Accessibility

The new transport system provide pervasive mobility choices which connect the four zones through a mixed modality and the two sides of Nahr Beirut within walking distance.

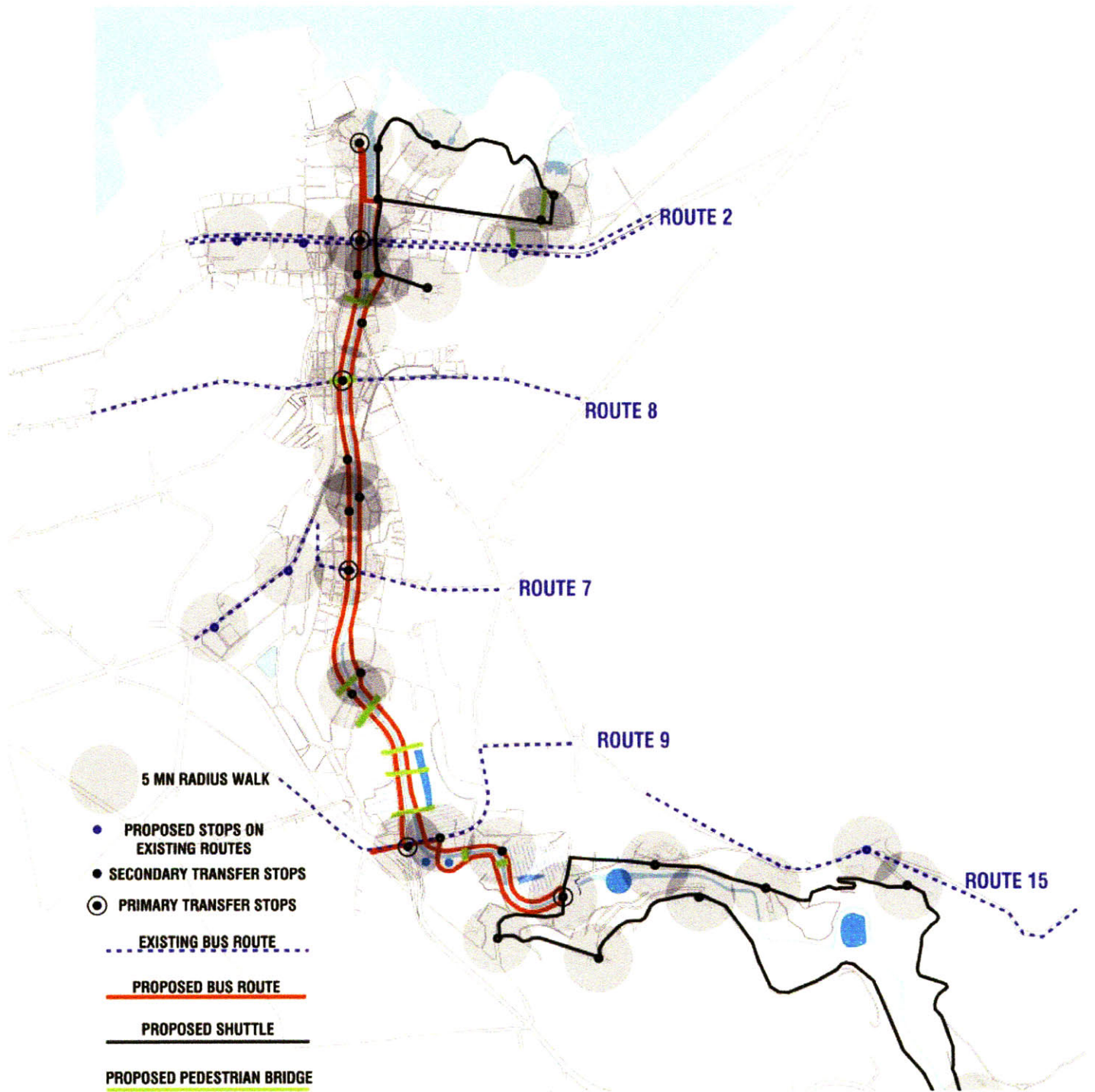


Figure 4.5: Transport System - Accessibility

Figure 4.6: Public Space System

The system identifies five distinct typologies of public space which respond to the different conditions along Nahr Beirut. They comprise platforms, parks, pedestrian conduits, fields, and public institutions.

Platforms exist at the intersection of Nahr Beirut and major vehicular crossings.

Parks consist of the two reclaimed railway stations, Abed Station and Mar Michael Station, reclaimed waterfront and landfill, and reclaimed open spaces adjacent to Nahr Beirut.

Pedestrian Conduits are green corridors which provide a continuous pedestrian navigation between the proposed public spaces.

Fields represent a broader territory: a biking network which overlay the agricultural grid, and linear public groves which define the interface of the agricultural section and the roads.

Public Institutions comprise cultural public programs and complement the proposed open spaces with a programmatic and institutional structure.

Together, these typologies will provide a supportive public framework in which Nahr Beirut inscribes in, so that the whole district can become a civic artery and green lung in the city.

PUBLIC SPACE SYSTEM

BASIN SCALE

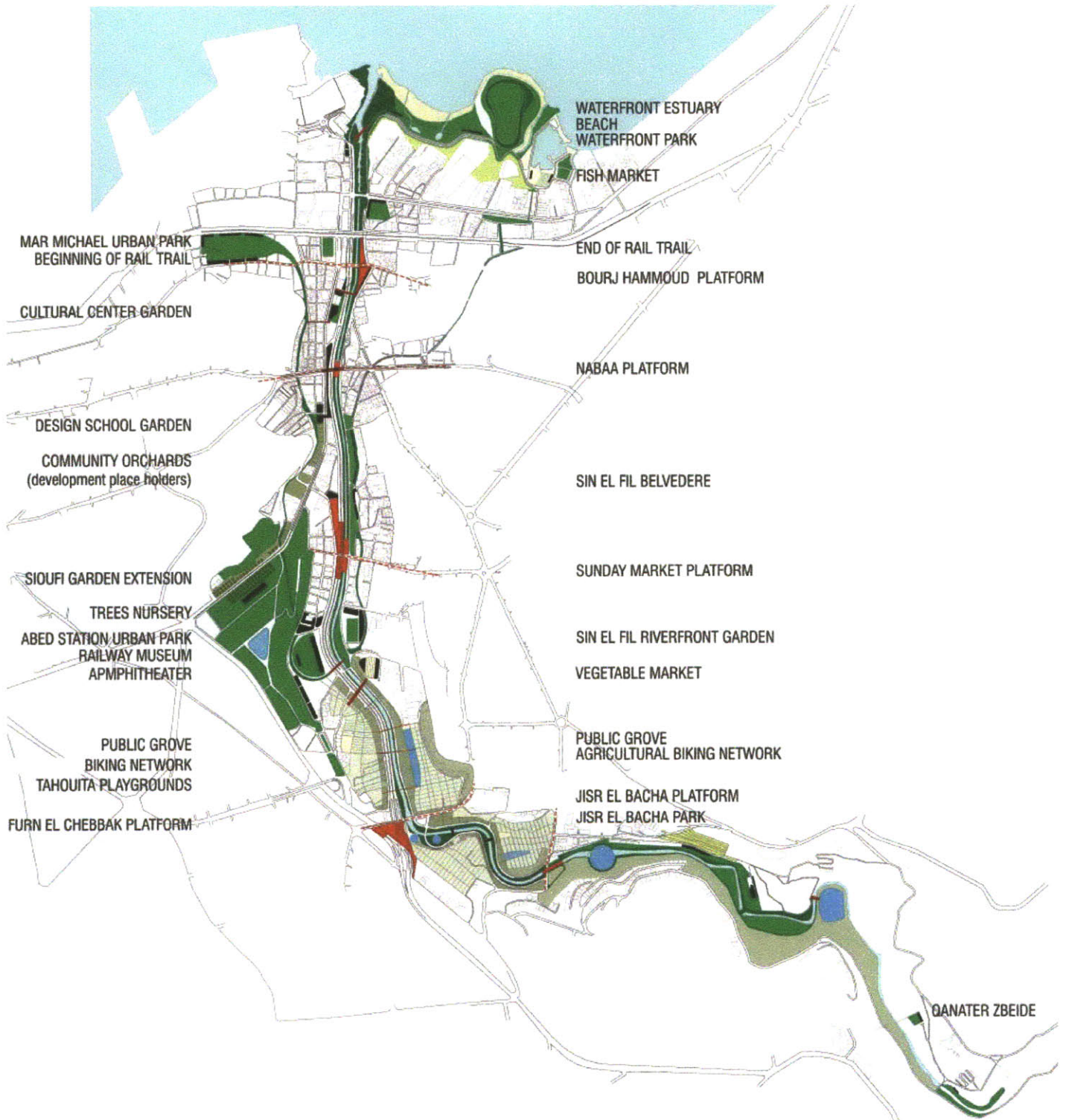


Figure 4.6: Public Space System

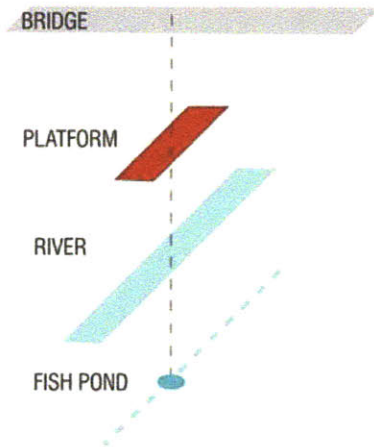


Figure 4.7.1: Platform Diagram



Figure 4.7.2: Nabaa Platform

Figure 4.7: Public Space System- Platform

The intersection of Nahr Beirut with major arteries and bridges represent a unique moment of overlapping infrastructures. The proposed platforms solve the existing connection issues and provide a juxtaposition of public space, pedestrian bridges and reclaimed water discharge points. Each of the proposed elements combines infrastructural performance with public moments. Pedestrian bridges expand to become a public room overlooking the river with a stair connecting to the platform beneath. Water discharge points turn into an event, fish ponds incorporated in the platform design. Other structures such as pergolas and benches provide shading and allow the infrastructural space to be inhabited. In the case of Sin El Fil Platform, proposed structure encompass market stalls to expand the existing Sunday Market and gradins for seating. The Furn El Chebbak Platform comprises a wetland park which is the waste water tertiary treatment phase, in addition to the platform's other functions. Jisr El Bacha Platform coincides under the remains of the Old Ottoman Bridge, and will host the Vintage Market. Each of the five platforms comprise a bus stop which is a major transfer station between existing bus routes and the new proposed bus route along Nahr Beirut.

