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THE CHALLENGE OF RIVER REHABILITATION IN COASTAL CITIES: THE CASE OF SAYNIQ RIVER

by
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ABSTRACT
OF THE THESIS OF

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Title: The Challenge of River Rehabilitation in Coastal Cities: The Case of Sayniq River

Sayniq River is a seasonal watercourse, 23 km in length, that marks the southern limit of Saida and the northern limit of Ghaziye. Sayniq extends from Safi and Al Rihane mountains at 662 m above sea level emerging at the Ein El Helweh Palestinian Refugee camp into the coastal plain of Saida-Dekerman terminating in its Mediterranean estuary. The riparian ecology has been undermined by sewage discharge, the river landscape compromised through encroachment onto the public domain, and the poor management of river resources. As a result, the river has been transformed from a living landscape and hydrological lifeline into a lifeless borderline.

As an urban designer, a Palestinian living in Ein El Helweh, I chose to research the Sayniq to understand its transformation, and to explore alternative urban landscape approaches to rehabilitate the river ecosystem, reclaim the river landscape, and capitalize its potential to improve the quality of life for Palestinian refugees in the camp and for the inhabitants of Saida.

The research applied the Ecological Landscape Design and Planning Approach (Makhzoumi and Pungetti, 1999) at multiple scales; the watershed scale; the urban scale of Saida-Dekerman; and the site scale. The approach forms the basis for proposing the urban landscape design intervention. Planning guidelines are proposed at the watershed scale by drawing on the Ecological Landscape Associations analysis of the Sayniq watershed. At the urban scale, the proposed strategies draw on Landscape Character Zones of the Sayniq river in Saida and the urban landscape design interventions at six strategic sites.

The Sayniq case study has the potential to serve as a pilot project that can be applied to other coastal rivers and seasonal streams in Lebanon, especially those in or close to Lebanese coastal cities.

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INTRODUCTION

1.1. Riparian Landscapes in Lebanese Coastal Cities

Riparian landscapes are “dynamic, three dimensional biophysical structures set in complex rivers corridors and cultural matrices from headwaters to the sea” (Naiman et al.,2005, p. 4). Rivers provide much more than water, they are significant ecological and cultural landscapes. Cities were established in proximity to water sources, rivers and springs which provided the basic services including water and food (Francis, 2012). Today, rivers are continuously degraded due to anthropogenic stresses that caused a loss in the value of these landscapes. Despite that, riparian landscapes, if managed as healthy ecosystems, will connect people, biota, and places that shape the character of cities and regions.

Historically, Lebanese coastal rivers and streams were “hydrological lifelines” (Frem, 2009) that irrigated the agricultural fields, operated watermills, and served as recreational and leisure landscapes. Today, the Lebanese large coastal rivers are integrated into the sewage infrastructure, channelized, as with the Beirut River and the Abu Ali River in Tripoli, covered, flowing through culverts as with Al Ghadir and the streams of Saida. The mismanagement of coastal rivers and streams not only damages the riparian ecology, but also undervalues their cultural significance.

1.1.1. Challenges to Rivers in Saida

Saida has two large rivers, Al Awali and Sayniq, respectively the northern and southern municipal boundaries. In between are four streams, Abu Gayyath, Amleh, Barghouth, and Ain Zaytoun, that are referred to as 'rivers'. The annual water flow in the Awali river is 320 Mm^3, while the Sayniq river has a seasonal discharge of 12 Mm^3 (USUDS, 2013). The seasonal streams of Bargouth, Amleh, and Abu Gayyath have negligible water flow.

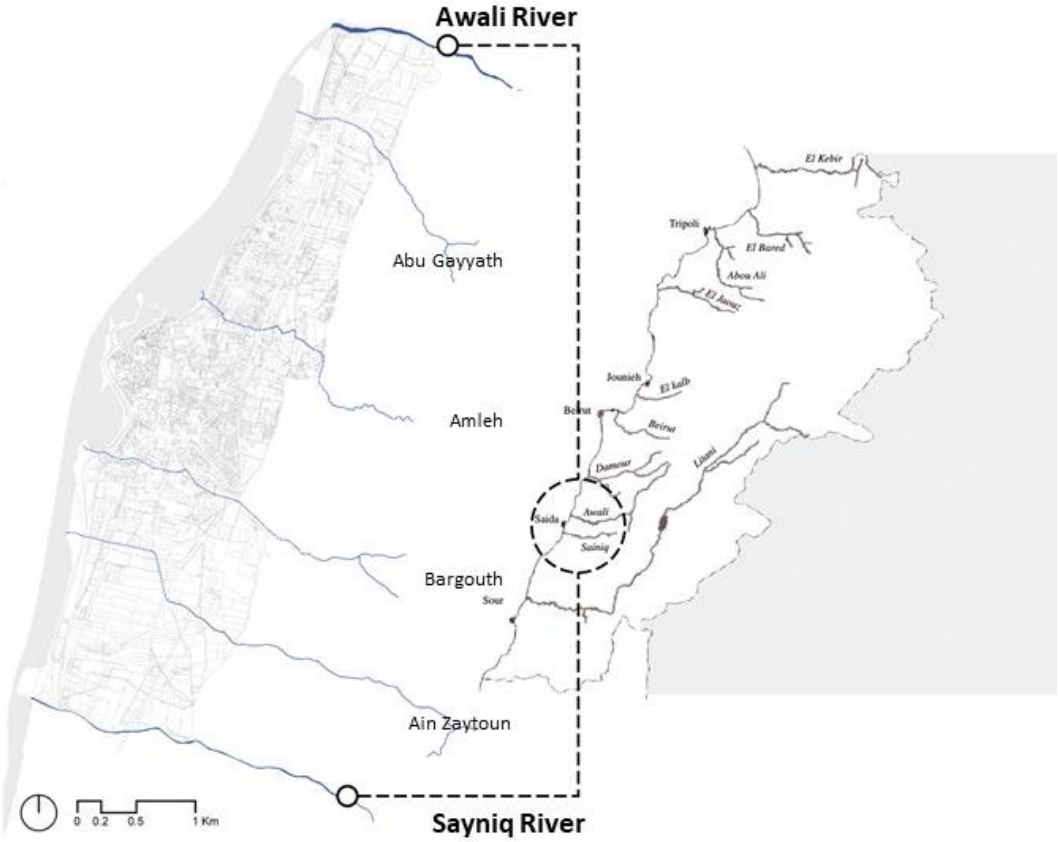


Figure 1. Main rivers and seasonal streams in Saida. Source: Author

Supported by the Council for Development and Reconstruction (CDR), today Saida and 63 neighboring municipalities are equipped with an extensive sewage infrastructure of 170 km in total (USUDS, 2013). More alarmingly is locating the sewage network in rivers and streams, as practiced by state agencies. The seasonal streams, incorporated within the sewage infrastructure, are often ‘covered’ for health reasons and to avoid odors arising. The Bargouth river became an underground sewage channel covered with the Saray road that obliterated it from the shared memories of the people in Saida (ibid). The ecological integrity of rivers and streams in Saida is compromised by the sewage infrastructure.

Figure 2. Failure of sewage infrastructural projects in Saida. Source: Author

The repercussions of the abovementioned challenges are often irreversible, complicating further challenges to the sustainable management of watercourses in

Lebanon. The environmental deterioration of rivers in the long term will not only compromise water availability, but destroy riparian habitats, and lose the shared public spaces for local communities.

1.1.2. Sayniq River in Municipal Saida

The thesis will explore the case study of Sayniq river from its origin at Nabaat Oum Chammas spring in Roum to its estuary in Saida-Dekerman. The focus of the urban landscape design intervention will be the Sayniq river in municipal Saida.

Figure 3. The landscape of Sayniq river in 1918. Source: Lil Madina, 2017

Sayniq river is a seasonal watercourse, 23 km in length, that marks the southern limit of Saida and the northern limit of Ghaziye. It extends from the steep slopes of Safi and Al Rihane mountain at 662 m above sea level to reach the coastal plain of Saida-Dekerman. The naming of the Dekerman came from the Turkish word 'Degirman' referred to the numerous watermills found on the river's bank (Lil Madina, 2017).

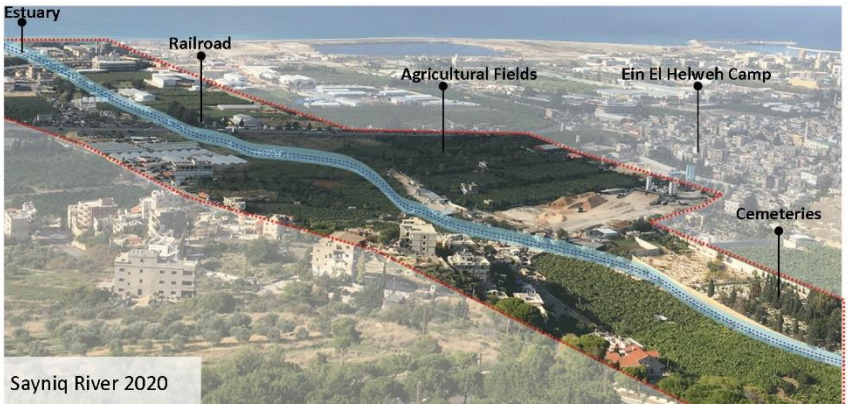


Figure 4. The landscape of Sayniq river in Saida today. Source: Author

Sayniq river enters Municipal Saida at the cemeteries next to the Ein El Helweh Palestinian Camp, and runs through the agricultural fields to discharge at its estuary at the industrial zone to the sea.

Figure 5. The current conditions of Sayniq river in Saida. Source: Author

Sayniq river in Dekerman area, the focus of the urban landscape design intervention, has cultural, hydrological, and ecological assets; the agricultural fields, railroad, wells, cemeteries, and the river estuary.

Historically, the landscape of the river watershed was mainly agricultural. The orchards of citrus trees dominated the coastal plain, while the fruits terraces dominated upstream. The corridor of the abandoned railway intersects Ein El Helweh camp at El Sekke area, and it crosses over the Sayniq river as a deteriorated bridge. The railway 'El Sekke' and Sayniq river were the focal public spaces for the Palestinian refugees and people from the neighboring areas. The elderly of Saida recalls the Palestinian refugees and people from Darb Esim playing near the edges of Sayniq river (Dictaphone, 2013). The irrigation of the agricultural fields in the Dekerman area depended on the water wells and mills (USUDS, 2013). Therefore, the Sayniq river did not have a major role in irrigating those fields, but it was mainly used as a recreational public space.

Today, the river still preserves its urban-rural character due to its proximity to the Maghdouche hills and presence of the large agricultural fields. Sayniq river changed from a hydrological lifeline to a lifeless borderline. It can support neither a healthy ecosystem nor serve as amenity landscape.

1.2. Thesis Position

1.2.1. Research Problem

Sayniq river is a forgotten and neglected seasonal river. This is partly because Sayniq is far from the urban development concentrated in the northern part of municipal

Saida. This has preserved to some extent the river morphology, though the ecological integrity has been compromised because of sewage discharge.

i. Sewage discharge in Sayniq river has two adverse repercussions.

First, destruction of the riparian ecology, and undermining the river as a living ecosystem. Second, the loss of the spatial and visual potential of the Sayniq river landscape.

ii. Although the Sayniq river corridor is a public domain, it has been subjected to encroachment due to the absence of enforcing laws that salvage it

Unlike Saida's other streams, the encroachments in the Sayniq river are minimal, predominantly by shacks with temporary materials and multi-story residential buildings.

iii. Sayniq river is a good case-study showcasing the poor mechanisms of coordination across municipal unions and municipalities.

Sayniq river is completely disregarded by Saida and adjoining municipalities that view the river as their backyard, infrastructure space. Due to the political and sectarian hurdles, the Jezzine, Saida-El Zahrani, and Eqleem El Toffah municipal unions have failed to safeguard the river watershed. The current land zoning along the river further demonstrates this approach that disregards the ecological and social values of the river, as it is zoned as an industrial area in Saida and Ghaziye, and as agricultural in Darb Esim.

iv. In the meantime, Sayniq river is mostly inaccessible.

The private agricultural fields and encroachments bordering the edges of the river made it physically and visually inaccessible.

For all these reasons, I chose to focus on the Sayniq, keeping in mind that rehabilitating the river and protecting the riparian ecology is possible as I hope to demonstrate in this thesis.

1.2.2. Thesis Statement and Research Questions

As an urban designer and a Palestinian living in Ein El Helweh camp, I aim through my thesis to explore strategies to rehabilitate the Sayniq river as an urban ecological corridor, a clean environment, and a linear amenity space that can improve the quality of life for Palestinian refugees in the camp, and for the inhabitants of Saida. The thesis will answer the following questions:

1. How can the Sayniq river mitigate the environmental problems and restore the riparian ecology?
2. How can the spatial integrity of the river corridor be addressed and encroachment by residential units be resolved?
3. How can the Sayniq river encourage cooperation across social divides, rather than serving as a demarcation of administrative boundaries between Saida and the adjoining municipalities?

1.2.3. Significance

The thesis is significant at both levels, local and national. At the local level, the linear amenity spaces along the Sayniq river will compensate for the lack of public spaces in Saida. The approach adopted to understand the Sayniq river, and propose alternative to its future development is holistic, addressing environmental, social, and

administrative issues. The thesis outcome will benefit people living in Saida in particular, Ein Al Helweh Palestinian camp located near the river and its neighboring villages such as Darb Esim. The camp's inhabitants are around 70,000 Palestinians residing in deprived areas (UN Habitat, 2010). Sayniq river is disconnected from the southern limit of the camp by the agricultural fields, and a segregation wall that defines the limit of the camp. Palestinians will benefit from the accessible and shared green spaces that will reconnect Ein El Helweh camp to the river.

At the national level, I hope the Sayniq case study will serve as a pilot project that can be applied to other streams and small coastal rivers in Lebanon, which constitute an ongoing challenge in Lebanese coastal cities. The holistic, integrative ecological methodology adopted, and the responsive design strategies proposed contribute to the gap in research on riparian landscapes.

1.3.Thesis Methodology

To investigate the rivers as landscapes and as ecosystems, it is essential to understand their form and structure at multiple scales (Allan, 2004). The complexity of rivers necessitate awareness of the synergies involved in order to alleviate the conflicts between the patterns and processes of social and ecological components (Forgaci, 2018).

The research methodology applied the Ecological Landscape Design and Planning Approach (Makhzoumi and Pungetti, 1999) at multiple scales; the watershed scale, the urban scale, the Saida-Dekerman, proposing the urban landscape design intervention at this scale.