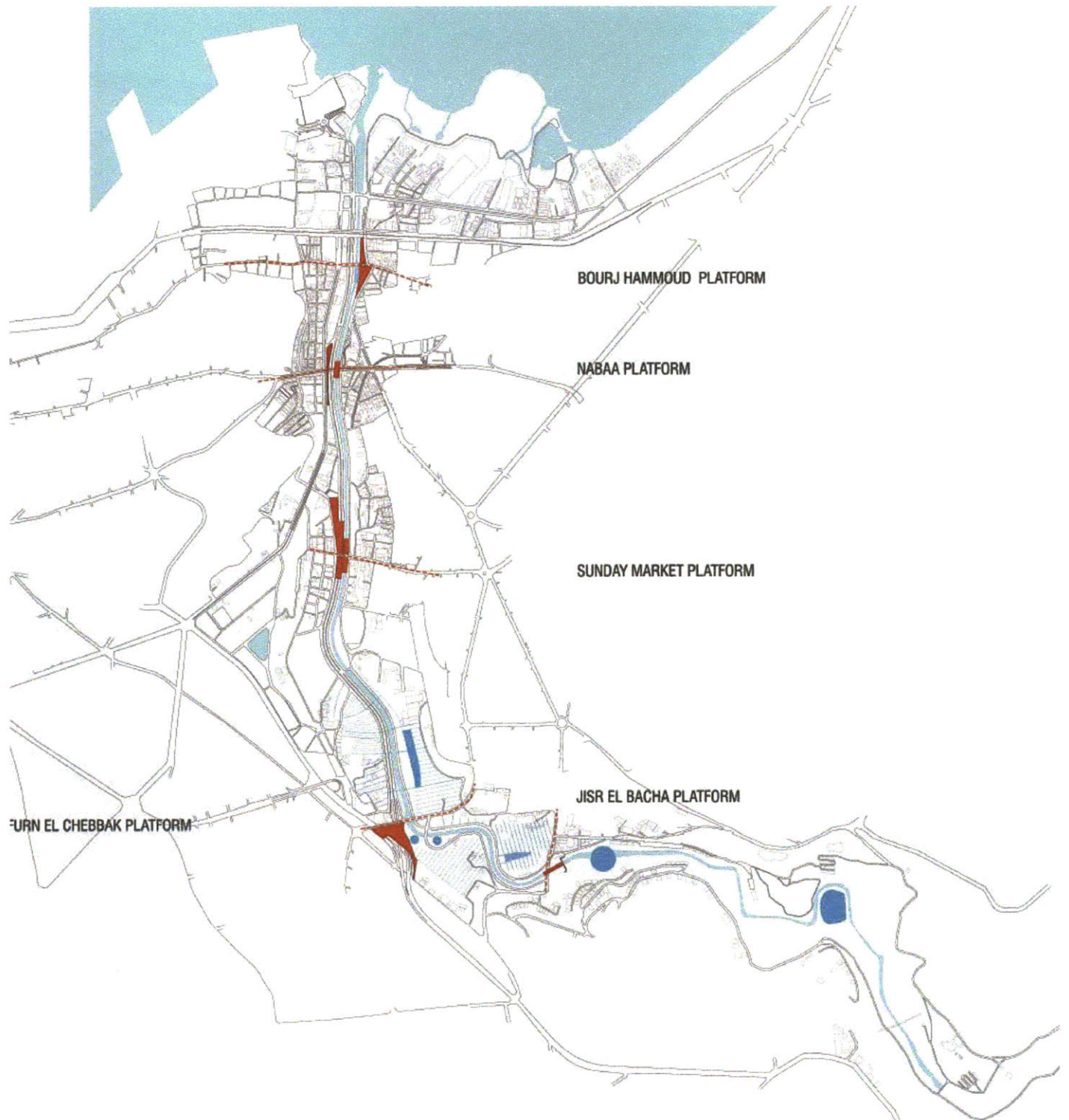


Figure 4.7: Public Space System- Platform

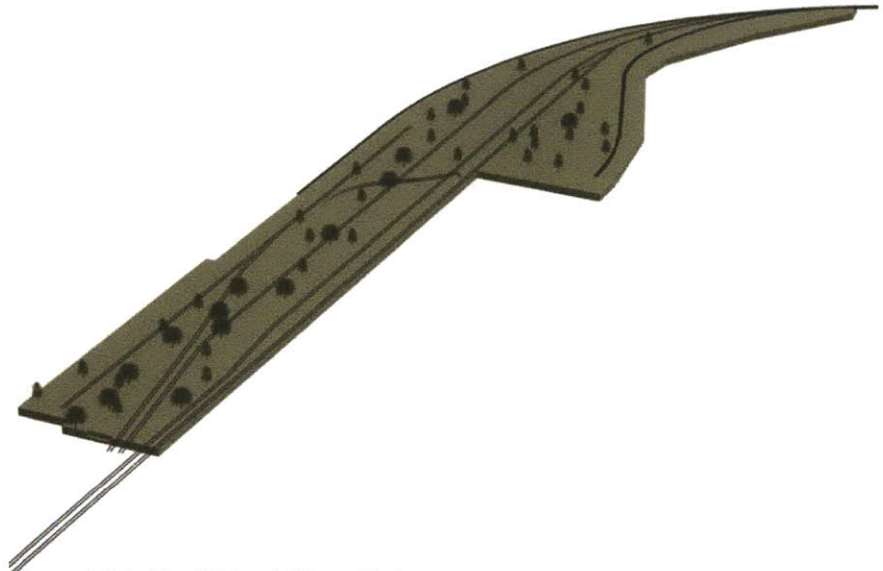


Figure 4.8.1: Mar Michael Urban Park

Figure 4.8: Public Space System- Parks

The proposed parks reclaim the current major open spaces along the river. As such, Abed Railway Station and Mar Michael Railway Station, the waterfront, and the infringing industrial stripe at Jisr el Bacha are converted to major urban parks. Such parks are programmed to overlay their industrial landscape and heritage with large scale events such as conventions, exhibitions and concerts besides leisure features such as jogging tracks, sport areas, picnic areas and woods. Small-scale linear gardens are created on existing open lots adjacent to the river, and re-establish connections between the existing communities and Nahr Beirut. That is the case of Sin El Fil belvedere and Sin El Fil riverfront garden, cultural center's garden and the design school garden on the Beirut Side, and the community hall garden in Quarantina. The city-scale and neighborhood scale communal events will be maintained and elaborated through the active presence of public institutions within or adjacent to the proposed parks.

PUBLIC SPACE SYSTEM
Parks

BASIN SCALE

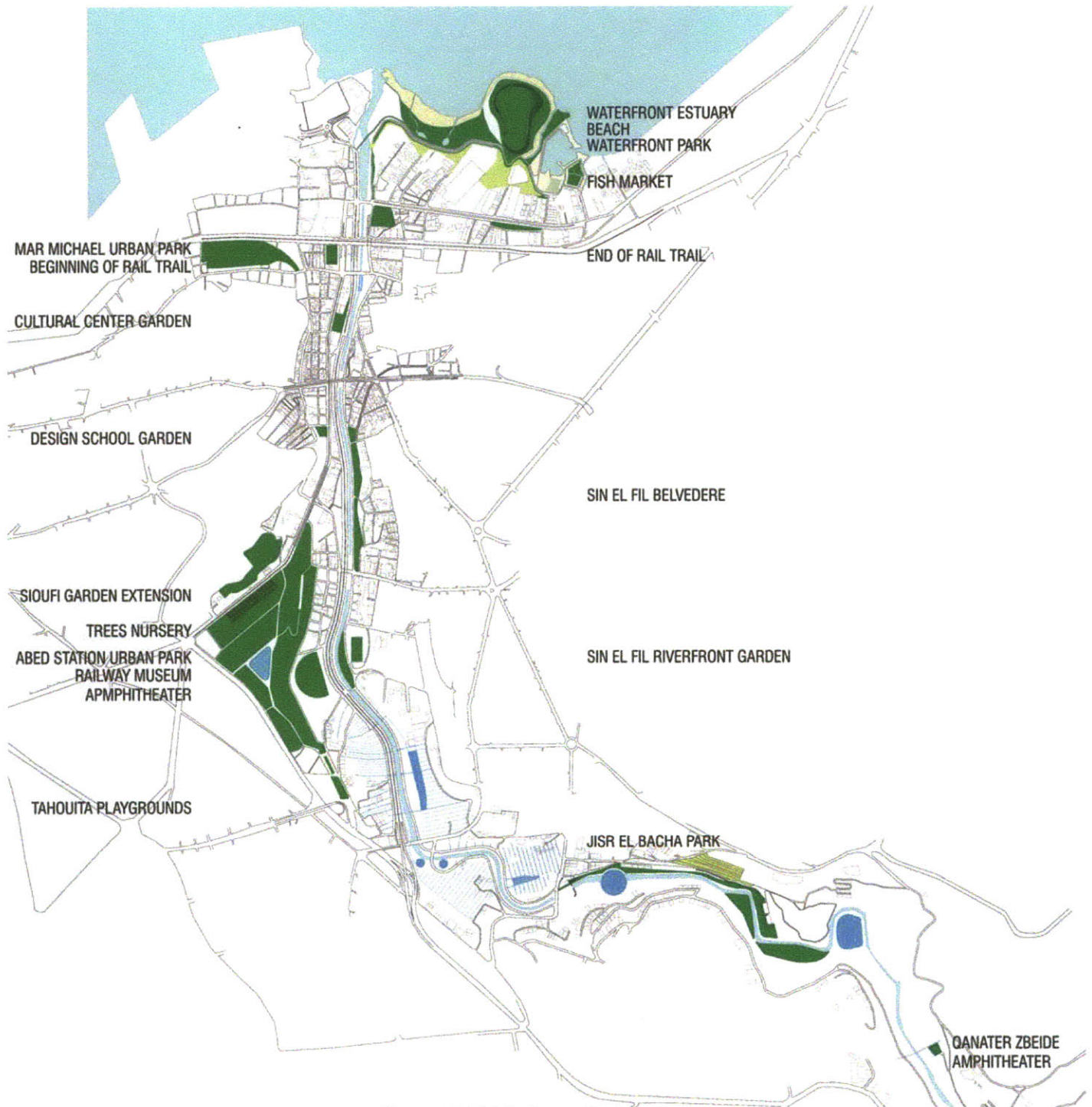


Figure 4.8: Public Space System- Parks

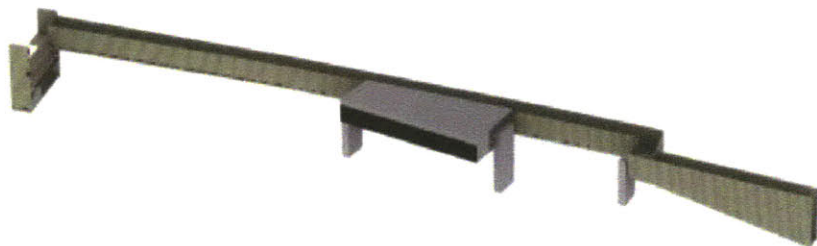


Figure 4.9.1: Yerevan Highway Bridge

Figure 4.9: Public Space System- Bridges

Bridges are systematically located to connect the adjacent neighborhood to both sides of Nahr Beirut and to the river promenade. They serve both as linkages and signals along Nahr Beirut's landscape. They are most of the time complemented with bus stop on both ends. When connecting to a platform, the bridges expand to include a public room over the river. When extending the Rail Trail over Nahr Beirut, the bridge comprises layers of vegetation and takes a structural expression. In the agricultural zone, the bridges become repetitive lattices which connect the fields on the two sides of the Nahr to become one main biking network spanning over the highway and the river.



Figure 4.9: Public Space System- Bridges

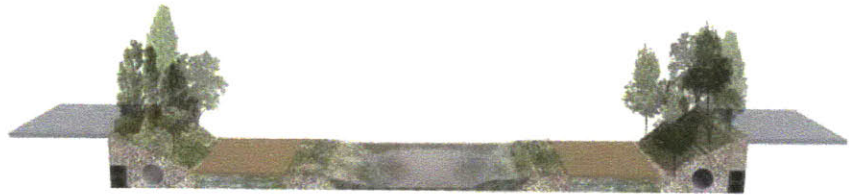


Figure 4.10.1: Nahr Beirut Trail

Figure 4.10: Public Space System- Pedestrian Conduits

There are two main pedestrian conduits: the Rail Trail and the Nahr Beirut Trail.

The Rail Trail overlays the former railway tracks which still exist in most parts of the Nahr district. The proposal reconstitutes missing parts of the trail, and bridge it over the Emile Lahoud highway and the Coastal Highway, to form a continuous pedestrian loop which begins and ends in major destinations. As such, the trail starts at Mar Michael Urban Park, bridges over Nahr Beirut at the same location of the former railway bridge, crosses dense residential neighborhoods of Bourj Hammoud and ends at the Waterfront Park. Nahr Beirut Trail consists of the linear promenade along the river. It starts at the Waterfront Park and ends at Jisr EL Bacha Park, connecting the waterfront, urban zone, agricultural transition and the valley. Together both trails provide a pedestrian navigation which overcomes the omnipresent vehicular arteries.



Figure 4.10: Public Space System- Pedestrian Conduits

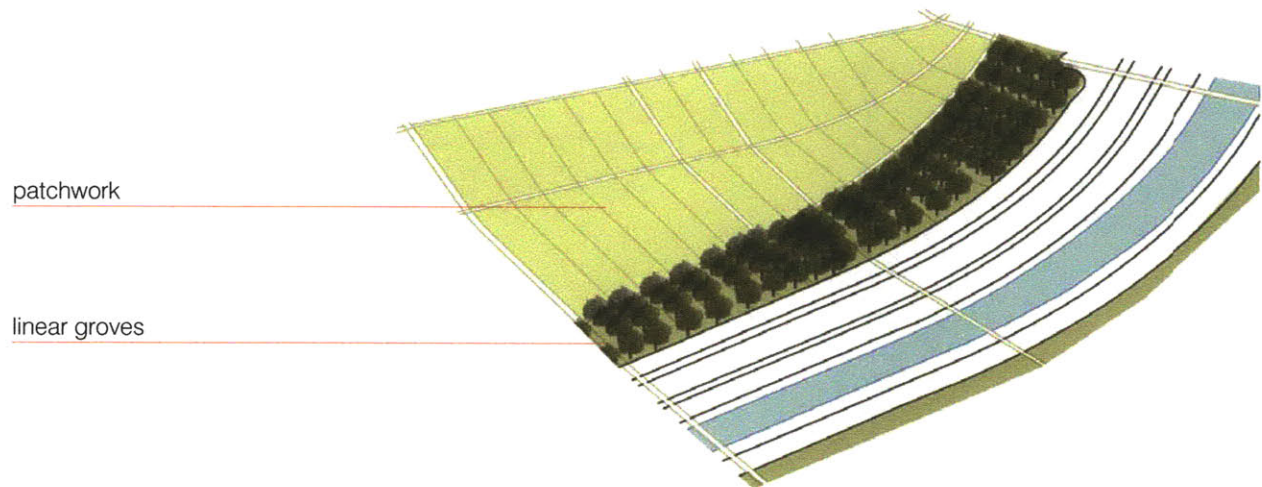


Figure 4.11.1: Tahouita Fields

Figure 4.11: Public Space System- Fields

The field typology occurs in the agricultural zone and the beginning of the valley and comprises two main landscapes: the patchwork and the linear grove.

Linear groves situate adjacently to the highway on sloping terrains. Their landformation next to the highway encloses the agricultural fields to make them giant rooms which can be used as diversion fields in case of severe flooding. the linear public groves will comprise fruitful trees that engage adjacent communities with public events such as picnics and fruit picking. On the Corniche El Nahr Boulevard, the community orchards could be used as place holders for future development while keeping in early the edge dense with deciduous trees.

Patchworks infill the inner surfaces in the agricultural zone. The agricultural grid embeds an irrigation system within it, and a biking network on top of it.

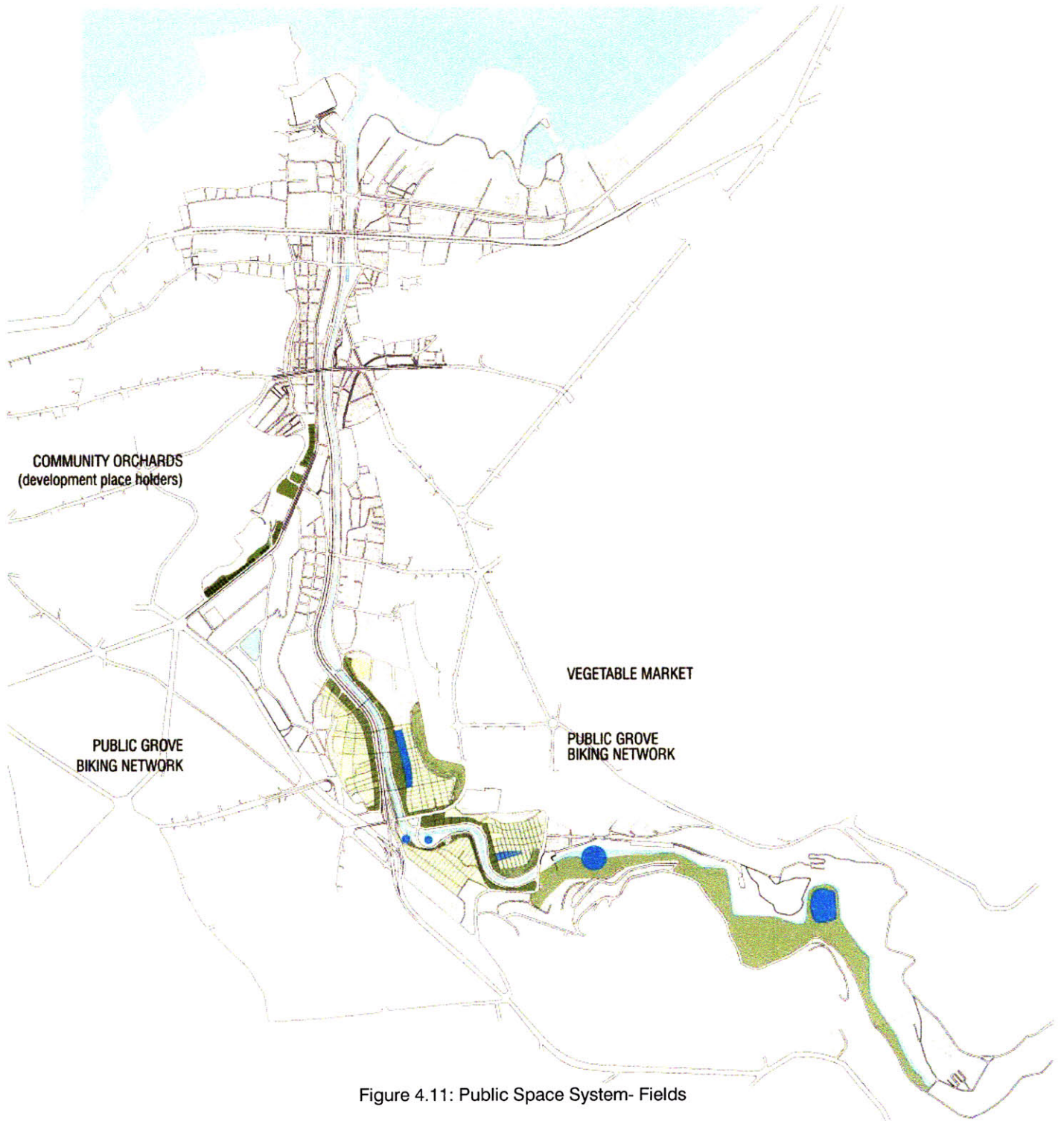


Figure 4.12: Public Space System- Public Institutions

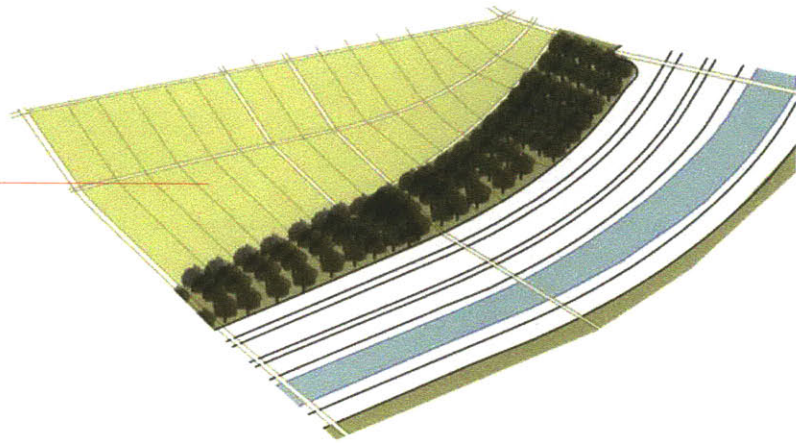
Public Institutions are located within and adjacent to the proposed open spaces to harness a communal stewardship over the proposed public open spaces through continuous programming and maintenance. Local Institutions such as municipality halls, senior housing, public library, public health club and design school will strengthen the connection of the adjacent communities with the new riverfront. Institutions such as the Railway Museum, Public Library, Auditorium, Bus Station, and Public Education will have larger catchment zones which engage the whole Metropolitan Area.

Proposed public programs favor education and culture so as to establish Nahr Beirut as the new multicultural artery of the city. Reactionary private landuses such as restaurants, cafes and commercial institutions will eventually complement the proposed public programs, allowing a balanced mix between public and private realm on Nahr Beirut.