At the level of the watershed, the approach used the Ecological Landscape Associations (ELAs) to understand the landscape in a holistic manner. This in turn required identifying the biotic, abiotic, and cultural components of the landscape through an in-depth analysis. At the level of the Saida-Dekerman urban scale, the methodology used the ELAs of the watershed to identify the existing Landscape Character Zones (LCZs), and proposed new ones for the urban landscape design intervention. The aim was to use the proposed LCZs as the guiding principles for the

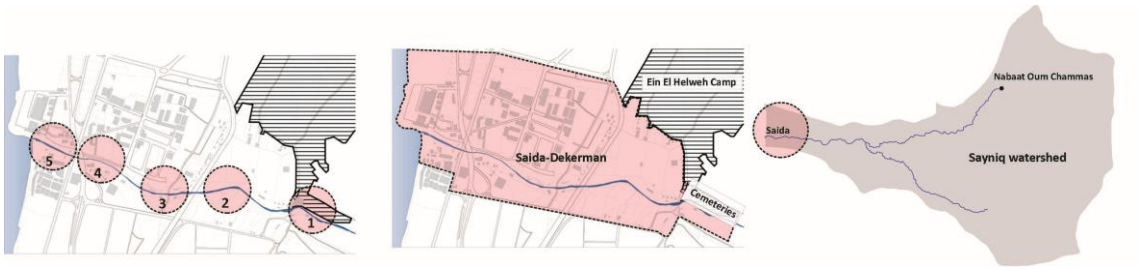


Figure 6. Thesis multiple scales framework. Source: Author

framework of the intervention. At the level of the urban landscape design intervention, the methodology applied the urban landscape design principles.

The research went through a data collection process to apply the methodology, starting with the Geographic Information System (GIS) data from the National Center for Remote Sensing (CNRS), and the Landscape Design and Ecosystem Management (LDEM) department at AUB. This data helped in identifying the types of soils in the watershed, land use, land cover, topography, built up areas, rainfall, and infrastructure. For the hydrological pattern, the research required looking into the archival maps of Sayniq river including army maps to locate the springs of the watershed. I collected further data by researching the websites of the Union of Municipalities in Sayniq watershed (Jezzine and Eqleem El Toffah) to better understand the narrative of Sayniq watershed. This data helped in identifying the Landscape Ecological Associations

(ELAs) of the Sayniq watershed to propose recommendations for the efficient management of the watershed.

The second research method was the field survey across two scales; Sayniq watershed and Saida-Dekerman. At the level of the watershed, the field survey and observation aimed to have a general overview of the landscape, identify the diverse types of trees, and plant species, and to capture photographs. At the level of Saida-Dekerman, the field survey was more focused, and thorough to understand the infrastructure pattern including sewage network and roads typologies. It also aimed to understand the current conditions, main landmarks, pedestrian circulation, accessibility, social and economic practices in each Landscape Character Zone (LCZ).

The field survey and observation also included informal interviews with the residents of the area including Palestinian refugees from Ein El Helweh camp to understand their perception toward Sayniq river in the past and today.

A third research method was to investigate local and regional case studies in similar Mediterranean contexts as the Sayniq. The aim was to learn from these approaches to river rehabilitation to overcome the challenges faced while proposing the recommendations and urban landscape design intervention.

CHAPTER 2

ECOLOGY AND PLANNING OF RIPARIAN LANDSCAPES

Rivers are complex and multi-layered landscapes that require a holistic understanding of the biotic, abiotic, and cultural components across multiple scales. The management of the dynamic river corridors require inputs from an interdisciplinary perspective.

For that reason, this chapter will present a literature review that draws on the intersection of the three overlapping disciplinary spheres: ecological sciences, urban design and planning, and urban development. The literature review will be supported by three local and regional case studies addressing the rehabilitation of rivers.

2.1. Ecological Sciences: River as Ecosystem

“Riparian” derives from the same source as “river" - the Latin origin riparius, a noun deriving from riparia, meaning "bank" or "shore" (Merriam Webster Dictionary). Riparian landscapes are “spatial morphological units combining the geomorphological features of the valley with the morphology of the urban fabric developed along the river (Forgaci, 2018, p. 45). The following section will explain the characteristics of the riparian systems, disturbance regimes, and their ecological management approaches.

2.1.1. The Morphology and Characteristics of Rivers

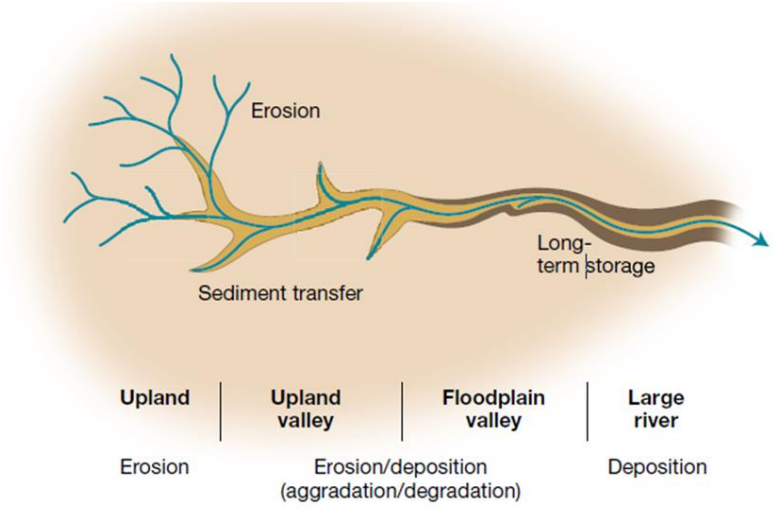


Figure 7. The geomorphic processes in the watershed. Source: Naiman et al., 2005

The rivers connected to their riparian zones are complex interconnected corridors that encourage the dispersal and adaptation of the biota to specific conditions (Naiman et al. ,2005). Morphologically, the rivers include headwaters, riverbanks, river channel, floodplain, and watershed (ibid). They are the ideal sites for erosion, transport, and sedimentation (ibid). Erosion occurs in the headwater of the watershed, the transport and deposition occur in the mid reach of the river, while the floodplain is predominantly depositional (ibid).

2.1.2. The Different Approaches to Connectivity in Rivers

2.1.2.1. The Biophysical Approach

The biophysical approach is translated in the river continuum concept that addresses the connectivity in riparian systems physically and biologically (Darby & Sear, 2008). The river continuum takes place between the watershed and the river at three levels; longitudinal, lateral and vertical.

- Longitudinal connectivity is related to the flow of water from the upstream to the downstream, and vice versa that affects the migration of aquatic species (May, 2006).
- Lateral connectivity is related to the relationship of the river to the watershed including the role of fauna and flora species in the watershed (ibid).
- Vertical connectivity is the influx of water between the underground and the river which is predominantly affected by the topography and temperature (ibid).

2.1.2.2. The Urban Design Approach

The urban designers perceive the connectivity concept in the riparian systems from a spatial perspective. Therefore, they apply this concept in their work on rivers by designing accessible spaces to people, linking the river itself to the city visually, or providing cultural attraction points along the river (ibid).

2.1.3. The Disturbance Regime

Riparian systems are influenced by the natural and anthropogenic disturbances (Naiman et al. ,2005). The natural disturbances such as erosion have a 'revitalizing' influence, while the anthropogenic disturbances such as pollution and land use changes have a 'debilitating' effect on these systems (ibid). Anthropogenic disturbances interrupt the connectivity of the riparian systems that cause a "physical restructuring of the river, introduction of exotic species or over harvesting of resources" (Forman, 2014, p: 192). Consequently, they lose their adaptation capacity, heterogeneity, and

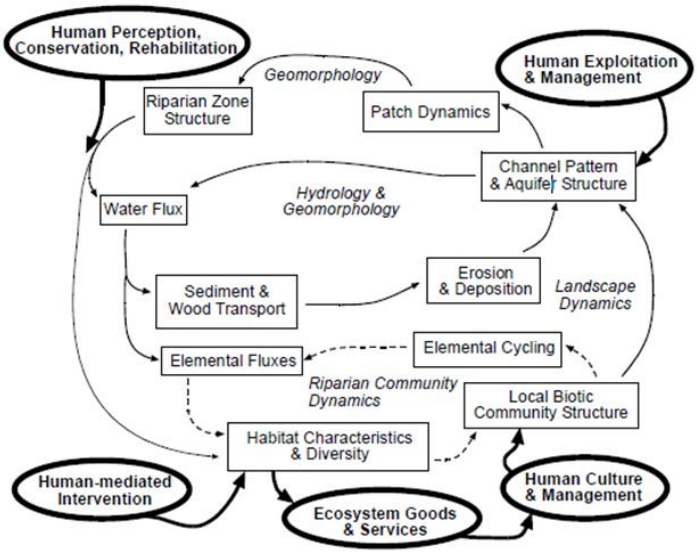


Figure 8. The influence of disturbances on the riparian systems. Source: Naiman et al., 2005

functionality (ibid). Turner (2001) and Forman (2014) stressed the need to manage the anthropogenic disturbances to decrease their dire impacts on the riparian systems. According to Turner (2001), the anthropogenic disturbances should be managed by imitating the spatial and temporal patterns of the natural disturbances. Forman (2014) identified the patches and corridor matrix that helped in understanding the human and natural patterns. He defined the patches as homogenous areas differentiated from their context, and the corridors as transport passages that connect the isolated habitat patches (Forman, 2014).

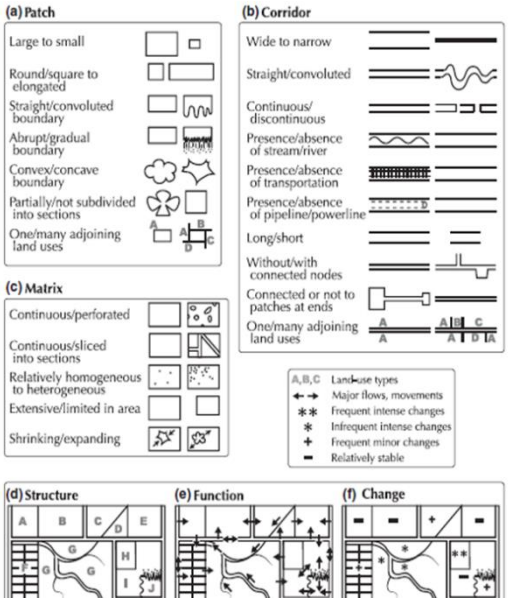


Figure 9. The corridor-patch matrix. Source: Forman, 2014

2.1.4. Ecological Management Approaches

2.1.4.1. Rehabilitation or Restoration

'Rehabilitation' or 'restoration' are terms used to imply a similar framework directed towards enhancing the health of the riparian landscape in terms of its ecological, hydrological and social aspect. Restoration, however, entails re-establishing the riparian system to its former state (Naiman et al., 2005). Rehabilitation aims to put the riparian system back to a good working condition, in other words, maintaining its ecological integrity (Simsek, 2012). The thesis accepts the fact that the riparian landscape of Sayniq river has been tremendously changing through time, and today it presents the environmental and spatial conditions that are very far from being preserved or restored. Restoration is more viable in non-urban areas where there are less human interventions, and larger width of the river corridor, in addition to the better habitat qualities (May, 2006).

In this thesis, I focused on how to mitigate the impacts of the deteriorating river ecologies, and despoiled riparian landscapes through the ecological and spatial rehabilitation. Regrettably, the damage to the Sayniq river makes 'restoration' difficult and costly because of the extent of riparian degradation.

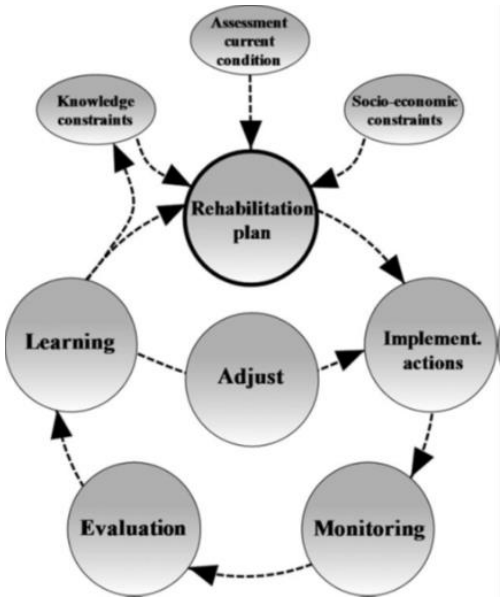


Figure 10. A conceptual framework for the rehabilitation of river. Source: Hermoso et al., 2011

2.1.4.2. Challenges to River Rehabilitation

The challenges facing the river rehabilitation process are: firstly; the fallacy that rehabilitation should be planned and implemented at the same scale (Hermoso et al., 2011). Secondly, the struggle between the ecosystems processes and socio-economic issues had been a main constraint in rehabilitating rivers (ibid). Thirdly, the lack of knowledge that the management of rivers is a process based and adaptive cycle (ibid). The rehabilitation actions should be carefully prioritized to optimize their efficiency at the watershed scale (ibid).

2.2. Urban Design and Planning: River as Green Corridor

2.2.1. Ecological landscape Design and Planning

Makhzoumi and Pungetti (1999) identified two key concepts; greenways and ecological networks based on research in conservation biology and landscape ecology. Both terms focused on connecting the protected patches to form a network (Makhzoumi & Pungetti, 1999). These concepts challenge the traditional conservation approaches that focus on protecting the isolated sites and species (ibid). Additionally, the green ecological corridors act as a 'positive asset' for the conservation of biodiversity on the long term (ibid).

The ecological landscape design and planning approach developed by – Makhzoumi and Pungetti - (1999) integrates the ecosystem processes and the socio-cultural goals in a holistic urban framework (Al Sabbagh, 2015).

The spontaneity of the approach encourages the intuitive and creative design solutions while prioritizing landscape integrity, sustainability, and ameliorating the character of

place (ibid). The methodology of the ecological landscape design and planning will be further elaborated in chapter 3 to apply it on the Sayniq watershed.

2.3. Urban Development: River as Space

2.3.1. Saida Urban Sustainable Development strategy (USUDS)

Medcities, initiative found in Barcelona in 1991, aims to empower the Mediterranean local institutions by providing the technical assistance to solve the urban environmental challenges in their cities (Makhzoumi & Al-Sabbagh, 2018). This initiative focused on developing projects in three main sectors; City Development Strategies (USUDS), Urban Services and Environment, and Economic and Social Development (Medcities, n.d). In 2012, the City Development Strategies (USUDS) for Saida city, a Euro Mediterranean project, was launched by Saida municipality and Hariri Foundation (HFSHD) (ibid). Medcities followed the bottom-up and participatory approach that engages the stakeholders and citizens of Saida in building the urban development strategies (ibid). USUDS adopted a process-based approach through a strategic planning framework that contradicts the current developmental regulations in Lebanon (ibid). Based on the community aspirations, the vision of the strategy prioritized adequate health and social protection, diversified economy, healthy environment, and protected natural and cultural heritage (ibid).