Figure 4.12: Public Space System- Public Institutions

Fields



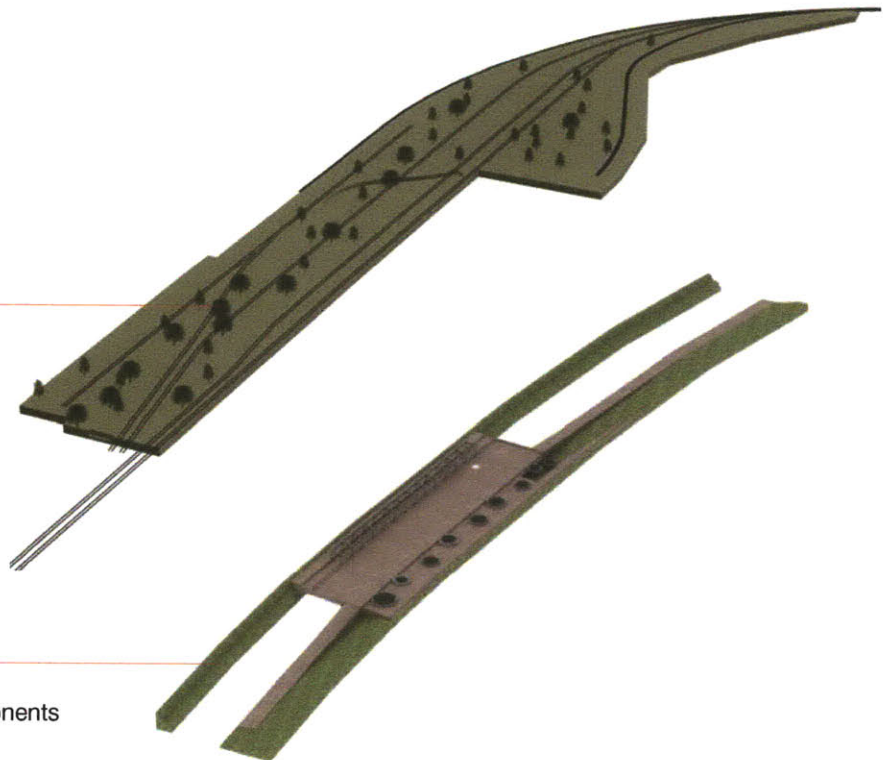
Pedestrian Conduit



Bridges



Parks



Platforms

Figure 4.12.1:Public Space Components

PUBLIC SPACE SYSTEM

BASIN SCALE

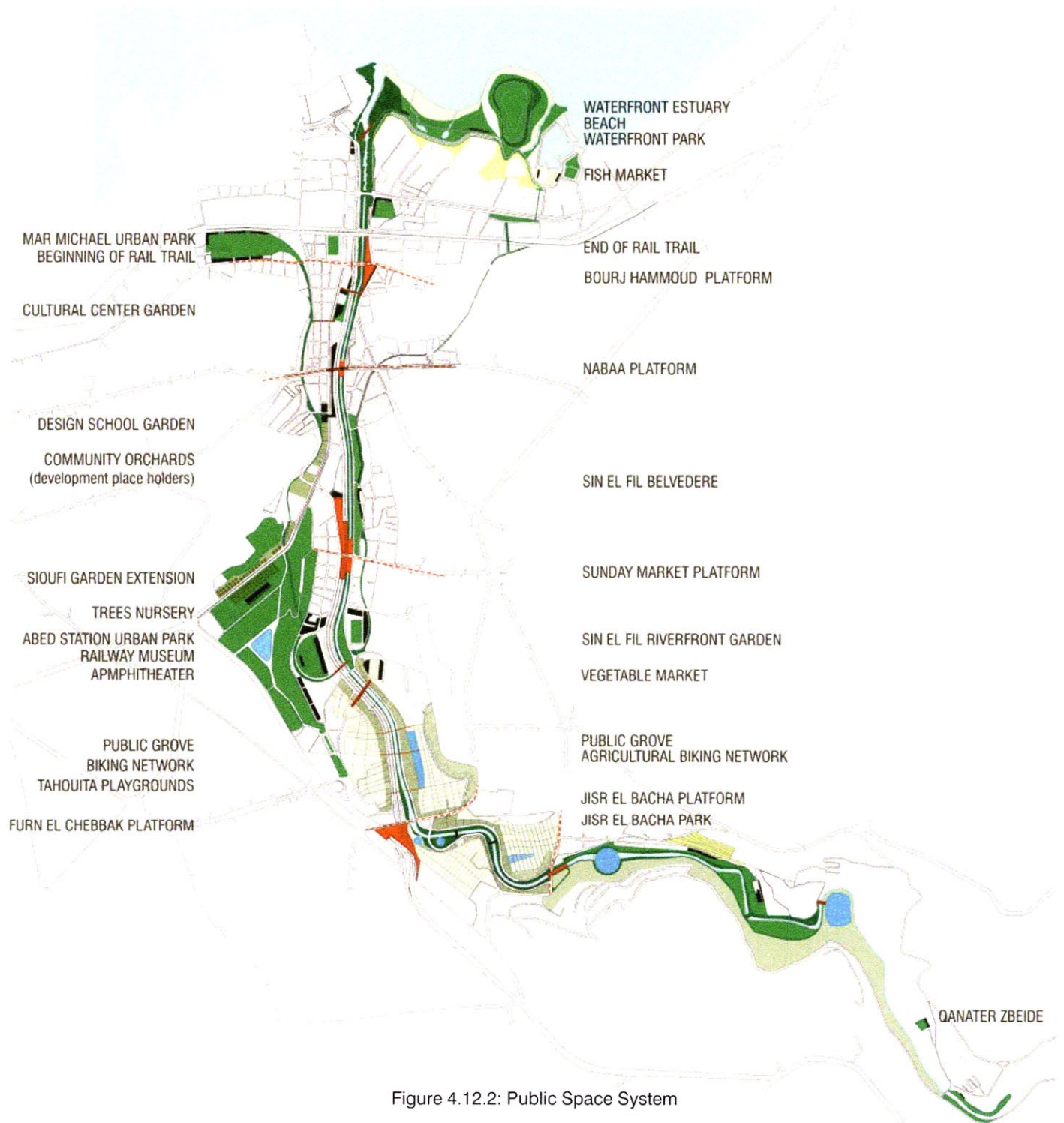


Figure 4.12.2: Public Space System

Figure 4.13: Waterfront - General Plan

The proposal advances as an initial step the relocation of the waste treatment plant to an infill lot in the industrial district. This will allow to widen the mouth of river and expand the existing estuary. The estuary is brought inside the river by lowering the ground of the Nahr below sea level until the Coastal Highway Bridge. The slaughterhouse will be relocated outside the district, in a remote location. The proposed waster water treatment plant, linear parking and technical functions are located at the back of the waterfront, as a buffer between the industrial stripe and the new waterfront park. Liberated from technical facilities, the waterfront will then be punctuated by a set of public instances: the port public markets, the estuary, the waterfront park, the beach, and the renovated fisherman port. This zone also comprises the beginning and end of the rail trail which starts in Mar Michael Urban Park and ends in the fishermen's port.

1 WATERFRONT General Plan

ZONE SCALE



Figure 4.13: Waterfront - General Plan

Figure 4.13.1: Waterfront - Water Treatment Plan

The plan proposes to neutralize industrial discharges by running a new collector in front of the current industrial outfalls. Collectors will convey water from industrial zone and the city to the treatment plant where it will receive primary and secondary treatment. Part of the water will receive tertiary treatment on site through constructed wetlands and fish ponds then feed in the estuary and the rest will be pumped through a network along the river to the major wetland field upstream for further treatment.

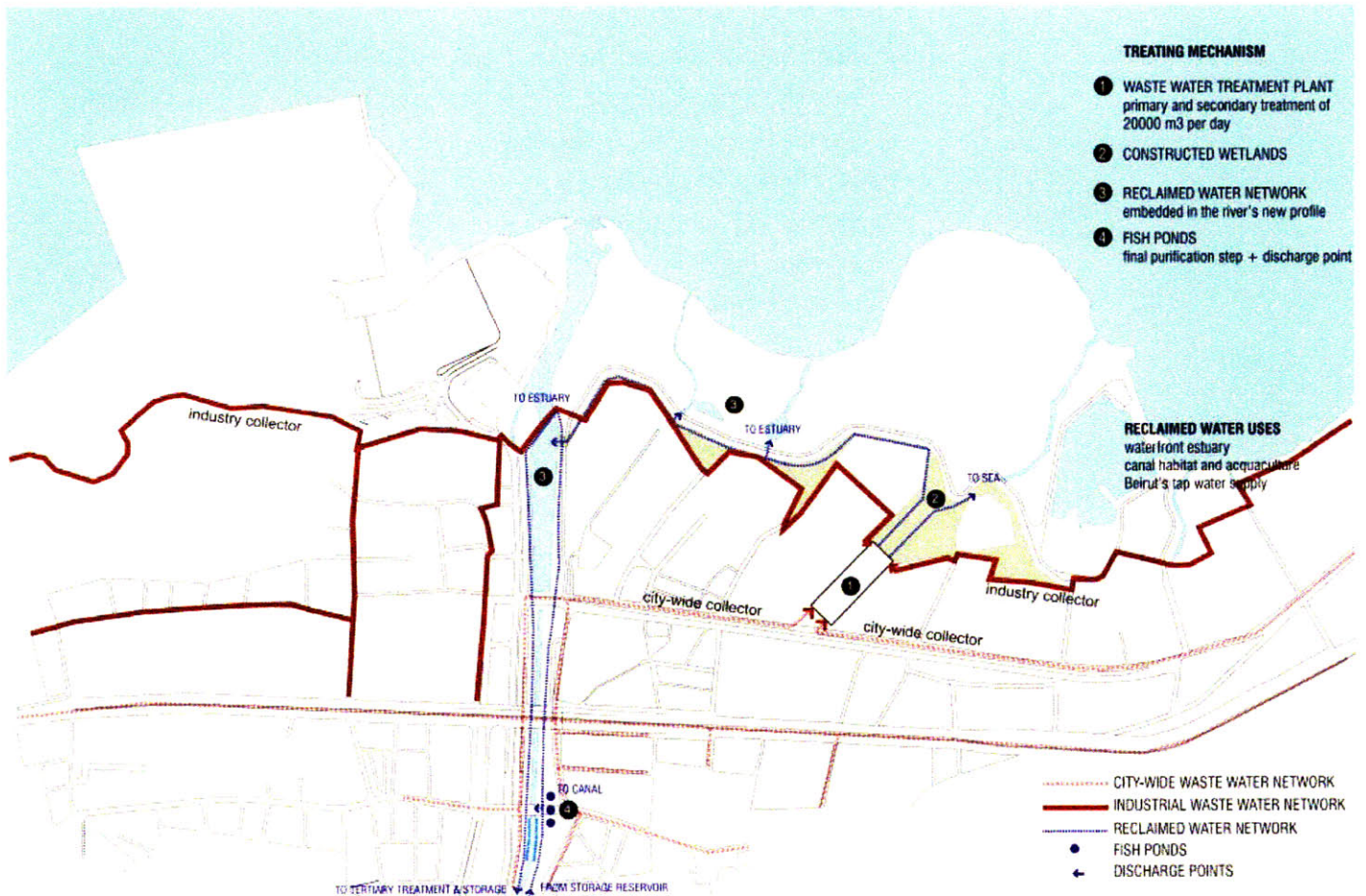


Figure 4.13.1: Waterfront - Water Treatment Plan

Figure 4.13.2: Waterfront - Access Plan

Accessibility in the waterfront zone is optimized by a new bus route which starts at the Port until Jisr EL Bacha with major transfer stops at the Coastal Highway Bridge, and the Bourj Hammoud Bridge. The proposal reclaims the footprints of the ramp which extended the seaside road over Nahr Beirut's former walls. The new intersection happens at grade, and the former ramp is replaced by widened banks. The Waterfront Park is accessible through a shuttle service which connects it with Bourj Hammoud town square, an extensive pedestrian network, and the extension of the Rail Trail which ends in the fishermen's port.

It also comprises two main vehicular accesses, and a circulation loop which is isolated from the fast traffic of the national highway and seaside road, allowing a slower traffic and service access from the seaside road. The collaborative network of parking is treated as dense bosques with soft surfaces allowing run-off treatment.

1 WATERFRONT Access Plan

ZONE SCALE

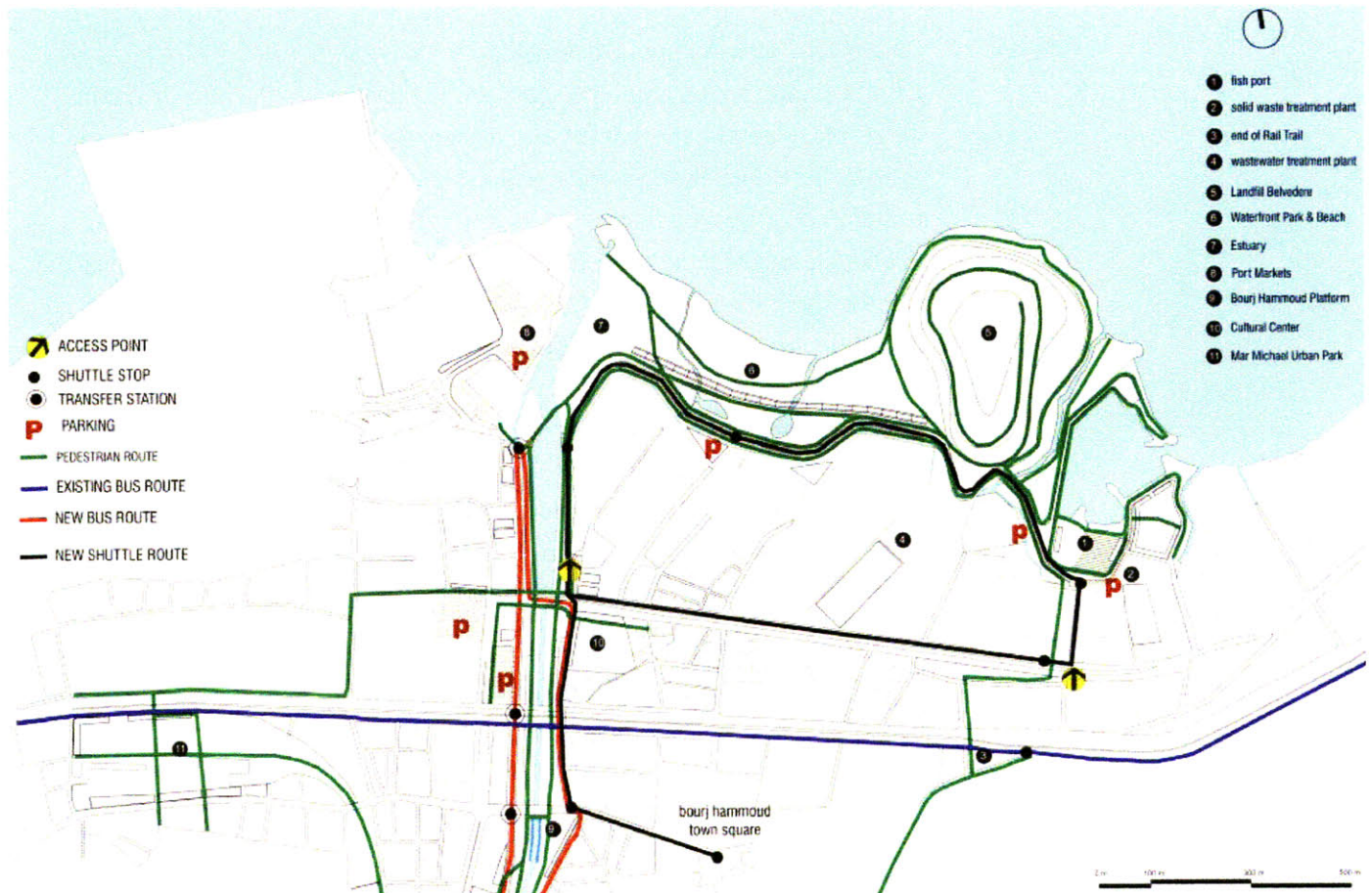


Figure 4.13.2: Waterfront - Access Plan

Figure 4.14: Urban Zone- General Plan

On the public space level, the urban zone contains the two major urban parks, Mar Michael Station and Abed Station, and linear community gardens such as Sin El Fil Belvedere and the Riverfront Park. Public programs include a design center with a public roof, community halls, a public library, an auditorium, a public library, municipality headquarters, the Lebanese Railway Museum, a communal health club and senior housing.

Nahr Beirut Trail, the Rail Trail and the public platforms of Bourj Hammoud and Sin El Fil are the linkages between those different public spaces.

The stormwater and wastewater network in the urban zone are integrated within the river's new profile the water is either going from the treatment plant to the wetland park upstream or coming from the wetland park and revealed at the platforms through fish ponds before being discharged in the Nahr.

On the mobility level, strategic bridges join the two communities on both sides of the river and coincide with public transport bus stops. the new created spaces on the Nahr fall within walking distance from the centers of the different neighborhoods'.