2.3.2. Landscape Strategies of USUDS

USUDS adopted the landscape ecological design and planning approach that integrated the natural sources such as rivers, watercourses, sea waterfront, and railroad

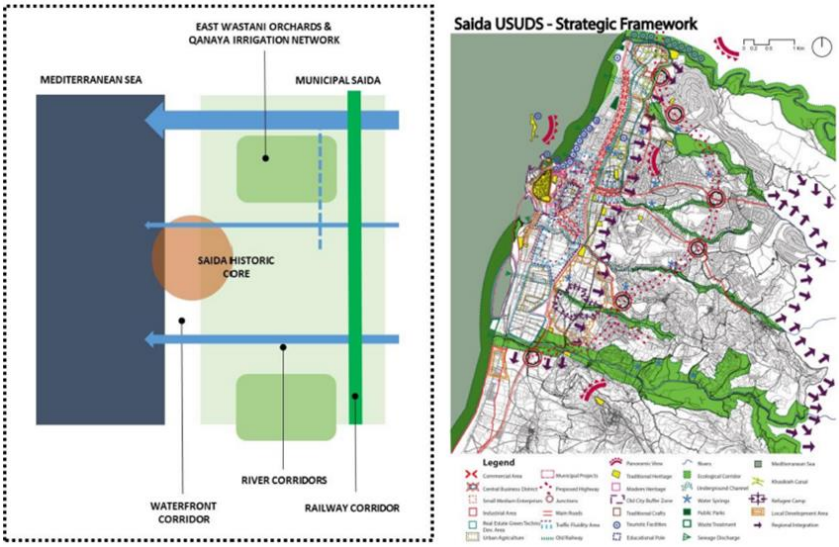


Figure 11. Saida USUDS Strategic Framework. Source: Makhzoumi & Al-Sabbagh, 2018.

into a green-blue network (ibid). The proposed network preserved the natural sources as cultural landscapes, ecological corridors, and amenity spaces. The green-blue network focused on the natural sources that are integral to the collective memory of people in Saida whether rich or poor, Lebanese or Palestinians (ibid).

My thesis builds on the principles and strategies of USUDS that will inspire my urban design strategies for the Sayniq river in Saida.

2.4. Local and Regional Case Studies

2.4.1. The Reclamation of Amleh River

The reclamation of the Amleh river case study in Saida is a local proposed intervention by the Lil Madina initiative that builds on the Saida Urban Sustainable Development Strategies for municipal Saida (USUDS) that proposes to protect and rehabilitate the network of coastal rivers as ecological, green corridors, combining environmental health and amenity service to the city (USUDS, 2013). The work of Lil Madina initiative on the Amleh river bridges urban strategies with on-ground

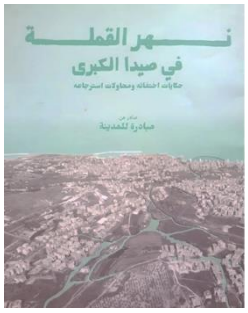


Figure 12. The Amleh River in Greater Saida Book. Source: Lil Madina, 2017

implementation through a participatory approach that includes the process of negotiation with all stakeholders, municipal authorities, local institutions, and the public.

The Amleh river is known for its sewage outlet and the unpleasant smell that emanates from its estuary at the Saida waterfront. In the past, Saidawis have many memories of social practices such as swimming in the estuary, and family gatherings in the agricultural fields along the Amleh river (Lil Madina, 2017).

Today, the ecological and environmental status of the Amleh river is under threat due to the unregulated urban expansion, encroachments, in addition to the culvert covering a huge part of the river (ibid). The re-direction of 70 % of the sewage

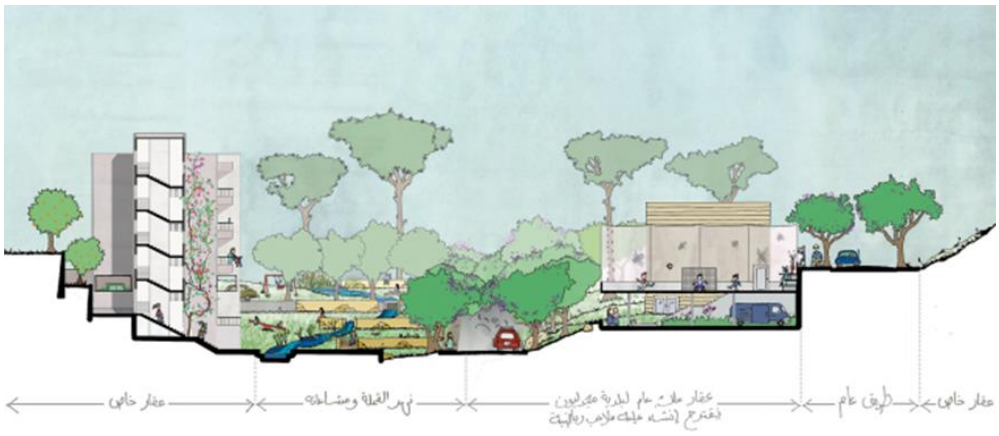


Figure 13. Section showing the design proposal for Amleh river. Source: Lil Madina Initiative, 2017

infrastructure from the Amleh river in 2015 alleviated the success opportunities of this case study (ibid).

Lil Madina initiative aimed to reclaim the communal spaces of Amleh river, and create a network of green pathways that will reconnect the river back to Saida (ibid). Both Sayniq and Amleh river in Saida face the same struggles, however the repercussions are less pronounced in Sayniq river that has a greater potential of becoming an urban ecological corridor.

2.4.2. Resuscitating the Fez River

Figure 14. Historical evolution of the Fez river. Source: ASLA 2010 Professional Awards, 2010 https://www.asla.org

The Fez River is located in Morocco within the Sebou river basin; it is the central spine of the Medina Fez. The conditions of the Fez river deteriorated heavily as

a result of the tanning industry found at the river accompanied with the extensive use of river water (ASLA 2010 Professional Awards, 2010).

This case study proposed by Bureau E.A.S.T is American Society for Landscape Architects (ASLA) award winning proposal (ibid). It proposes strategic planning and phased implementation to restore the river environment, improve the natural and cultural landscape, and to provide public open spaces (ibid). The strategic framework of the river aims to enhance the quality of water through the stabilization of river banks, constructed wetlands, and rain water harvesting (ibid).

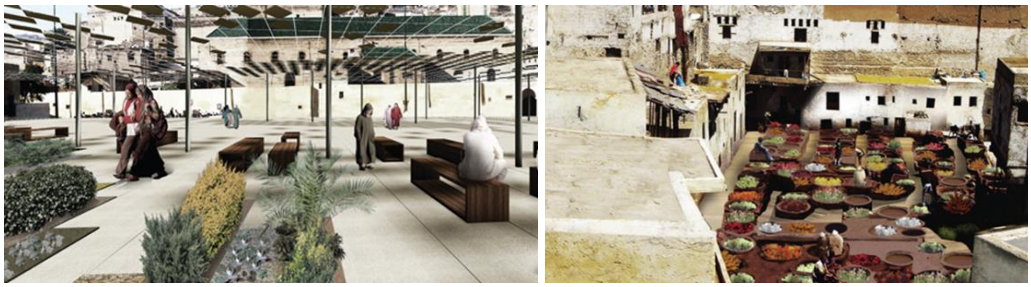


Figure 15. R'cif public plaza and Chouara garden. Source: ASLA 2010 Professional Awards, 2010 https://www.asla.org

The success factor of this case study was the selection of the strategic locations, threatening the environmental health of the watershed, for the urban design intervention. The three design interventions were; the R'cif Plaza, Andalaus playground, and Chouara tanneries.

The design intervention of the R'cif site created a major public plaza that included the outdoor cafes and street vending kiosks (ibid). The design intervention of the Chouara site kept the intimate connection between the site and the tannery industries by providing workshops to the leather entrepreneurs to maintain this heritage industry (ibid). This case study is relevant to my research because of the larger ecological

context, the Mediterranean which will inspire my urban landscape design intervention in Saida.

2.4.3. The San Antonio River's Improvements

San Antonio river in Bexar County is the historic lifeline of San Antonio that continues through the downtown as the famous River Walk. The river has two main reaches; the Museum urban reach and the Historical mission reach. The river was channelized through the US Mercy corps to control the flood events (SWA, 2001). This

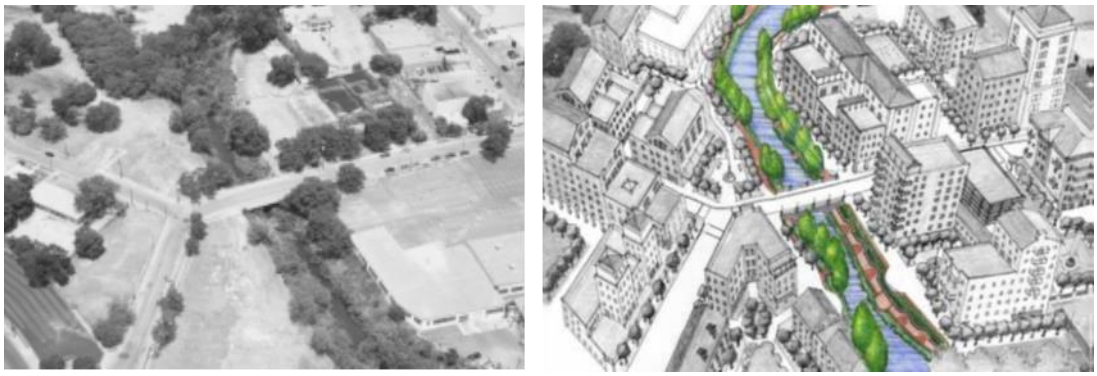


Figure 16. The Museum Urban reach before and after. Source: SWA, 2001

in turn made the river a lifeless and uninviting corridor for a long time. The Museum urban reach passes through the urbanized areas which was slightly influenced by the construction of the flood control channel (ibid). The Historical Mission reach was heavily impacted by the flood control channel that changed its urban morphology into an engineered channel with scarce vegetation (ibid).

San Antonio river case study aimed to set a design vision to develop the Museum urban reach in a sustainable manner with the diversified land uses (residential, commercial and entertainment uses) (ibid). The design vision will restore the Historic Mission (Southern) reach into a more natural river, while maintaining its floodwater capacity through modifying its fluvial geomorphology (ibid). It will also provide cultural and recreational opportunities such as water craft services, hiking, and biking pathways (ibid).

Figure 17. Historical Mission reach before and after. Source: SWA, 2001

The case of San Antonio river is relevant to my thesis since the river width is a stream-like one as in Sayniq river. However, the case study is heavily sourced, and it did not prioritize strategic goals in the restoration project which may hinder the implementation process.

To conclude, the three case studies presented in this chapter offered a framework for the rehabilitation of rivers.

The case study of Amleh river focused on the reclamation of the public domain of the river in a participatory planning approach. But, the proposal did not show the relation of the Amleh river to its watershed through a strategic management plan.

The case study of Fez river was successful in its strategic framework that addressed the management of the watershed. The proposed design interventions appraised not only the ecological aims, but also the cultural value of the site.

The case study of San Antonio river offered a comprehensive analysis of the main objectives of the project in addition to the urban design guidelines.

The conclusion drawn from the literature review is that the successful management of rivers requires:

- Firstly; robust understanding of the river's morphology and ecology in relation to the larger watershed area;
- Secondly, the rivers are living landscape corridors that cannot be perceived without recognizing their intimate relation to people.;
- Thirdly, the landscape of rivers is constantly evolving, therefore it should be addressed from a process-based approach not a fixed master plan;
- Fourthly, generating a sustainable development strategy requires the partnership between the international organizations, governing bodies, activists, and the public.
- The Ecological Landscape design and planning approach will integrate a flexible, holistic, and dynamic edge to the urban planning recommendations and the urban landscape design intervention for Sayniq river.

CHAPTER 3

ECOLOGICAL LANDSCAPE PLANNING APPLIED TO THE SAYNIQ RIVER WATERSHED

3.1. Ecological Landscape Design Approach

Makhzoumi and Pungetti (1999) developed the alternative methodologies for ecological landscape planning and design that enfold ecology and culture. The methodology of Makhzoumi and Pungetti (1999) studied the ecological and cultural processes that shaped the landscape. The underlying premises of this methodology are; firstly, the landscape is an evolutionary and dynamic process that is characterized by the interconnectedness of the abiotic, biotic and cultural components (Makhzoumi & Pungetti, 1999). Secondly, the complexity of these components will determine a creative temporal and spatial framework (ibid).

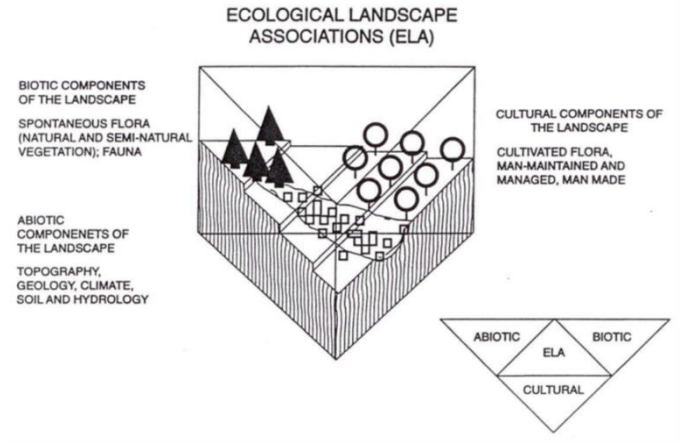


Figure 18. The Ecological Landscape Associations. Source: Makhzoumi & Pungetti, 1999

The application of this methodology requires;

- Analyzing thoroughly the abiotic, biotic and cultural components of a certain landscape (ibid),
- Classifying the outcome of the analysis into heterogeneous units in the form of Ecological landscape associations (ELAs) that will offer an "investigative and dynamic framework "(ibid, p. 216) for urban designers and planners.
- Translating those ELAs into t Landscape Character Zones (LCZs) that have a distinctive feature integrated in a homogenous type of the landscape (ibid).

3.2. Watershed History: From a Recreational to Threatened Watershed

Sayniq river runs from the slopes of Safi mountain and lower foothills of Roum village. The river has a minor catchment of 116 km^2 with an average annual flow rate of 12 Mm^3 (USUDS, 2013). The naming of the river changes, it is known as Chammas river in the upstream, and Sayniq river in the downstream. The landscape terrain of the watershed coupled with the dense woodlands and agricultural fields, made it a focal seasonal destination for people and tourists from all over Lebanon.

A major shift took place due to the successive Israeli attacks in 1967 and 1982 that destroyed most of the villages, archeological sites, and agricultural fields in the Sayniq watershed (Union of Eqleem Toffah Municipalities website, n. d). The steep slopes and deep valleys of the watershed created strategic watching towers for the Israeli Defense army to control the surrounding villages (ibid). As a result, many people fled away from their villages, and the touristic movement immensely declined (ibid). In

the meantime, the watershed serves as neither a recreational nor an ecological landscape.

3.3. Abiotic Components of Sayniq Watershed

3.3.1. Climate and Topography

Sayniq watershed belongs to the greater region of Saida that has a coastal central Mediterranean humid eco-climate (Al Sabbagh, 2015). The rainy period lasts for four months between October and April with a minimum temperature of 9 C in January (ibid). The summer season lasts for five to six months between May and September with a maximum temperature above 31 C in August and high levels of humidity (ibid).

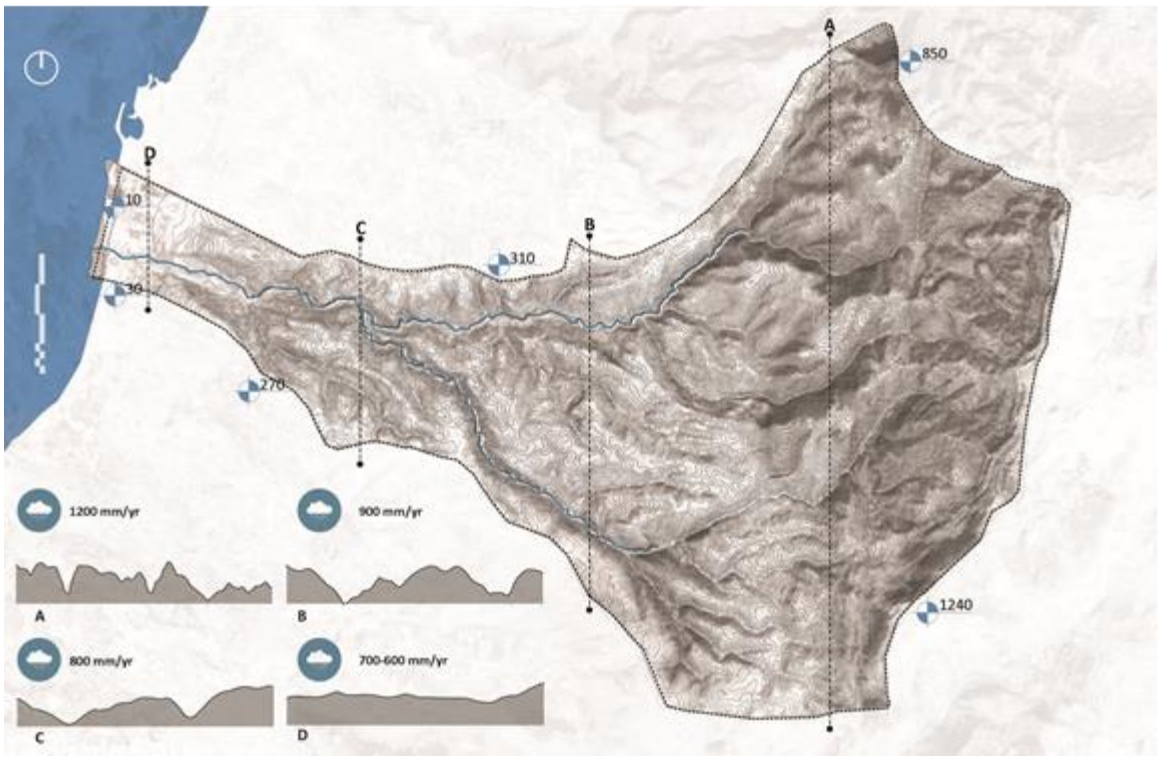


Figure 19. Topography and rainfall precipitation of Sayniq watershed. Source: Author based on GIS data from LDEM Department at AUB and CNRS

The average rainfall precipitation in the watershed varies; where the upper foothills receive between 1200 - 700 mm/year while the coastal plain receives 600 mm/year. The landscape terrain of the watershed varies in altitude from coastal sea level to 3410 m above sea level. Topography influenced the distribution of the vegetation cover over the watershed; where the agricultural fields dominated in the coastal plain, and the dense woodland dominated in the mountains.

Sayniq river is a stream-like river in the upper foothills with a narrow width of 4 m, and it becomes wider in the coastal plain. The estuary of the river at the industrial area in Saida today is compromised ecologically due to the construction of the solid waste treatment and wastewater treatment plant.

3.3.2. Soil

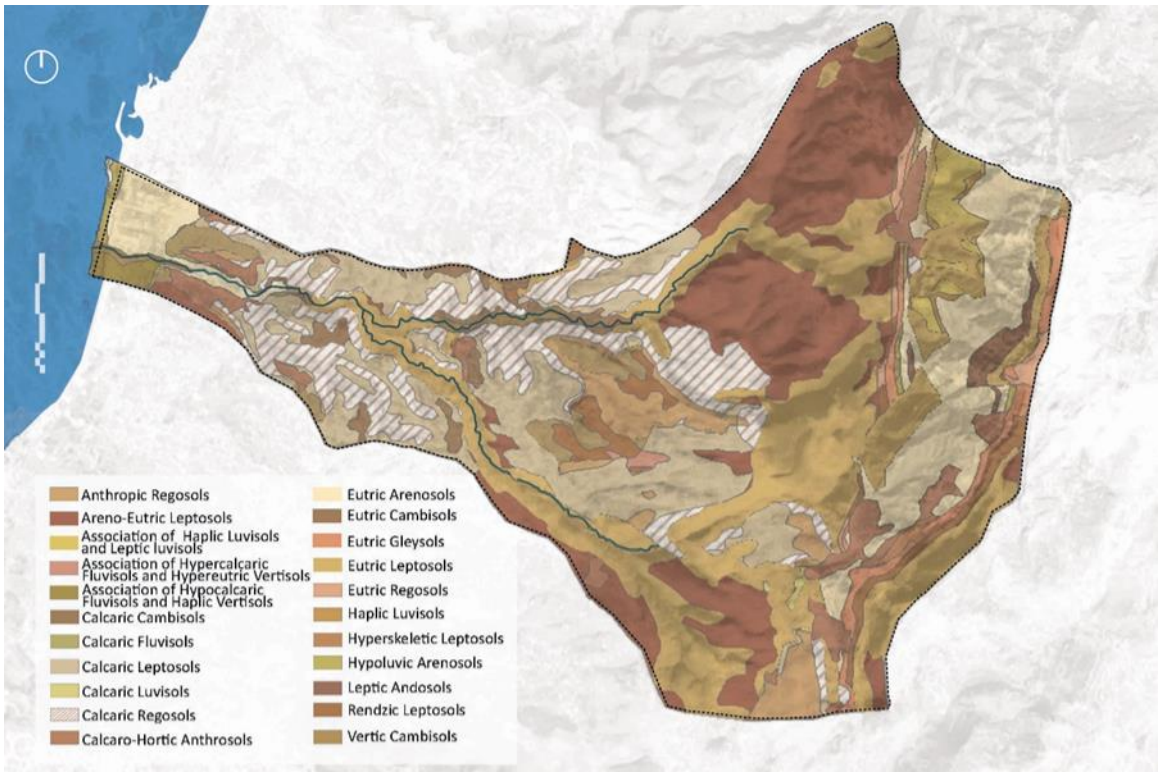


Figure 20. Types of Soil in Sayniq watershed. Source: Author based on GIS data from LDEM Department at AUB

The watershed contains different types of soils that created its robust ecological and cultural landscape of woodlands, scrublands, and agricultural fields. According to the GIS data, the foothills contain patches of Calacaric Regosols, Calacaric Cambisols, Calacaric Leptosols, and Calcaro-hortic Anthrosols. The mixture of these soils is suitable for the growth of the Mediterranean plants as well as tolerant to calcium carbonate such as olives (Al Sabbagh, 2015). Calcaro-hortic Anthrosols are found in the coastal plain of Saida indicates the long term use of agricultural practices (ibid). Additionally, patches of Eutric Arensols are found in the coastal plain.

3.3.3. Hydrology

3.3.3.1. Springs as Ecological Keys

The watershed of the river has an average annual discharge of 12 Mm^3, but today it is negligible (USUDS, 2013). The tributaries of Sayniq river seep in small valleys that shaped its riparian landscape. In the meantime, most of these tributaries dried out due to the loss in annual rainfall precipitation. Sayniq river has two main sources; one from Nabaat Oum Chammas at 662 m in lower foothills of Roum village in Jezzine Caza, and the other from rainfall coming from Safi or El Rihane mountain, and Eqleem El Toffah hills. Springs are found in upper stream and downstream as Nabaat Sfenta and Nabaat Motrane. The naming of some villages in the watershed came from its

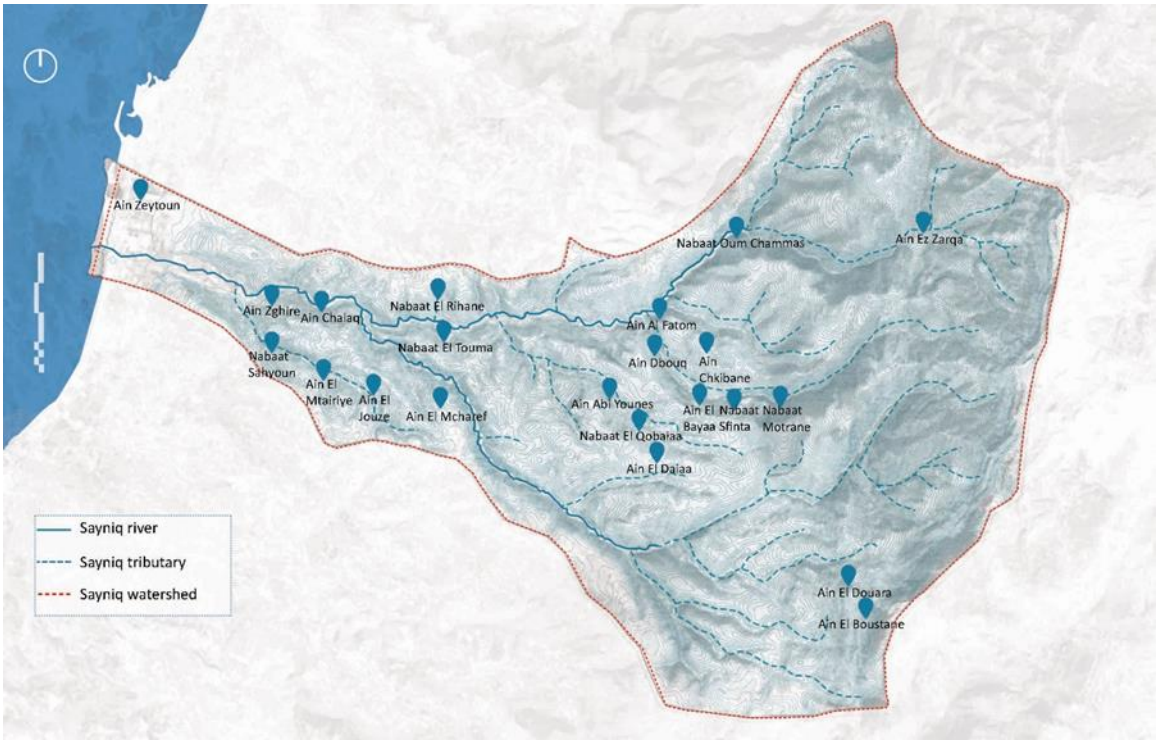


Figure 21. Springs of Sayniq watershed. Source: Author based on archival army maps

robust hydrological pattern, such as Jba'a village that means the sweetness of its abundant springs (Al Arabi Press, 2013). The value of these springs goes beyond being solely ecological, they are also water service providers and part of the shared memory of the watershed communities.

3.3.3.2. Springs as Service Providers

The villages in the watershed rely on two primary sources to provide water for portable use and irrigation. Firstly, the South Lebanon Water Establishment (WE) provides portable water for the regions of Jezzine, Zahrani, Saida, Tyr, Nabatiyeh, Bnt Jbeil, and Marjyoun (South Lebanon WE, n.d). Secondly, the deterioration and lack of maintenance of water networks of the water establishment directed people toward using

Figure 22. Springs in natural and urban settings in Jba'a. Source: Resident from Jba'a

the springs in Sayniq watershed for irrigation and portable use (Strategic Development Plan for Jezzine Region, 2012).

3.3.3.3. Springs as Part of the Watershed Communities

Springs were also a significant part of the cultural landscapes of Sayniq watershed. The watershed communities share the memories of people leaving their houses to create their own huts around the springs, light the candles, and stay up there during the summer time (Al Arabi Press, 2013). So, celebrating these springs as unique cultural landscapes becomes a must in the meantime.

3.4. Biotic Components of Sayniq Watershed

3.4.1. Woodlands

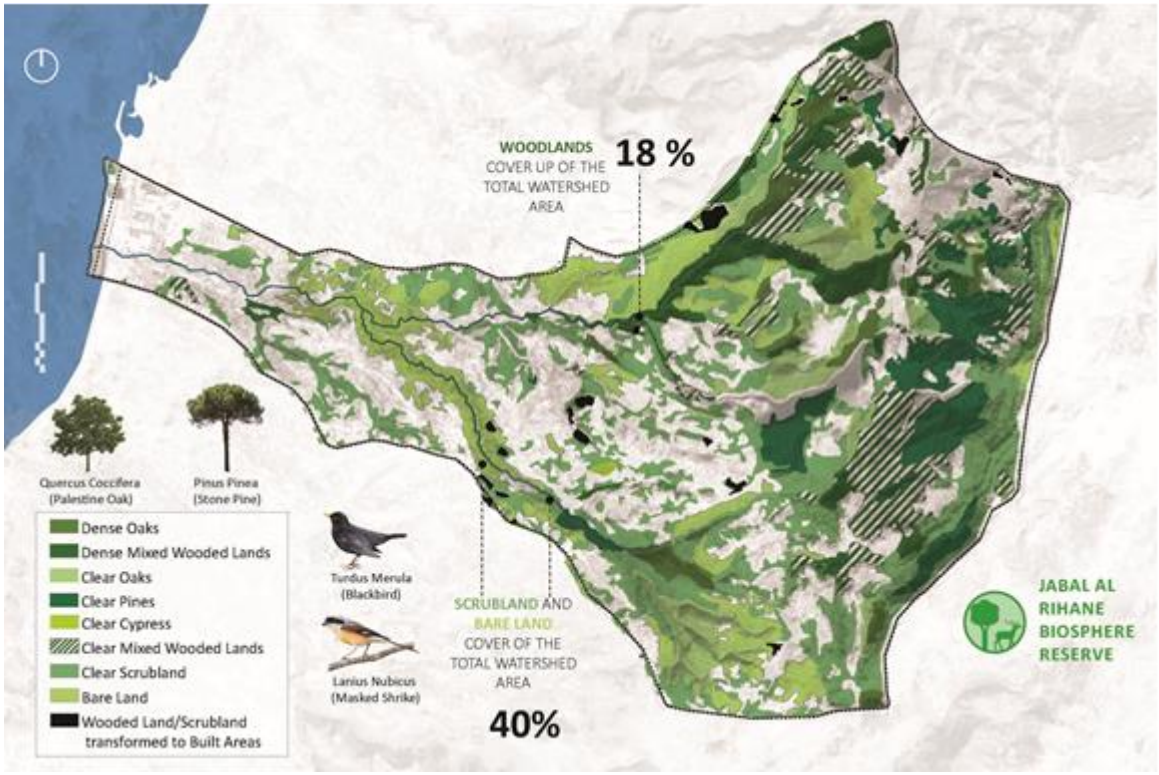


Figure 23. Biotic Components of Sayniq watershed. Source: Author based on GIS data from CNRS

The watershed contains six types of woodlands; dense and clear mixed wooded lands, dense and clear oaks including *Quercus calliprinos*, clear pines including *Pinus Pinea*, and clear cypress including *Cupressus sempervirens.* Woodlands include native trees species, and they are home to different animal species including *Lanius nubicus* and *Turdus merula* birds (Wild Lebanon, n.d). The several Israeli Attacks made most of these woodlands inaccessible today since they contain unidentified land mines in random sites. The inaccessible woodlands remained maintained and protected from the anthropogenic stresses until recent times.