2 URBAN ZONE
General Plan

ZONE SCALE

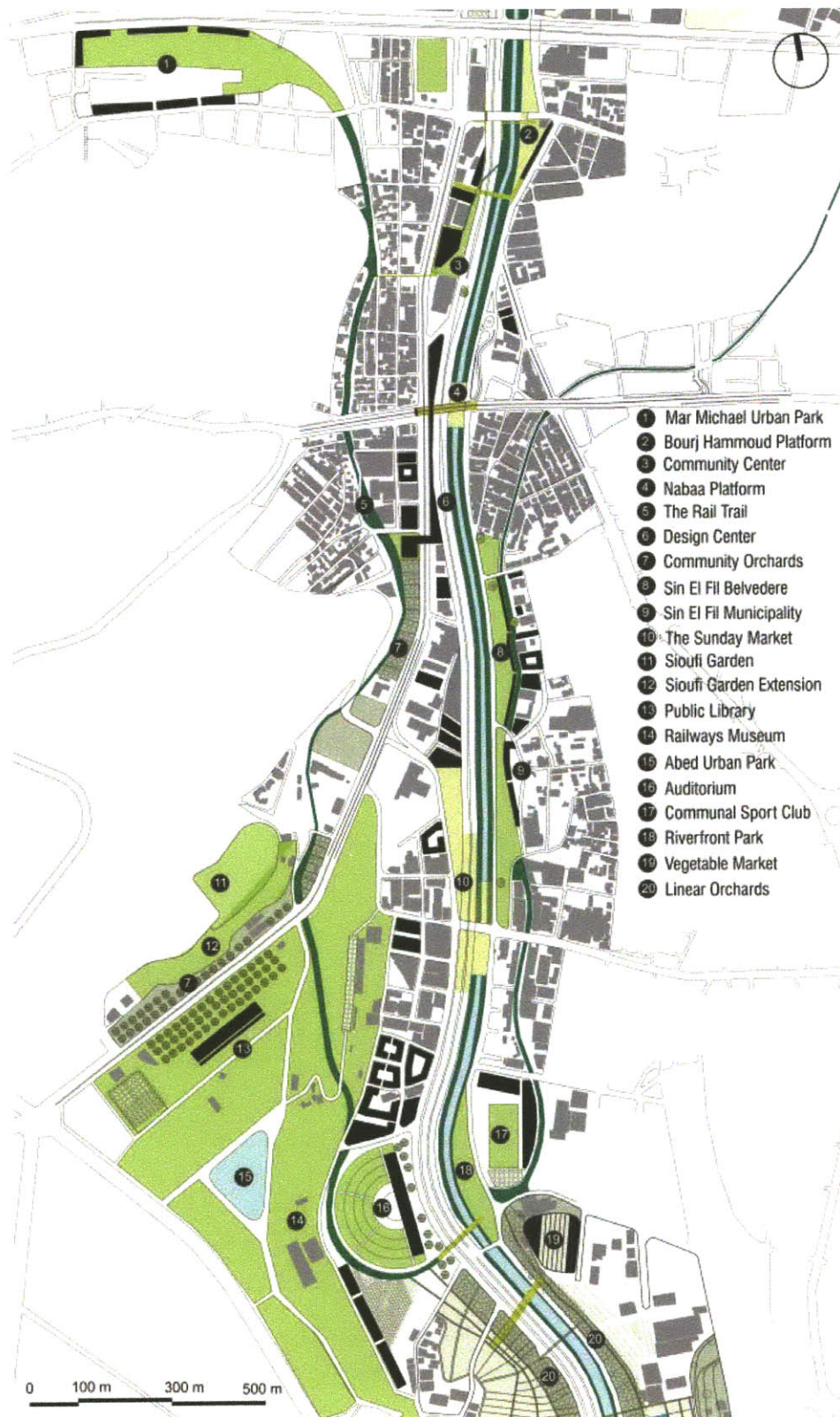


Figure 4.14: Urban Zone- General Plan

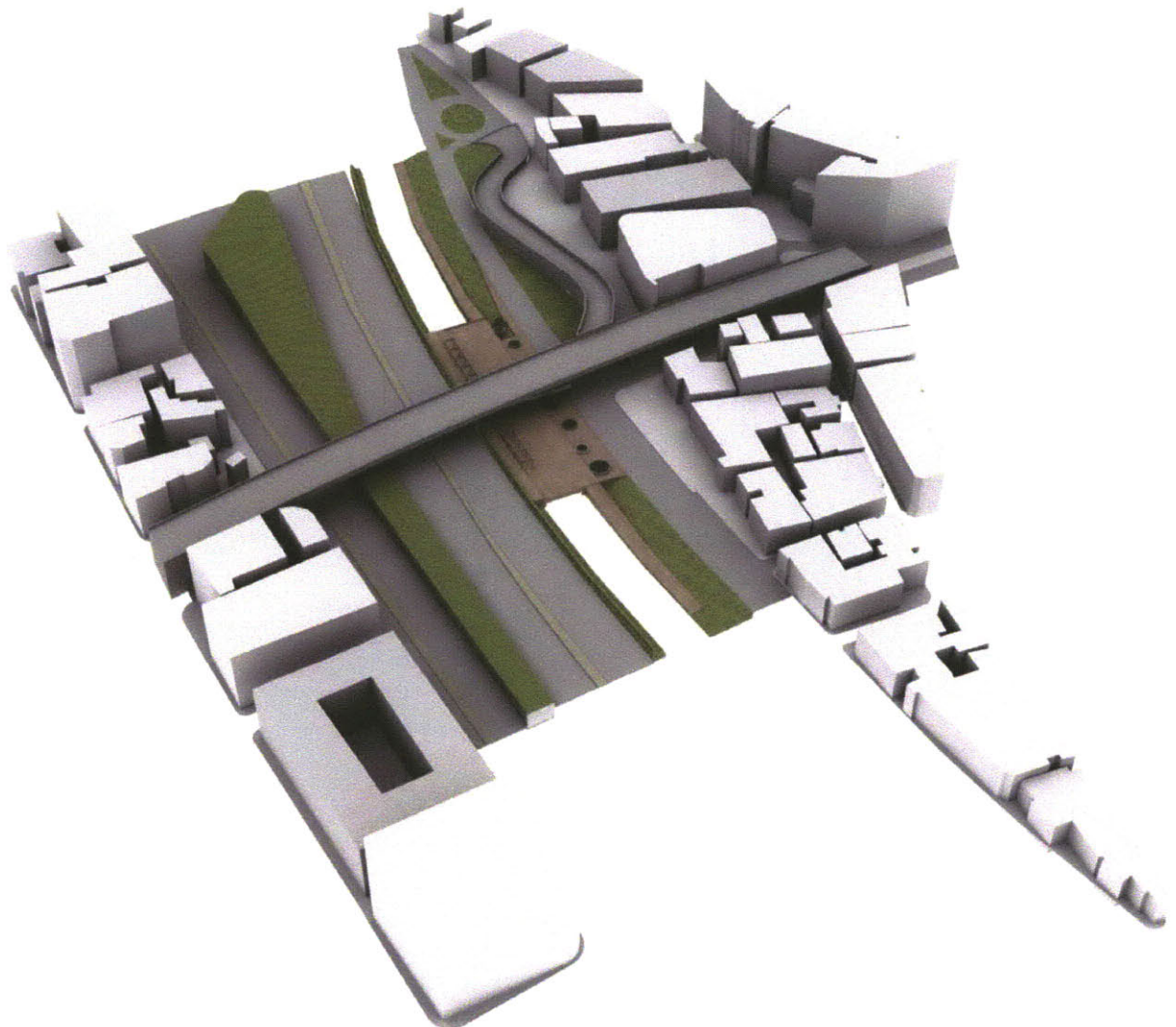


Figure 4.14.1: Nabaa Platform Axonometry

2 URBAN ZONE Nabaa Platform

ZONE SCALE

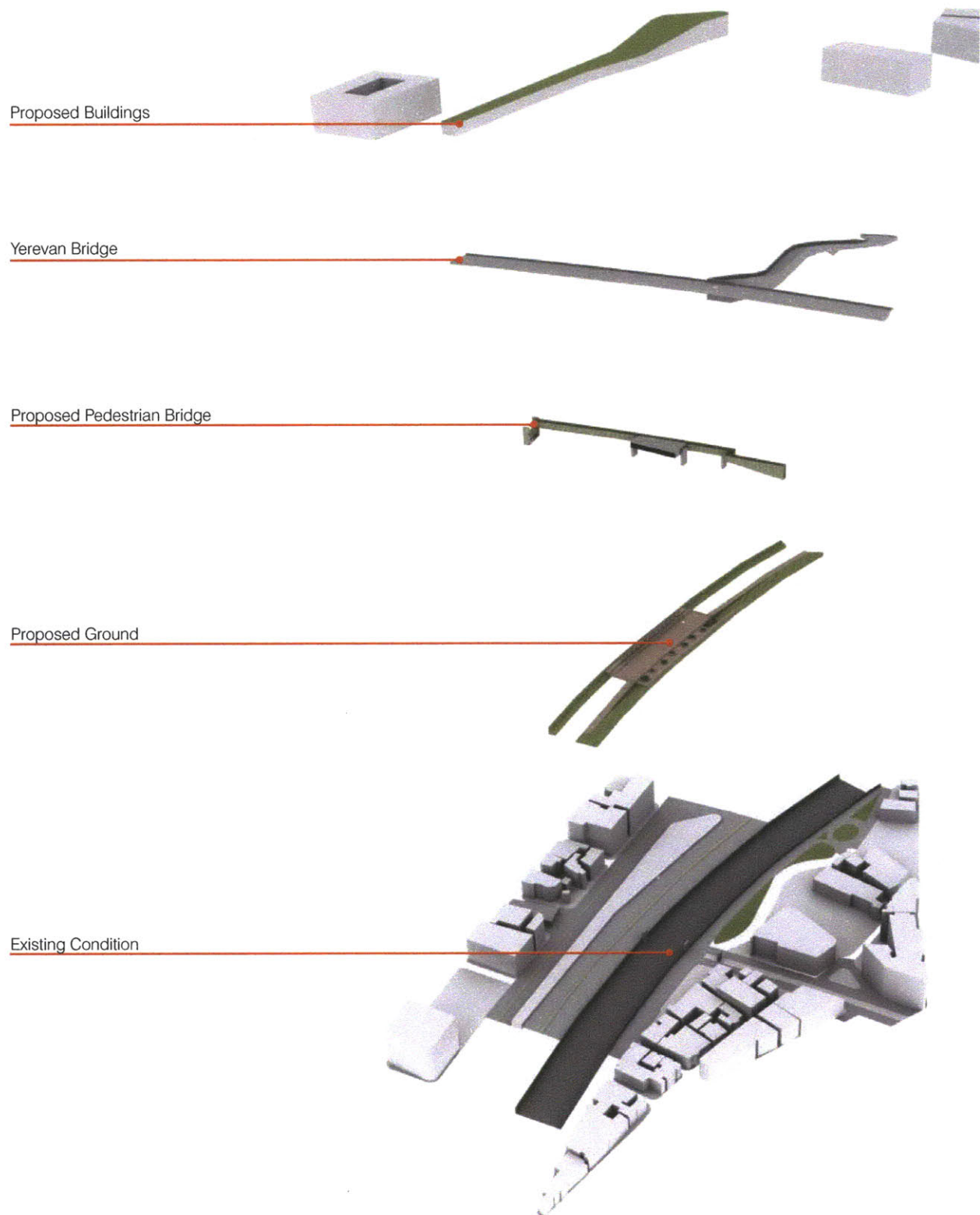


Figure 4.14.1: Nabaa Platform Exploded Axonometry



Figure 4.14.2: Nabaa Platform Perspective



Figure 4.14.2: Nabaa Platform Perspective

Figure 4.15: Agricultural Transition- General Plan

The agricultural transition represents a continuation of the urban zone transport systems, water systems, and Nahr Beirut Trail. Furthermore, it comprises the multifunctional water structures which are deployed and embedded within the agricultural grid and layered with two main public programs: the new biking network and the public groves. This zone features the wetland park which is located off-channel as an extension to Furn El Chebbak Platform, and from which the water is reclaimed back to the city or directed in the channel to specific discharge points.

The existing vegetable market which is currently infringing the fluvial domain was relocated to a new position, closer to the fields, in order to widen the river banks at its former emplacement.

This relocation is complemented by a new pedestrian bridge which connects the two sides of this agricultural stripe at the vegetable market, and announces the beginning of frequent bridging all along this zone. Bridges are situated in this area as markers in the landscape and span the biking network over the highway and Nahr Beirut.

3 AGRICULTURAL TRANSITION General Plan

ZONE SCALE



Figure 4.15: Urban Zone- General Plan



Figure 4.15.1: Tahouita Fields Plan and Section

3 AGRICULTURAL TRANSITION Fields

ZONE SCALE

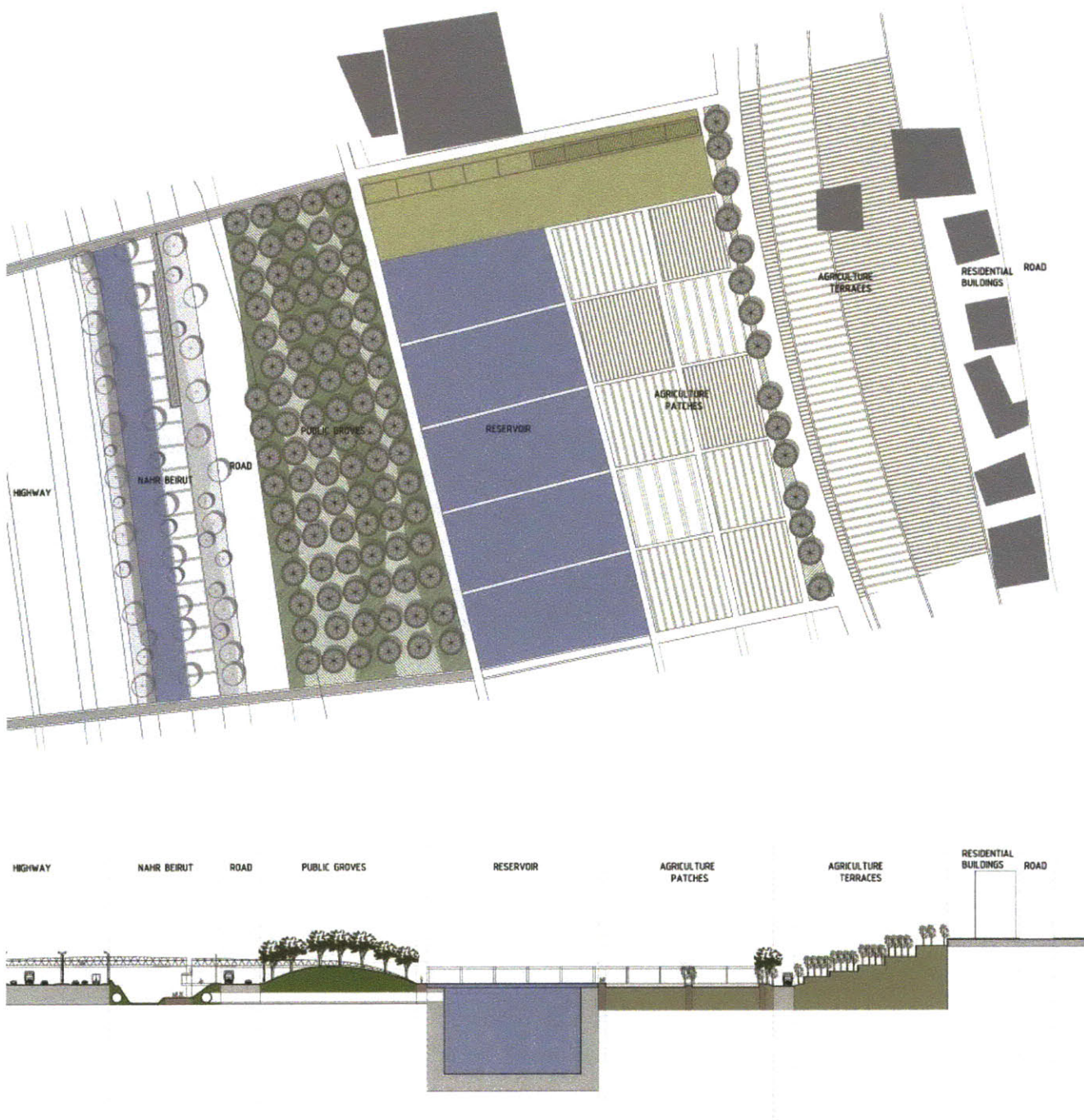


Figure 4.15.1: Tahouita Fields Plan and Section



Figure 4.15.2: Tahouita Fields Perspective

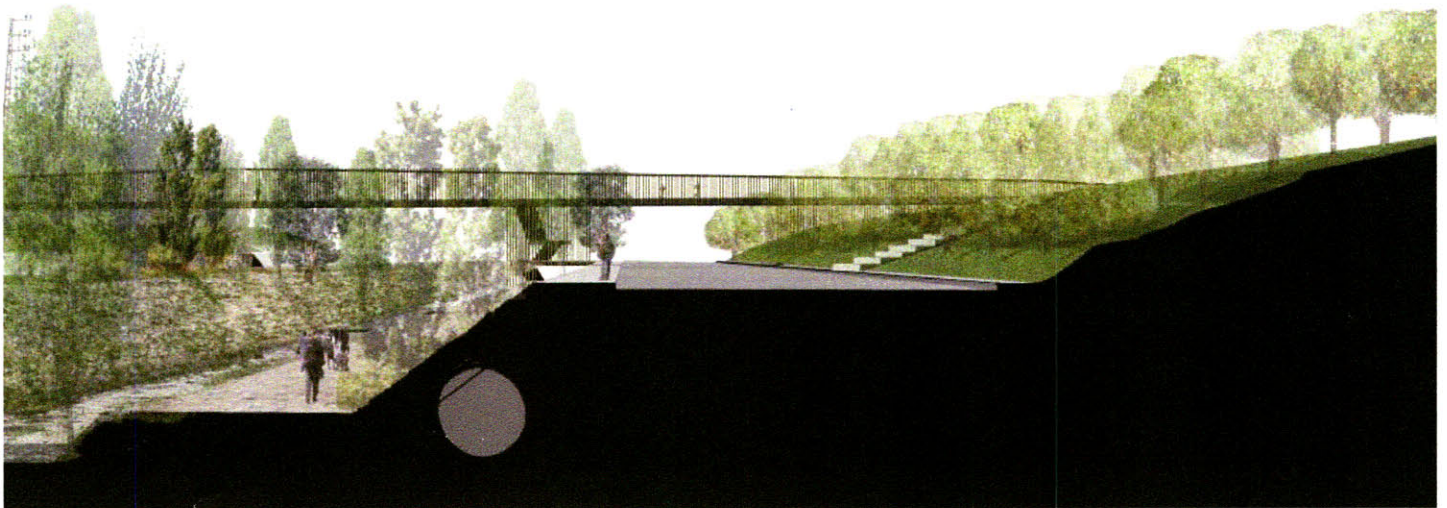


Figure 4.15.2: Tahouita Fields Perspective

Figure 4.16: Valley- General Plan

The valley starts by the last platform which hosts a market coinciding under the ottoman bridge. The proposal advances the relocation of infringing construction factories to vacant lots in the Mkalles Industrial City. Some buildings will be removed to widen the Nahr Beirut banks, while others will be re-used to host programs like a research institute and vacation club. In the upper valley, the existing health club adjacent to the roman aqueduct will be replaced by Nahr Beirut Valley Foundation and an open-air amphitheater will replace the private tennis courts which border the aqueduct. After the Dachouniyyeh Dam, there will be public facilities which provide cooking and sanitary equipment for a picnic area.