3.4.2. Garrigue Scrubland

The garrigue are Mediterranean scrublands, and they are found predominantly along the valley of Sayniq river at higher altitudes. They are home to the diverse groups of wild flowers such as *Iris Palestina* and *Anenome coronaria,* and birds such as *Lanius nubicus* and *Carduelis chloris* (Wild Lebanon, n.d).

The rich ecological landscape of woodlands and scrublands extends beyond the limit of the watershed since it is bordered by Al Rihane biosphere reserve from its eastern limit. Sayniq watershed acts as a connecting living landscape in relation to its context.

3.5. Cultural Components of Sayniq Watershed

3.5.1. Agricultural fields

The cultural components of Sayniq watershed include the agricultural fields and built areas. Found in the foothills and coastal plain, the agricultural fields cover up to 39 % while the built areas cover up to 1 % of the watershed area (USUDS, 2013). According to GIS data, the types of agricultural products are divided into banana (*Musa acuminata*), citrus trees (*Citrus sinensis*), olives (*Olea europaea*). Those fields are home to a diverse groups of animals such as *Testudo graeca* and *Archon apollinus* (Wild Lebanon, n.d).

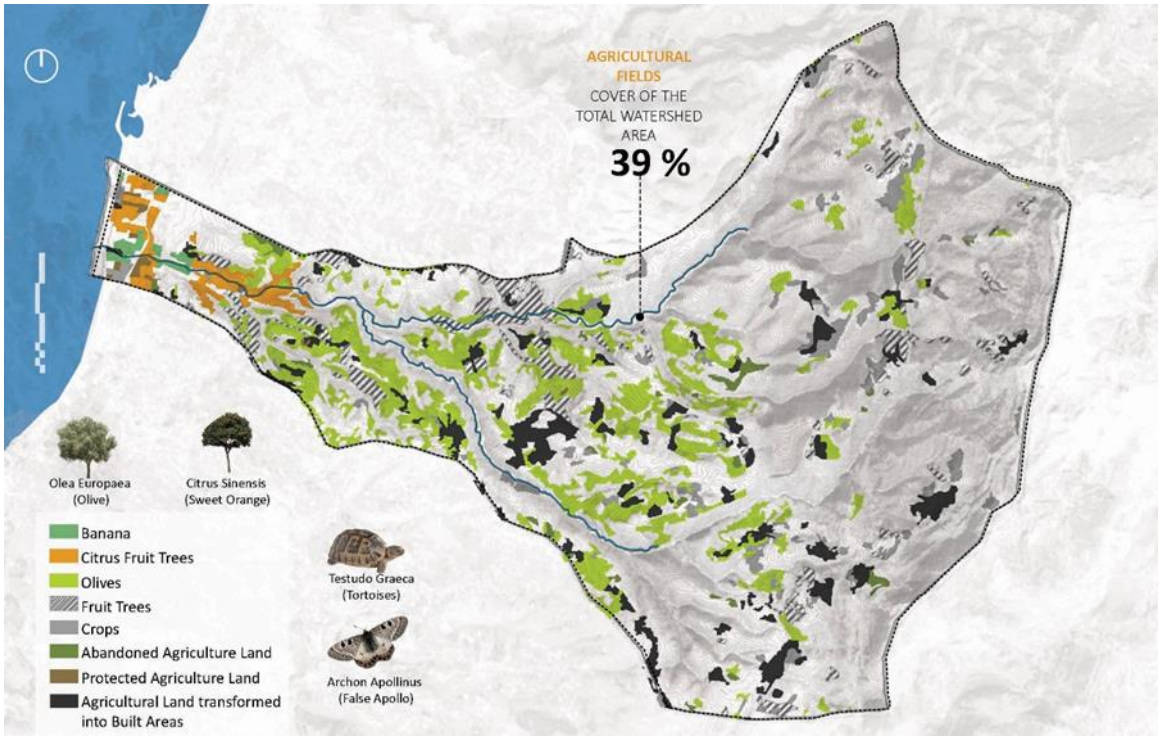


Figure 24. Cultural Components of Sayniq watershed. Source: Author based on GIS data from CNRS

Figure 25. Olive Terraces in Jba'a. Source: Resident from Jba’a

The agricultural fields are divided into two; arable in the coastal plain, and terraced olives and fruits trees. The agricultural production declined due to several reasons; the deterioration of the irrigation network channels, the decrease in the competitive

qualities of the agricultural products, and the outdated agricultural practices and regulations (Strategic Development Plan for Jezzine Region, 2012).

3.5.2. Built up

The built-up areas in the watershed capitalized on the previous agricultural fields, dense woodlands, and scrublands. The types of built areas are divided into dense urban fabric, medium density urban fabric, low density urban fabric, and industrial/commercial areas. The foothills have lower density of built-up area compared to that in the coastal plain. The most important landmarks in the built up areas are the Industrial zone and Ein El Helweh camp in Saida.

The typologies of roads are divided into primary roads (Jezzine-Anan road), secondary roads, tertiary roads, motorway (Sayniq motorway), coastal road (Maarouf

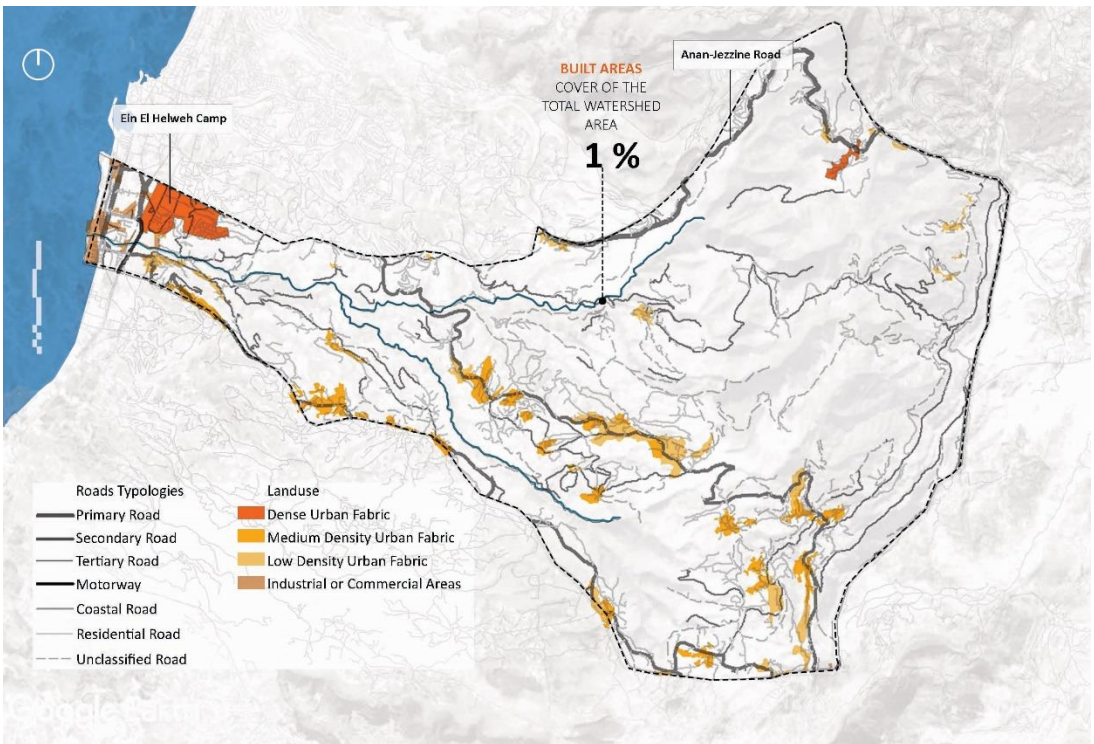


Figure 26. Built up and road typologies of Sayniq watershed. Source: Author based on GIS data from CNRS

Saad road), and residential roads. Fortunately, the Sayniq river has no main infrastructural roads crossing over it which increases its opportunities of becoming an urban ecological corridor.

3.6. Threats to the Sayniq Watershed

The watershed of Sayniq river faces several threats that suppresses its ecological and social viability. The threats are divided into natural (Roum fault) and anthropogenic ones (Quarries and Sewage infrastructure). Roum fault is an extension of the Yammouneh fault that crosses Jezzine area which made the villages prone to landslides and earthquakes (Strategic Development Plan for Jezzine Region, 2012).

Quarries impose another anthropogenic stressor for the villages in the watershed. According to GIS data, the quarries are located close to the channel of Sayniq river, and its tributaries such as the quarry in Kfar-Hatta, Tanbourit, and Jernaya. Quarrying destroys the biodiversity of the riparian watershed, and produces

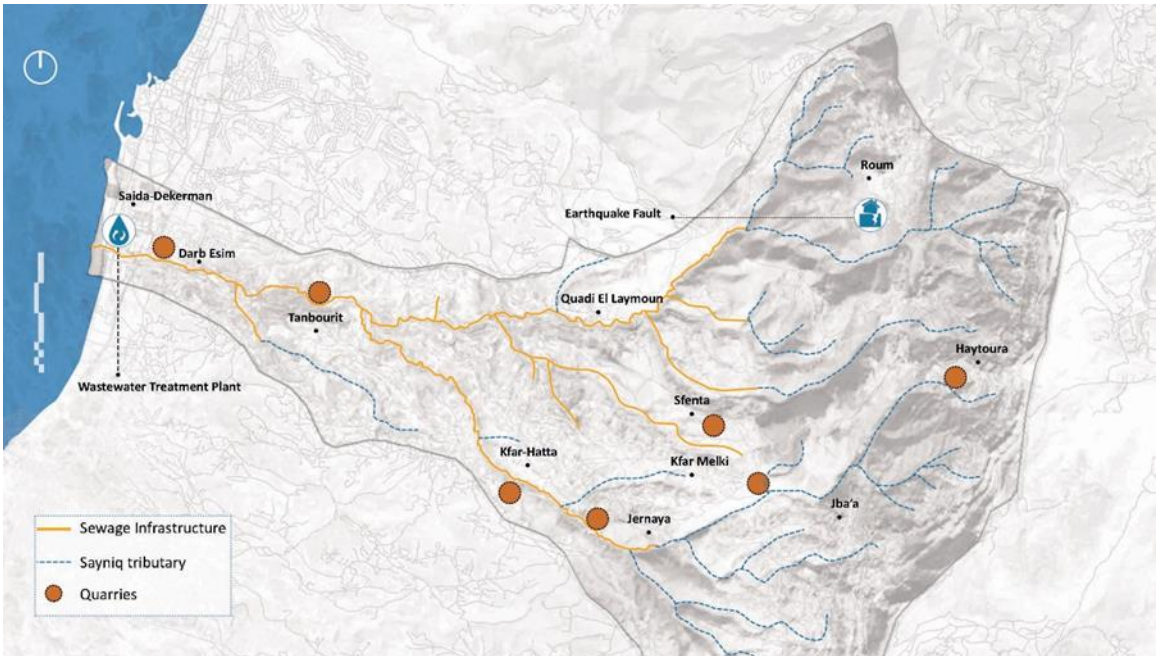


Figure 27. Natural and anthropogenic stressors threatening Sayniq watershed. Source: Author based on GIS data from CNRS

wastes. The locations of the quarries must be studied, planned and managed properly to reverse their negative impacts (Strategic Development Plan for Jezzine Region, 2012).

The deteriorated sewage network in the Sayniq river and its tributaries river is a timely issue that the unions of municipalities are trying to manage properly. The main lines of the network are allocated to collect the surface runoff and sewage network (USUDS, 2013). The sewage network includes wastewater treatment plant located the at the estuary of Sayniq river where sewage is lifted up for final treatment from solid wastes only (ibid). Managing and monitoring the sewage infrastructure efficiently will bring back benefits to the villages in the watershed such as re-using the treated sewage for irrigating the agricultural fields, making fertilizers from organic wastes, and producing energy that can run the plant (ibid).

3.7. Ecological Landscape Associations of Sayniq Watershed

After the extensive reading of the biotic, abiotic, and cultural component of the Sayniq watershed, six Ecological Landscape Associations were identified;

ELA 1: Woodland/Foothills

This association has a high ecological, hydrological, and cultural significance. It is found predominantly in the foothills of the watershed.

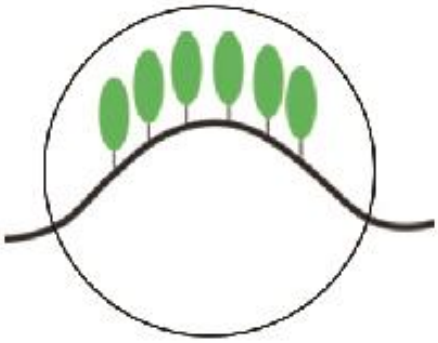


Figure 28. ELA 1 Diagram. Source: Author

ELA 2: Scrubland/Foothills

Similarly, this association has a high ecological, hydrological, and cultural significance. It is found in the valley of Sayniq river, so it has an important role in stabilizing the river banks.

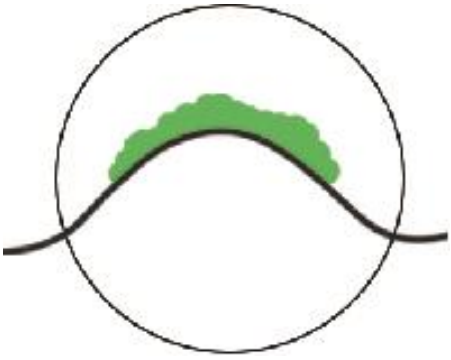


Figure 29. ELA 2 Diagram. Source: Author

ELA 3: Agriculture/Foothills

This association has a high ecological and cultural significance. It provides robust habitats for animals and plants species. The olive terraces represent a part of the Mediterranean cultural landscapes.

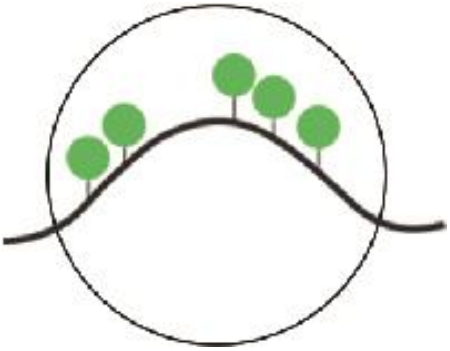


Figure 30. ELA 3 Diagram. Source: Author

ELA 4: Agriculture/Coastal

This association has a high ecological and cultural significance. It is found predominantly in the coastal plain bordering the riverbanks of Sayniq river which helps in protecting it until today. Also, this ELA will help in identifying the Landscape Character zones (LCZs) of Sayniq river in Saida-Dekerman.

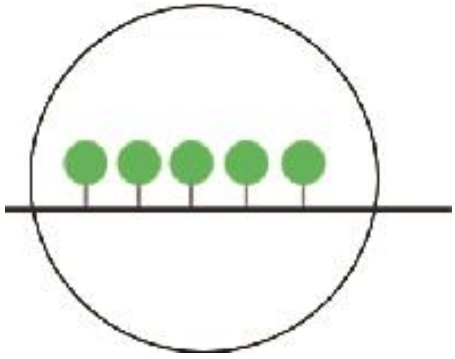


Figure 31. ELA 4 Diagram. Source: Author

ELA 5: Built / Foothills

This association has an ecological and hydrological threat on the watershed of Sayniq river. The uncontrolled use of springs imposes a threat on the level of underground water, thus affecting the level of water flow of Sayniq river.

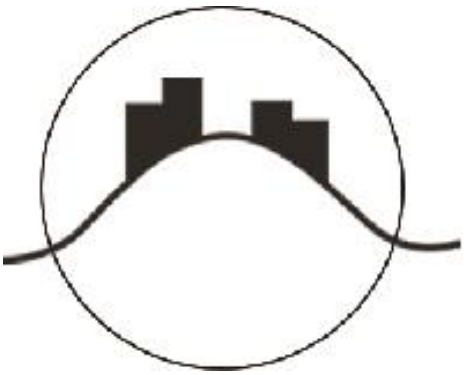


Figure 32. ELA 5 Diagram. Source: Author

ELA 6: Built / Coastal

This association has an ecological and hydrological threat on the watershed of Sayniq river. Ein El Helweh Palestinian Refugee camp and the industrial zone in Saida represents this association. Also, this ELA will help in identifying the Landscape Character zones (LCZs) of Sayniq river in Saida-Dekerman.

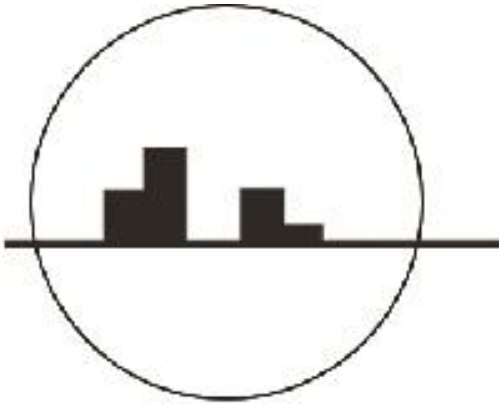


Figure 33. ELA 6 Diagram. Source: Author

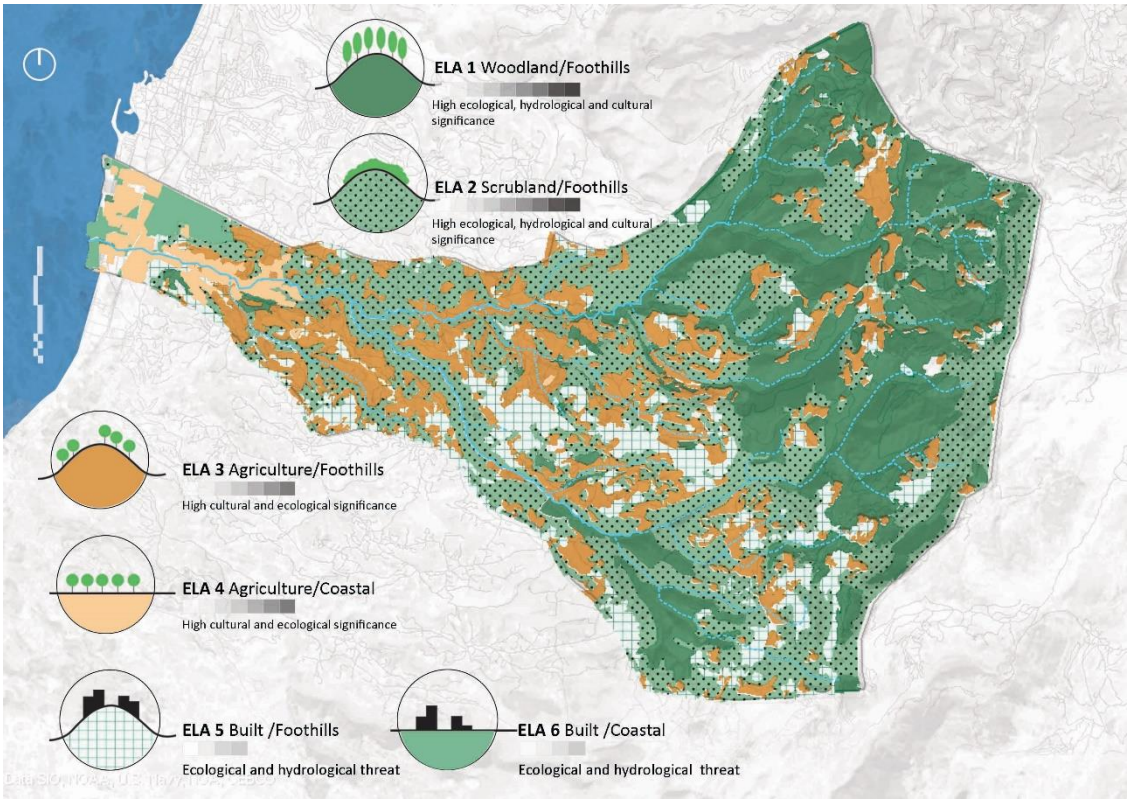


Figure 34. Ecological Landscape Associations of Sayniq watershed. Source: Author

3.7.1. Watershed Typologies

The interconnected relationship between the biotic, abiotic, and cultural components of the watershed created four typologies. It showed the most severe area, Sayniq river in Saida, that should be addressed in a timely manner to enhance the environmental and spatial conditions of the Sayniq river.

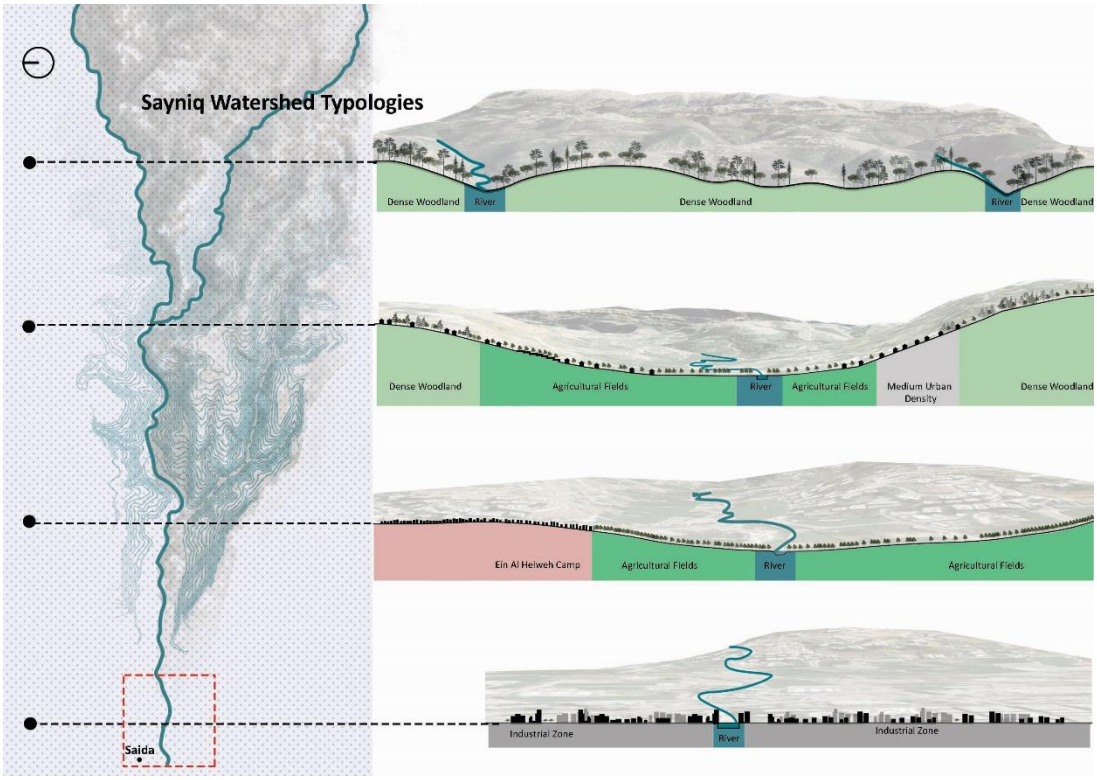


Figure 35. Sayniq watershed typologies. Source: Author

3.8. Three Unions of Municipalities in Sayniq Watershed

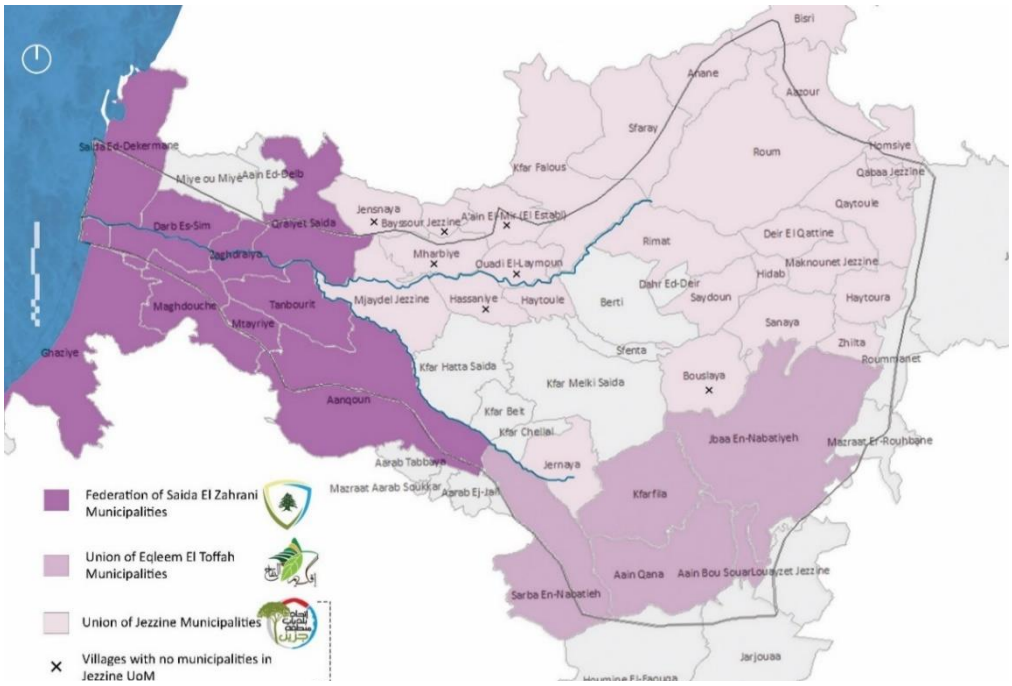


Figure 36. Union of municipalities in Sayniq watershed. Source: Author based on GIS data from CNRS

The villages in the watershed of Sayniq river belong to the three unions of municipalities (UoMs); Federation of Saida-Al Zahrani municipality, Eqleem El Toffah Union of municipalities, and Jezzine Union of municipalities.

3.8.1. Federation of Saida-El Zahrani Municipalities

The union was established as per decree 118 of 1977 in March, 23, 1978, and it includes 16 municipalities; Saida, Haret Saida, Abra, Hilaliyeh, Bramiyeh, Darb Esim, Miye Ou Miye, Ghaziye, Tanbourit, Aanqoun, Majdelyoun, Qraiyet, Ain Delb, Bqosta, Salhiyeh, and Maghdouche (Solh, 2012). The watershed includes 8 municipalities from this union which are Saida, Darb Esim, Ghaziye, Zaghdraya, Tanbourit, Aanqoun, Qraiyet, and Maghdouche. The municipality of Saida leads the union until today due to its political affiliations, and it being a main service provider for the region (ibid). In terms of services, the union works mostly on implementing the infrastructural projects including roads and highways, in addition to the management of solid waste and sewage infrastructure for the villages in the union (ibid).

3.8.2. Eqleem El Toffah Union of Municipalities

Union of Eqleem El Toffah municipalities is a local authority as per decree 34 in January, 30, 2002 that includes 10 municipalities including; Ain Bou Souar-Jba'a, Arab Salim, Jarjouaa, Houmin Tahta, Houmin Fawaa, Roumin, Sarba, Ain Qana, Kfar Fila, and Azza (Union of Eqleem El Toffah Municipalities website, n. d). The watershed includes 3 municipalities from this union which are Ain Qana, Ain Bosaur-Jbaa, and Kfar Fila. The union provides development projects that respond to the needs of the union in the fields of agriculture, solid waste management, health and education.

3.8.3. Jezzine Union of Municipalities

Jezzine union of municipalities is a local authority that was established in the district of Jezzine governorate of South Lebanon as per the decree 15998 in December, 15, 2015 that includes 30 municipalities (Jezzine Union of Municipalities website, n.d). The municipalities in the union are Jezzine, Beteddine Liqsh, Bkasine, Benwati, Homsiye, Haytoura, Roum, Rimat, Chkadif, Zhilta, Sanaya, Sabah, Sfaray, Saydoun, Aray, Deir El Qattine, Haidab, Haytoule, Karkha, Kfar Jarra, Kfar Falous, Lebaa, Mjaidel, Machmouche, Wadi Jezzine, Jernaya, Meidan, Maknounet Jezzine, Anane, and Azour.

The watershed includes 15 municipalities from this union which are, Haytoura, Roum, Rimat, Haitoura, Zhilta, Sanaya, Sfaray, Saydoun, Deir El Qattine, Haidab, Haytoule, Kfar Falous, Jernaya, Mjaidel, and Maknounet Jezzine. The union develops and enhances the living qualities of Jezzine region through the preservation of the natural and cultural heritage, securing economic growth, and the protection of the green spaces (Jezzine union of Municipalities website, n.d).

Eqleem El Toffah and Jezzine UoM recently received a grant from the French ministry of Foreign Affairs to conduct a comprehensive study of the sewage infrastructure in Sayniq river to propose solutions, but the project is in the preliminary phases (Eqleem El Toffah Union of Municipalities Website, n.d).

These unions are comparatively working on providing solutions for their villages to the same problems facing the watershed. Yet, those problems cannot be managed at the villages scale, and goes beyond the capacity of the union to manage it. On the contrary, it must be addressed at the watershed scale to provide a consistent and efficient management plans between the unions. The collaboration between Jezzine and

Eqleem EL Toffah UoM to solve the sewage issue in the watershed of Sayniq river shows a preliminary trial toward understanding the necessity for the effective coordination between the unions.

CHAPTER 4

SAYNIQ RIVER LANDSCAPE IN MUNICIPAL SAIDA: SITE ANALYSIS

The previous chapter presented the ecological landscape design methodology, and its application on the watershed of Sayniq river through defining the Ecological Landscape Associations (ELA).

The integration of the ELA 4 (Agriculture/Coastal), ELA 6 (Built/Coastal) of the watershed, and the distinctive features of Sayniq river in Saida such as rail road and cemeteries identified the four landscape character zones.

This chapter will focus on an extensive analysis of these zones in terms of their existing conditions, and their relation to the river. The chapter will conclude by identifying the environmental, ecological, social, and economic issues of each landscape character zone.