In this section, the water structures are storage reservoirs used for irrigation, and sediment traps which will constantly be emptied by the construction materials' factories.

4 VALLEY General Plan

ZONE SCALE



Figure 4.16: Valley- General Plan

Figure 4.16.1: Valley- Access Plan

Nahr Beirut pedestrian trail links the previous zone with the valley, and widens at Jisr El Bacha linear park. The proposed bus route ends at the Jisr El Bacha Bridge. From there, a shuttle service provided by Nahr Beirut Valley Foundation will run between Jisr El Bacha and Dachouniyyeh Dam. The first valley trail starts at the vacation club and ends at the Dachouniyyeh Dam. A second trail starts from the Dam into the upper basin. Limited parking space will be provided in this upper zone, while most cars will park in Jisr El Bacha and use the shuttle as the main transport mode.

4 VALLEY Access Plan

ZONE SCALE



Figure 4.16.1: Valley- General Plan

Figure 4.17: Waterfront Profile

In its three variations, the new profile of the channel recreate the microclimate of the existing channel through the concentration of riparian vegetation on both banks. Besides their environmental role, the vegetation stripes will act as a buffer from traffic and street noise, provide urban runoff treatment and shade in the dry season.

The old channel walls will be replaced by structural gabion walls, with a skin treatment which allows the growth of riparian vegetation and habitats on it. The channel's concrete floor will be totally removed, allowing the direct exchange between the riparian stream and the groundwater tables. The channel will also comprise waste water and stormwater drains which convey water between the elements of the previously elaborated water systems. In its three profiles, the channel can contain a flow rate reaching 900 cubic meters per second.

In the waterfront zone, the profile of the channel is symmetrical, and is lowered below sea level to bring the estuary in. Pedestrian paths will be brought inside the channel profile on both sides and layered over gravel foundations.

1 WATERFRONT PROFILE

CHANNEL SCALE

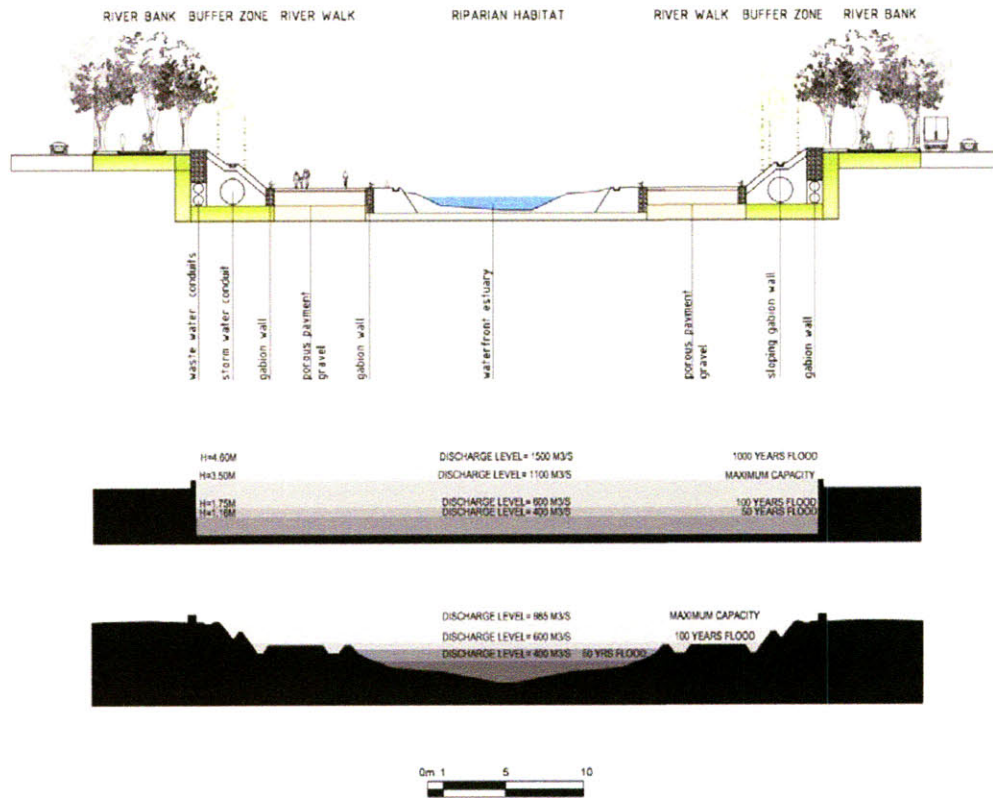


Figure 4.17: Waterfront Profile

Figure 4.18: Urban Zone Profile

In the urban zone, the profile becomes asymmetrical, as the channel completely opens up to Bourj Hammoud and Sin El Fil neighborhoods while maintaining a consolidated edge on the highway side. Pedestrian paths are located on the Bourj Hammoud and Sin EL Fil side, while pedestrian bridges provide the transversal linkage with the Beirut side.

2 URBAN ZONE PROFILE

CHANNEL SCALE

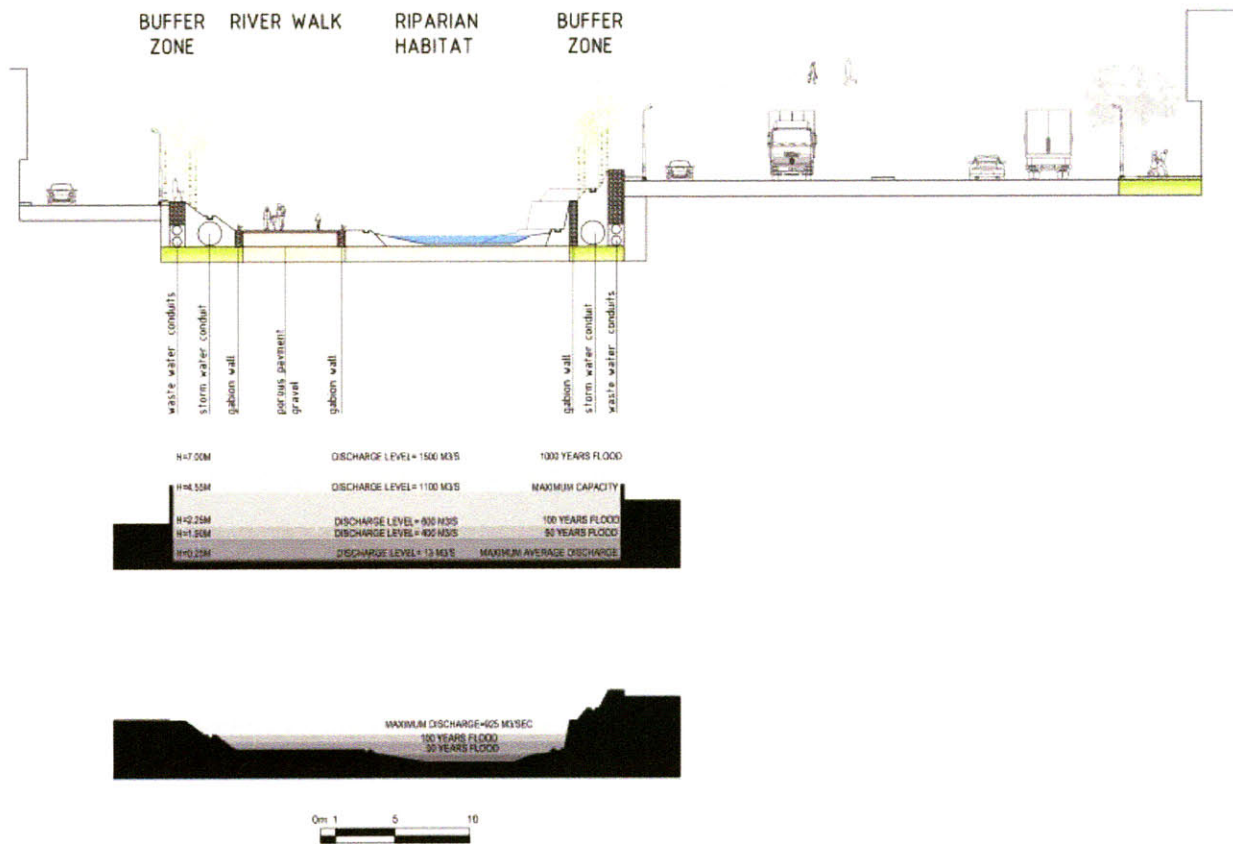


Figure 4.18: Urban Zone Profile

Figure 4.19: Agricultural Transition Profile

The channel's profile widens up in the agricultural zone through gradual terracing, taking advantage of the available space between the road and the channel walls.

The waste water conduits end in the reservoir which controls the inputs and outputs of the wetland park and the stormwater conduits end at Jisr El Bacha Reservoir.