4.1. Urban Design Intervention Site: Boundaries and Historical Milestones

4.1.1. Identifying the Boundaries of the Study Area

Sayniq river in municipal Saida is a borderline between the three administrative zones; Saida-Dekerman, Ghaziye, and Darb Esim. The river and its estuary have a

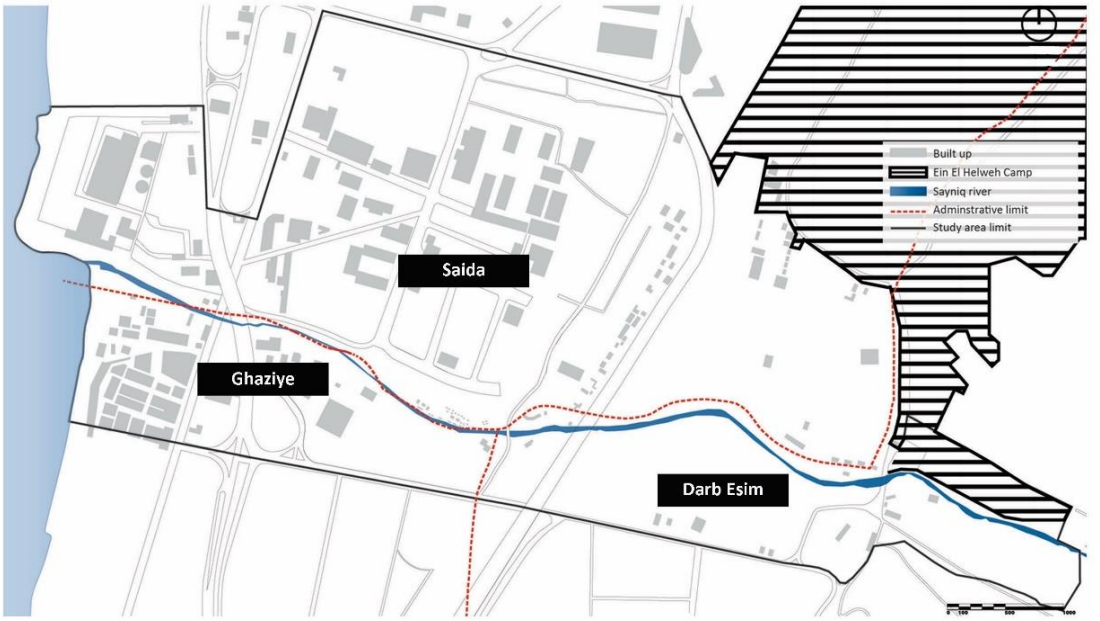


Figure 37. Sayniq river in Saida: Site Boundaries. Source: Author

strategic location for its context that entailed defining the boundaries of the studied area of 1.1 km^2 according to a topographic, vehicular, and physical limit.

4.1.1.1. Topographic limit

The topography of the studied area varies between the beginning of the river in municipal Saida and its estuary; Sayniq river is overlooked by the hilly peak of Maghdouche, in specific the iconic statue of Lady of Mantra located at 190 m above sea level. The difference in levels between the hills of Magdouche and the river forms the eastern topographic limit of the site.

4.1.1.2. Vehicular limit

The two vehicular edges, the extension of Sayniq motorway and Al Hesbe road, define the northern and southern boundary of the studied area accordingly. Those permeable edges act as the main connectors between the studied area and its context.

4.1.1.3 Physical Limit

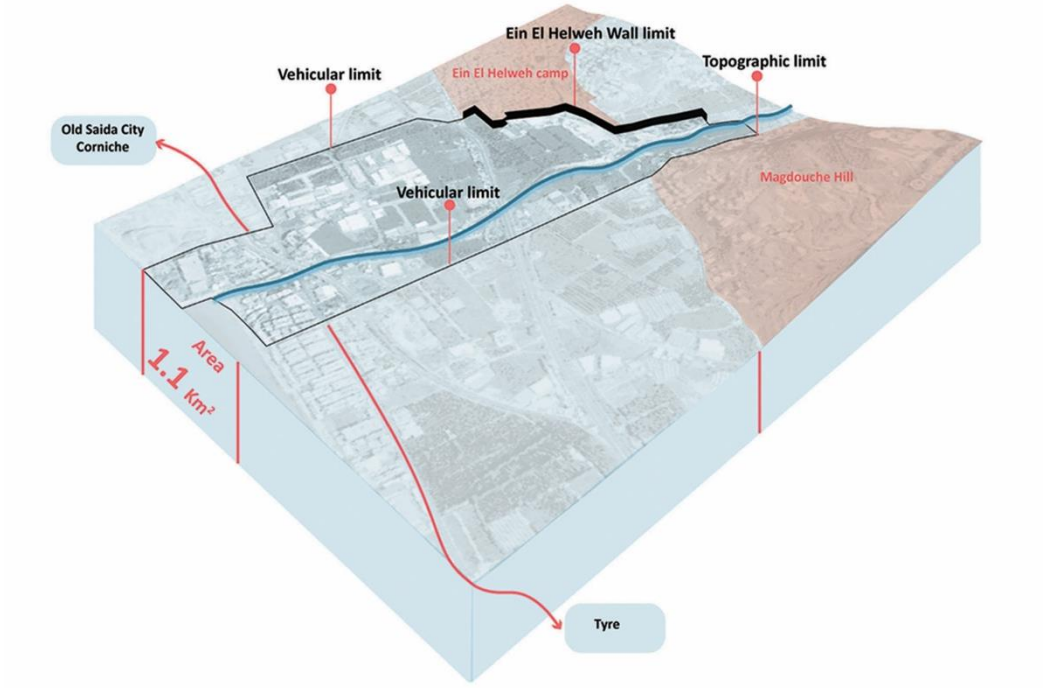


Figure 38. Context of the site limit. Source: Author

The segregation wall of Ein El Helweh Palestinian refugee borders the north-eastern part of the studied area that segregated it from the camp, thus forming the physical limit. This limit also deprived the underprivileged Palestinian refugees of being integrated socially in their context.

It is worth mentioning that despite the degraded conditions of the estuary of the river, it remains the hotspot between the waterfront of Saida and Ghaziye. The proximity of the river to the Old City of Saida, corniche, Ein El Helweh camp, Darb Esim, and Ghaziye ratifies re-imagining the river as an ecological and recreational corridor.

4.1.2. Landmark Historical Events

Historically, the landscape of the Sayniq river was characterized by the absence of urban development, and the dense agricultural fields of citrus trees. It was also a public space for mostly the underprivileged people living in the nearby areas, in specific the families of Ein El Helweh camp and Ghaziye. Besides the recreational activities, the fishermen used the area extending from the estuary toward Saida-Dekerman as the best fishing spot (Dictaphone, 2013).

Today the Sayniq river is a very different landscape, transformed, and polluted. The impaired local riverine ecology of the river disconnected the people in Saida from one of their greatest assets. Milestone dates in the transformation of the landscape of Sayniq river are herein discussed chronologically.

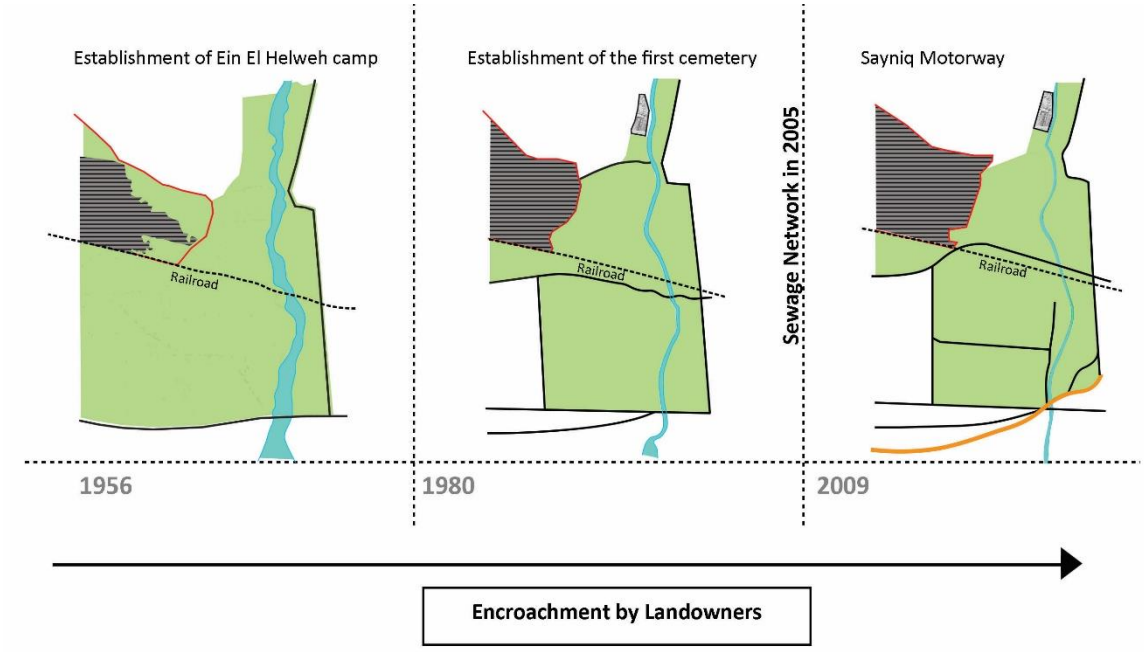


Figure 39. Landmark Historical Events for the landscape of Sayniq river in Saida. Source: Author

4.1.2.1 Palestinian Refugee Displacement in 1948 and Cemeteries

In 1948, the aftermath of the Palestinian refugee displacement initiated Ein El Helweh camp along the old railroad crossing Al Bargouth river. In 1952, UNRWA became in charge of providing the educational, social, and health services for the registered Palestinians in the camp (Relief Web, 2017). Being a contested urban space of 1.5 km^2 with high population density (ibid), the camp is known as the 'Capital of

Figure 40. The road to Sayniq river from Ein El Helweh camp. Source: Author

Diaspora'. Palestinian refugees can access Saida through the army check points only located at each entrance. Indeed, the urban conditions of the camp made it a security zone and an open prison. The road network is divided into two main streets; Al Fawkani and Al Tahtani streets that connect the camp to the Sayniq river passing through the Darb Esim army check point. In 1980, the first cemetery for the Palestinian refugees was established by the Palestine Liberation Organization (PLO) at the edge of Sayniq river. It falls under the responsibility of the association for the Care of the Families of the Martyrs and Wounded (*مؤسسة رعاية شؤون أسر الشهداء و الجرحى*). As the first old

cemetery became full, a new cemetery was initiated in the plot next to it in 2012. Those cemeteries tell the narrative of the Palestinian refugees of Ein El Helweh camp since 1984 until today.

4.1.2.2. Encroachment by Landowners

Sayniq river helped in irrigating the agricultural fields surrounding it, however, the landowners of the private agricultural fields compiled wastes and debris in the river as an excuse to extend the limit of their lands (Dictaphone, 2013). The flow of water in the river was not negligible; on the contrary, the Sayniq river caused recurrent events of flooding, especially in 1955 that destroyed several agricultural fields (ibid). As a result, the channel of the river was modified from a wide river to a stream-like one.

4.1.2.3. Sewage Network of Sayniq River

In 2005, the Council for Development and Reconstruction (CDR), along with the funds from the Japan Bank for International Cooperation (JPIC) implemented a wastewater collection network that included the sewage extension lines, the treatment plant, and the sea outfall line (USUDS, 2013). The network also included sewage pipelines of 170 km that covered Greater Saida and its nearby villages (ibid).

4.1.2.4. The Construction of Sayniq Motorway

CDR planned the maritime boulevard in Saida as a part of the development projects initiated by the late Prime Minister Hariri in 1998 (Kalash, 2001). The Sayniq motorway connects the maritime boulevard in Saida and Maghdouche. The motorway

was named after the late prime minister Hariri, but it is commonly known as Sayniq motorway among the people in Saida.

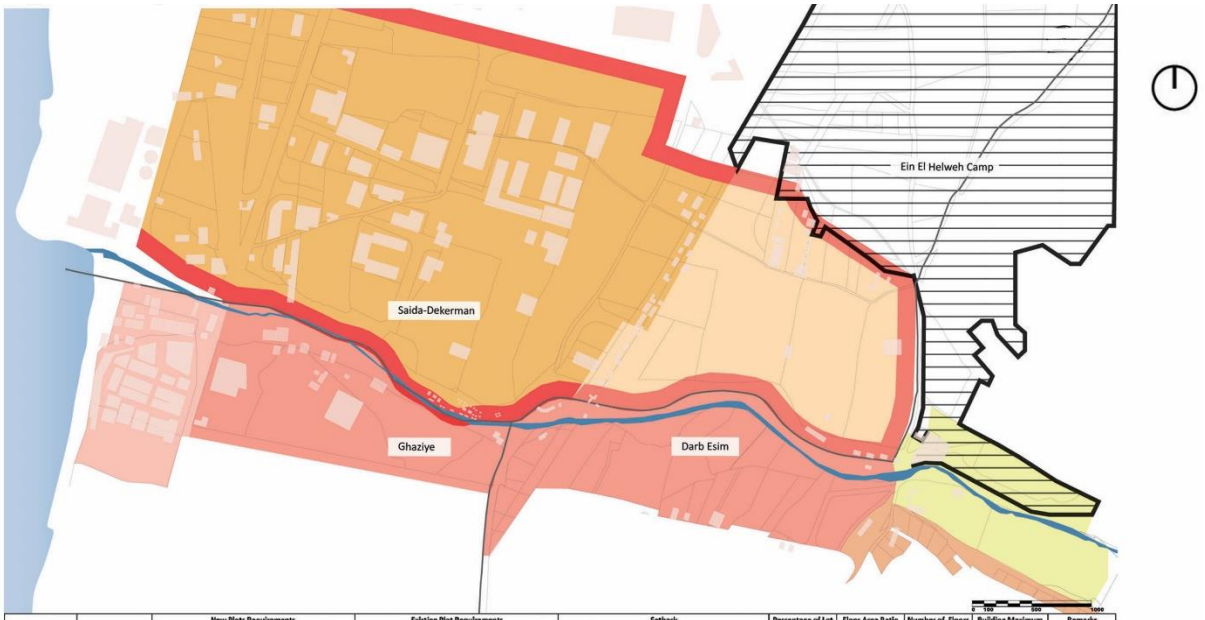
4.2. Change in Zoning plan in Dekerman Saida in 2017

	Zone	New Plots Requirements			Existing Plot Requirements			Setback			Percentage of	Floor Area Ratio (FAR)	Number of Floors	Building	Remarks
		Minimal area	Minimal facade	Minimal depth	Minimal area after alignment	Minimal facade after alignment	Minimal depth after alignment	Setback from the edge of the road or alignment	Centered Setback	Rear setback					
		m²	l.m	l.m	l.m	l.m	l.m		l.m	l.m	%			l.m	
Saida-Dekerman Masterplan 1995	F - Low Residential Density	1200	30	30	750	20	20	setback on the road axis as shown on the road network plan with a minimum of 3 m from road or alignment edge	4.5	4.5	20	0.6	3	13.5	
	I -Industrial	1500	30	35	1000	22	22		6	6	70	1.4	-	-	
	I2- Industrial	1200	30	30	800	20	20		4.5	4.5	40	0.8	-	-	
	G- Touristic	5000	60	60	2500	50	40		6	10	15	0.3	-	-	
Ghaziyeh Masterplan 2016	F - Industrial	1000	20	20	500	15	15	3	3	3	60	1	-	-	
	OT - Transitional Industrial	1500	25	25	1000	20	20	4	4	4	50	1	2	10	
Darb Esim Master plan 2013	A - Residential downtown	1000	22	22	500	16	16	3	4.5	4.5	30	0.9	3	12	Refer to DGU
	OT - Transitional Industrial	1500	30	30	1000	22	22	4	4.5	4.5	25	0.5	-	10	Refer to DGU
	AG - Agricultural	10000	80	80	5000	50	50	5	5	5	5	0.05	1	4	Refer to DGU

Figure 41. Zoning Regulations for Sayniq river:1995. Source: Author /Developed based on 1995 Masterplan from DGU-Saida

The urban development along Sayniq river follows the master plans currently in use for the neighboring zones; Saida, Darb Esim, and Ghaziye. The urban development in Saida follows the master plan issued in 1995 as per decree number 6552 that was revised in 2017.