3 AGRICULTURAL TRANSITION PROFILE

CHANNEL SCALE

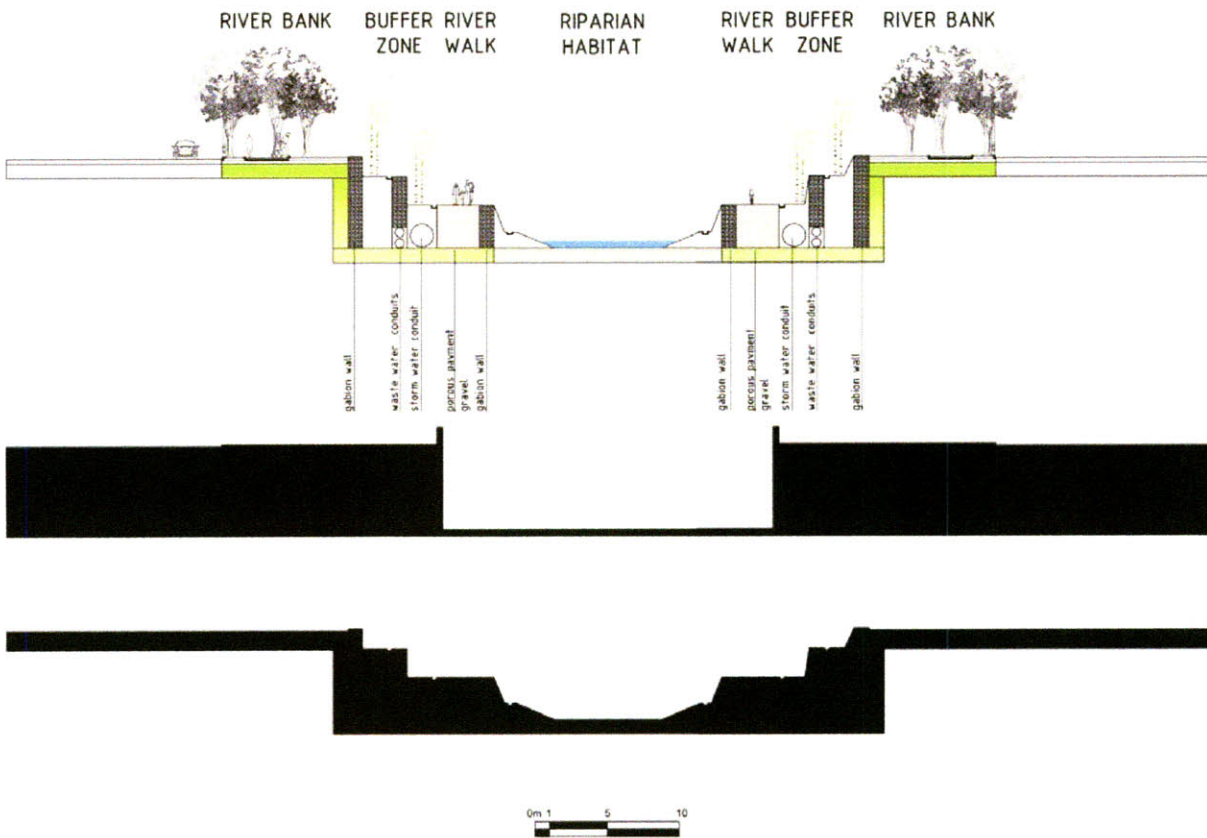


Figure 4.19: Agricultural Transition Profile

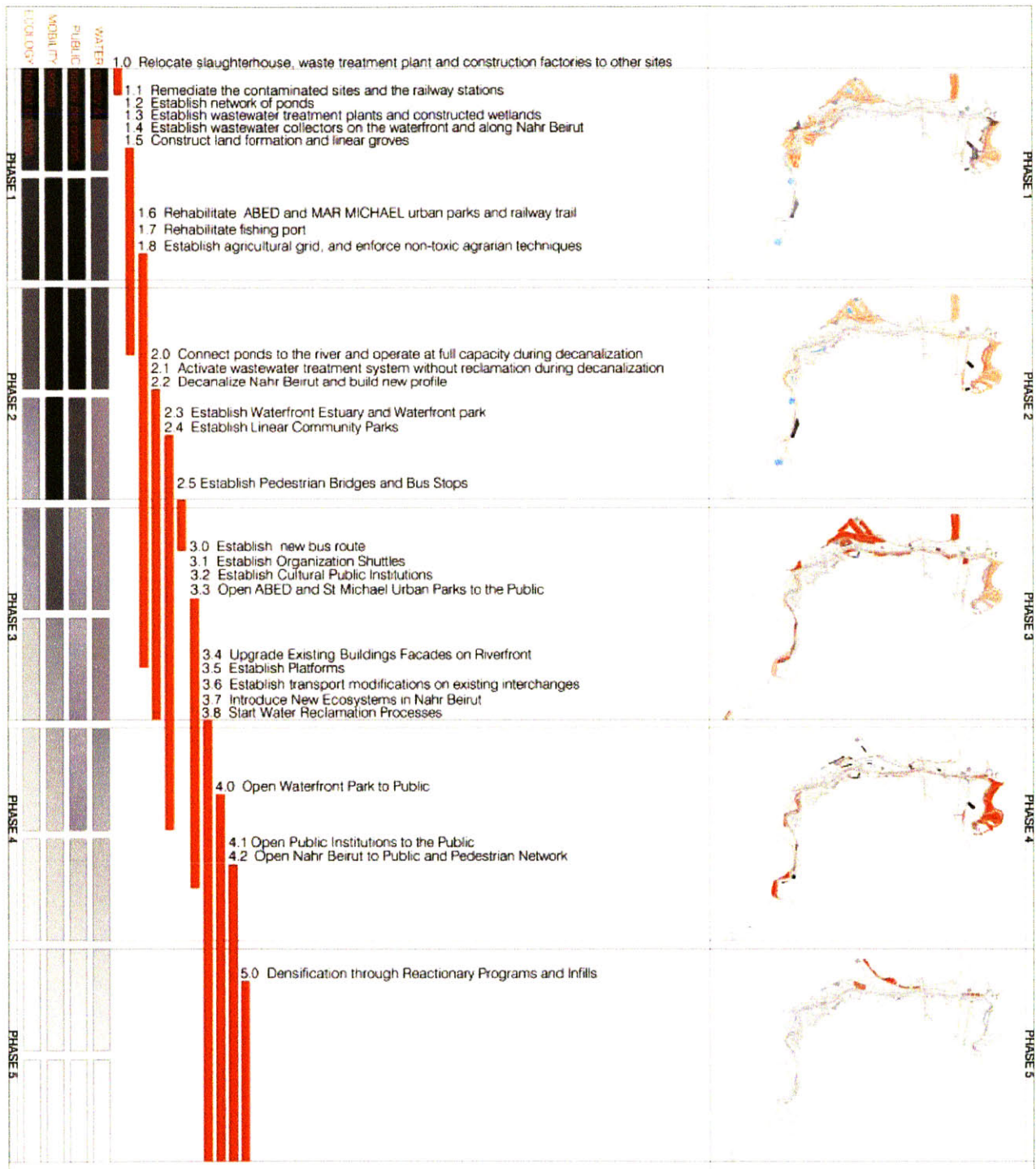
Figure 4.20: Implementation

A preliminary phase requires the relocation of the slaughterhouse, the waste treatment plant, the construction factories and the vegetable market to their new location.

The first phase starts with the remediation of the contaminated and post-industrial sites simultaneously with the construction of the wastewater and multifunctional water systems. The second phase comprise the full activation of the water systems and the gradual decanalization of Nahr Beirut. The third phase witness the gradual establishment of the proposed public space network around the river while it is still being decanalized, and the introduction the new mobility system. This phase is only feasible with active community involvement in shaping the local parks and establishing the proposed public institutions of each municipality. The fourth phase will introduce Nahr Beirut and the waterfront park. The fifth phase will regulate the reactionary programs along the river's district to allow a mixed income housing and mixed commercial land uses.

By the end of each phase, the quality of water, the availability of public space, the mobility, accessibility and habitat conditions along Nahr Beirut will improve gradually.

Figure 4.20: Implementation



CONCLUSION

CONCLUSION

The current global emphasis on infrastructural rehabilitation have introduced infrastructure as a major field which urban designers need to engage and re-envision. In the case of Nahr Beirut, this is even more urgent, given the immediate needs of the surrounding districts and the city of a better water management, public green space, and pedestrian- friendly mobility and the current assets that Nahr Beirut currently has on all three levels.

For this reason, the complete rehabilitation of Nahr Beirut as an artery and its re-integration in Beirut could only be accomplished by acting at a metropolitan scale.

Through this design proposal, I have demonstrated how a multilayered framework of public space, water and transport can transform an object infrastructure to an infrastructural landscape, and can become a great start to address the social, environmental and urban problems of Beirut.

On the water level, Nahr Beirut was attributed an unprecedented role, which is to become a tool to reclaim water, thus remediating Beirut's water supply shortages. On the transport level, Nahr Beirut took advantage of the highway which isolates it by introducing a new rapid bus line along it, bridging over it, and manipulating key intersections. Finally, the proposed network of infrastructural landscapes have provided a much needed egalitarian public space that reclaims the right to environment in the city and promotes social equity. The location of the river in the middle of low and middle- income neighborhoods have strengthened the democratic nature of the infrastructural landscape and helped to situate its role which mends urban, environmental and social disparities around it.

This framework is a schematic start to investigate the different components on a smaller scale.

Aside from design, this proposal needs a strong stand from the various stakeholders to resist short-term individual profits, and invest the last remaining open spaces of the city, namely the Nahr Beirut district, to provide an open and accessible green space which extends from waterfront all through the valley.

Under the current urban policies, such a proposal could easily be fragmented and realized only in parts, thus failing to achieve its greatest potential; which is to adopt an integrated approach to water, transport and public

space. This is why it is crucial for any elaboration of this project to maintain a metropolitan framework while zooming in to small scale developments.

Carrying this project to a design development phase requires further technical data and a design commitment to rethink the infrastructural form and performance of each component, in order to fully engage the civic realm through program and form.

The rehabilitated infrastructural landscape of Nahr Beirut offers the city a major opportunity of significant technical, social and environmental value on the long-term.

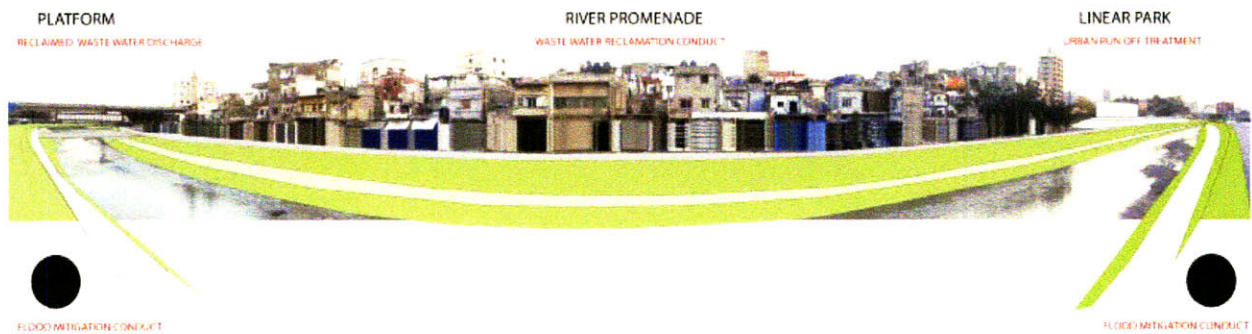


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Drawn by S. Frem.

Figure 3.42: Pedestrian bridge linking two green spaces. Drawn by S. Frem.

Figure 3.43: Pedestrian bridge linking two agricultural networks. Drawn by S. Frem.

Figure 3.44: Proposed bus and shuttles routes providing the longitudinal connection along the river. Drawn by S. Frem.

Figure 3.45: Network of Public Spaces. Drawn by S. Frem.

Figure 3.46: Densify the edge with buildings infill in the urban zones. Drawn by S. Frem.

Figure 3.47: Densify the edge with linear groves in the agricultural zones. Drawn by S. Frem.

Figure 3.48: Nahr Beirut as a performative and civic space. Drawn by S. Frem.

Figure 3.49: Platform combining water, transport and public space functions. Drawn by S. Frem.

CHAPTER 4

Unless cited otherwise, all following drawings were conceived and drawn by the author.

Basin Scale

Figure 4.1: Multifunctional Water System - Normal Layout

Figure 4.2: Multifunctional Water System - Flooding Layout

Figure 4.3: Water Treatment System

Figure 4.4: Transport System – Mobility

Figure 4.5: Transport System – Accessibility

Figure 4.6: Public Space System

Figure 4.7: Public Space System- Platform

Figure 4.7.1: Platform Diagram

Figure 4.7.2: Nabaa Platform

Figure 4.8: Public Space System- Parks

Figure 4.8.1: Mar Michael Urban Park

Figure 4.9: Public Space System- Bridges

Figure 4.9.1: Yerevan Highway Bridge

Figure 4.10: Public Space System- Pedestrian Conduits

Figure 4.10.1: Nahr Beirut Trail

Figure 4.11: Public Space System- Fields

Figure 4.11.1: Tahouita Fields

Figure 4.12: Public Space System- Public Institutions

Figure 4.12.1: Public Space Components

Figure 4.12.2: Public Space System

Zone Scale

Figure 4.13: Waterfront - General Plan

Figure 4.13.1: Waterfront - Water Treatment Plan

Figure 4.13.2: Waterfront - Access Plan

Figure 4.14: Urban Zone- General Plan

Figure 4.14.1: Nabaa Platform Axonometric

Figure 4.14.1: Nabaa Platform Exploded Axonometric

Figure 4.14.2: Nabaa Platform Perspective

Figure 4.15: Urban Zone- General Plan

Figure 4.15.1: Tahouita Fields Plan and Section

Figure 4.15.2: Tahouita Fields Perspective

Figure 4.16: Valley- General Plan

Figure 4.16.1: Valley- Access Plan

Channel Scale

Figure 4.17: Waterfront Profile

Figure 4.18: Urban Zone Profile

Figure 4.19: Agricultural Transition Profile

Implementation

Figure 4.20: Implementation

CONCLUSION

Figure v: The infrastructural landscape.

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