The 1995 master plan categorized the Dekerman edge of Sayniq river into 4 zones; I, I-1, F and G. Zone I and I-1 are characterized with



	Zone	New Plots Requirements			Existing Plot Requirements			Setback			Percentage of Lot Coverage	Floor Area Ratio (FAR)	Number of Floors	Building Maximum Height	Remarks
		Minimal area m^2	Minimal facade l.m	Minimal depth l.m	Minimal area after alignment l.m	Minimal facade after alignment l.m	Minimal depth after alignment l.m	Setback from the edge of the road or alignment	Centered Setback l.m	Rear setback l.m	%			l.m	
Saida-Dekerman Revised Masterplan 2017	I2 - Industrial	1500	30	30	1000	22	22	According to the decree of the setback on the road axis as shown on the road network plan with a minimum of 3 m from road or alignment edge	4.5	4.5	70	1.4	-	-	
	I4 -Transitional Industrial	1500	30	30	1000	22	22		4.5	4.5	70	1.4	-	-	
	I2'- Industrial	1200	30	30	800	20	20		4.5	4.5	70	1.4	-	-	
	I4'- Transitional Industrial	1200	30	30	800	20	20		4.5	4.5	70	1.4	-	-	
Ghaziyeh Masterplan 2016	F - Industrial	1000	20	20	500	15	15	3	3	3	60	1	-	-	
	OT - Transitional Industrial	1500	25	25	1000	20	20	4	4	4	50	1	2	10	
Darb Esim Master plan 2013	A - Residential downtown	1000	22	22	500	16	16	3	4.5	4.5	30	0.9	3	12	Refer to DGU
	OT - Transitional Industrial	1500	30	30	1000	22	22	4	4.5	4.5	25	0.5	-	10	Refer to DGU
	AG - Agricultural	10000	80	80	5000	50	50	5	5	5	5	0.05	1	4	Refer to DGU

Figure 42. Zoning Regulations for Sayniq river: After 2017. Source: Author /Developed based on 2017 Masterplan from DGU-Saida

industrial land uses with exploitation ratios of 70% and 40% respectively. Zone G is characterized with touristic land uses, with an exploitation ratio of 15 %. Zone F is

characterized with low residential land uses with an exploitation ratio of 20 %. Nevertheless, the revised version of the 1995 master plan in 2017 categorized the Dekerman edge of Sayniq river into 4 zones; I2, I2', I4 and I4'. I2 and I2' zones are characterized with industrial land uses, while I4 and I4' zones are characterized with transitional industrial land uses, however, these zones have an exploitation ratio of 70 %. The master plan for Ghaziye issued on January, 1, 2016 as per decree number 4062 categorized the southern edge of the river into two zones OT and F. Zone OT is characterized by transitional industrial land use, an FAR of 1 (two floor building) with an exploitation ratio of 50%. Zone F is characterized by industrial land use, an FAR of 1 (not defined number of building floors) with exploitation ratio of 60%. However, the master plan of Darb Esim issued on May, 22, 2013 as per decree number 21 categorized the southern eastern edge of the river into two zones; A, OT, and AG. OT zone in Darb Esim master plan is characterized with industrial transitional land use, an FAR of 0.5 (undefined number of floor building) with exploitation ratio of 25%. AG is characterized with agricultural land uses, an FAR of 0.05 (one floor building) with low exploitation ratio of 0.05%. A zone is characterized with the residential downtown land uses, an FAR of 0.9 with maximum building height of 12 floors.

The changes in the master plan of Saida convey the vision of Saida's municipality toward the Dekerman edge of Sayniq river as a solely industrial zone with an increase in the development rights. The revised master plan lacks any regulations to protect both the agricultural fields and Sayniq river, eventually it will make them prone to land speculation (USUDS, 2013). Since the revised master plan recognizes the industrial zone exclusively to the southern edge of Saida, then it must be properly planned and integrated with mixed land uses to avoid any harmful effect to the natural

resources and the inhabitants of the area. Similarly, the case of Ghaziye master plan doesn't envision any protection policies for the agricultural fields nor the Sayniq river. The expected future scenario for the river will be the loss of a valuable watercourse that has the potential to compensate for the lack of the urban amenity landscape in Saida. For that reason, protecting the public domain of the Sayniq river and preventing its integration into the grey infrastructure network becomes a must.

4.3. The Urban Physical Conditions

4.3.1. Typologies of Land uses

Figure 43. The typologies of land use in Sayniq river. Source: Author

In terms of the typologies of land uses, the study area is mostly occupied with the large plots of agricultural fields, however other types of land uses are present. The eastern part of the Sayniq river near Ein El Helweh is occupied with the old and new cemetery of Ein El Helweh and few industrial land uses. The middle part of the study area is occupied by the large agricultural fields. The estuary of the river is occupied by

the industrial land uses as per the master plan of Saida and Ghaziye. The diversified land uses created the landscape character of the Sayniq river.

4.3.2. Figure Ground

Figure 44. Figure ground for Sayniq river. Source: Author

The figure ground of Sayniq river shows that the urban development is concentrated at the estuary of the river, and the context of the study area with the high chaotic urban development in Ein El Helweh camp. The different spatial typologies are directly related to the different typologies of land uses; the large lots belong to the industrial buildings and warehouses, while the fine grained ones belong to the shacks

and residential buildings. The wide voids on both edges of the river belong to the large plots of the agricultural fields.

4.4. Landscape Character Zones

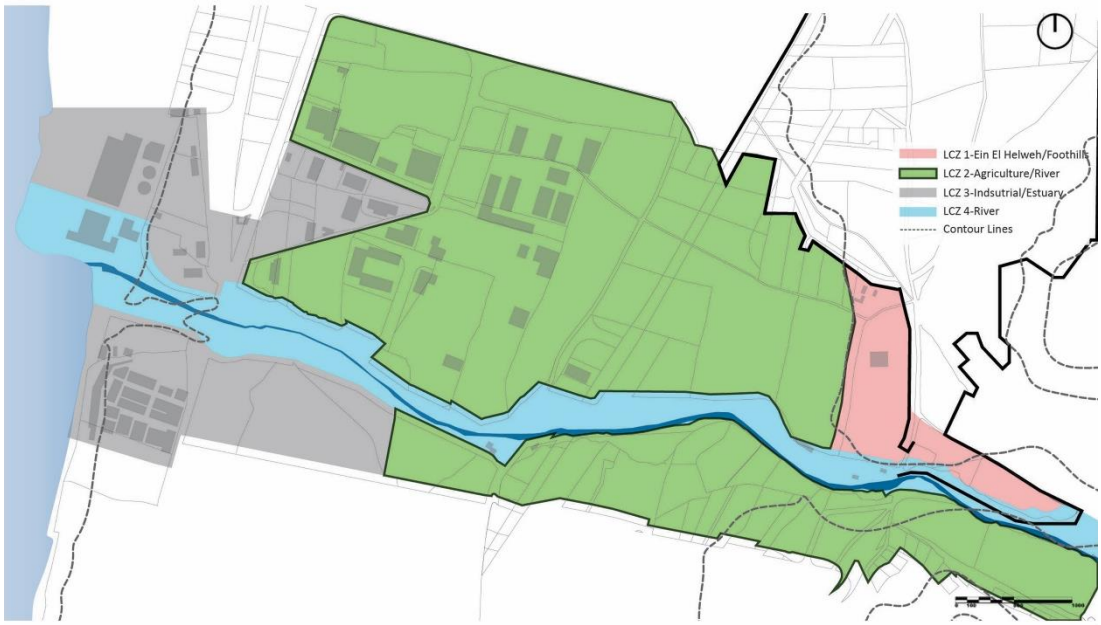


Figure 45. Landscape Character Zones for Sayniq river. Source: Author

The four identified landscape character zones are site specific characters which are; Ein El Helweh/Foothills zone, Agriculture/River zone, Industrial/Estuary, and River zone. Each zone has its specific site components that will be investigated thoroughly through this chapter.

4.4.1. Accessibility and Road Network

Apart from the construction of the Sayniq motorway, the road network connecting the four landscape character zones is categorized into three types; motorways, main, secondary, and railroad. Fortunately, this network is not aligned in

parallel to the river, but it bridges over it near Ein El Helweh camp, at the railroad and the estuary area.

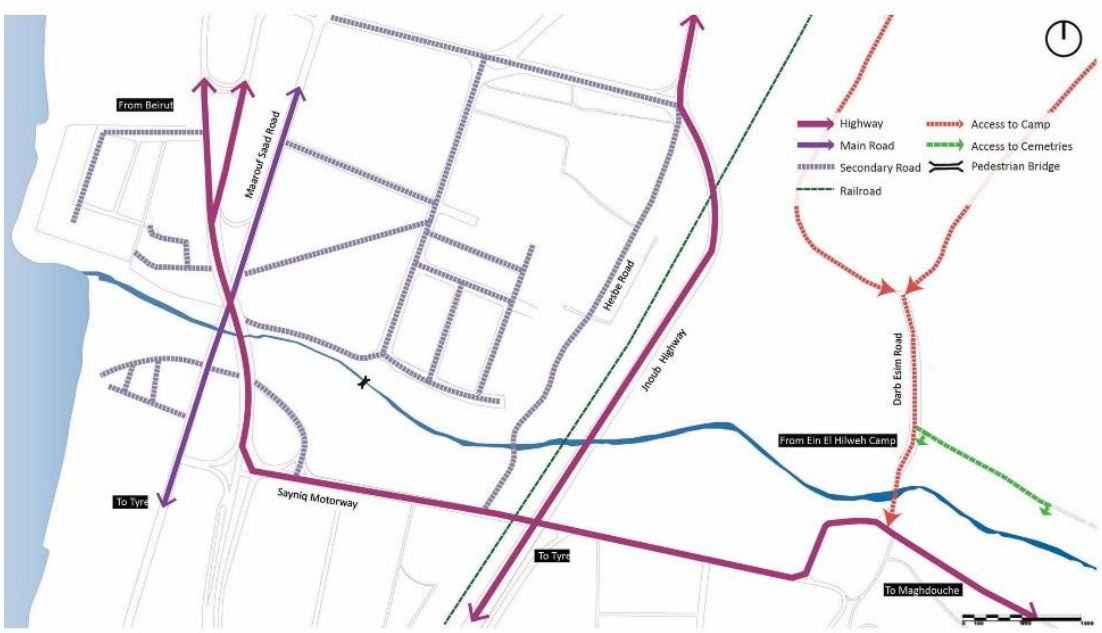


Figure 46. Road typologies. Source: Author

The maritime road known as Maarouf Saad road connects Saida to Beirut and Tyre. The Coastal Tyre-Saida highway known as Jnoub highway connects Saida to Beirut and Tyre, but it is less active than the maritime road. The secondary roads are service roads that connect the industrial companies and warehouses in Dekerman and estuary of the river. Also, the road network includes the railroad which can be seen clearly passing over the Sayniq river under the Jnoub highway.

4.4.2. LCZ 1: Ein El Helweh/Foothills

4.4.2.1. Segregation Wall

The concrete wall in 2016 was built based on an agreement between the Lebanese government and Palestinian political parties that aims to ‘reinforce’ the Lebanese-Palestinian peaceful coexistence. The camp is surrounded with around 30 km length and 6 m high concrete wall which is equipped with the watching towers and wires. LCZ 1 is primarily shaped by this segregation wall.

Figure 47. Segregation wall of Ein El Helweh camp. Source: Author

4.4.2.2. Landmarks and Circulation of LCZ 1

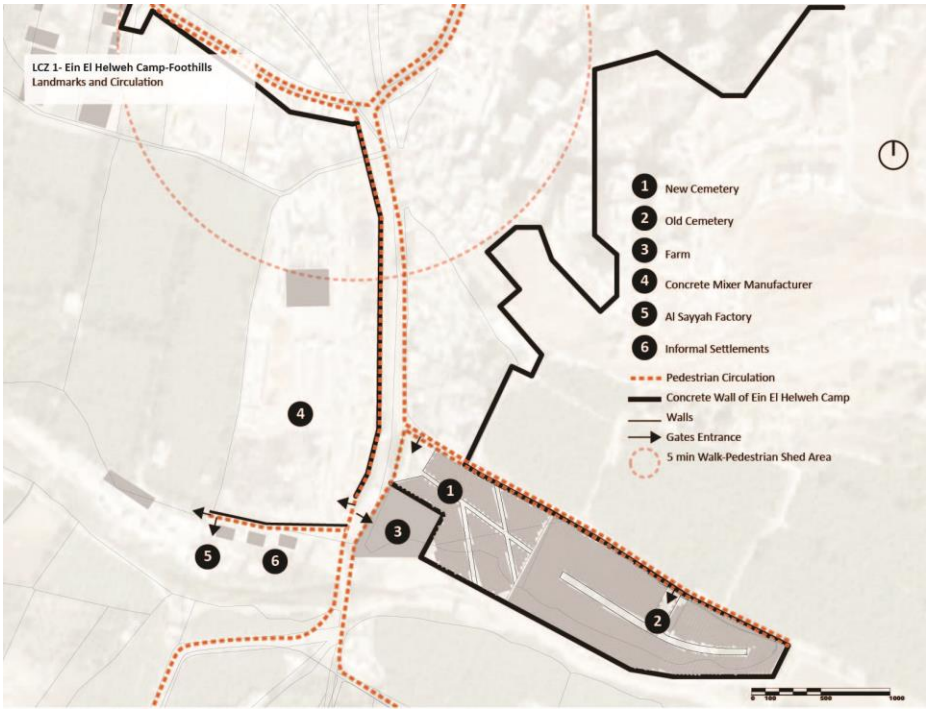


Figure 48. Landmarks and circulation of LCZ 1. Source: Author

This zone acts as an economic and religious destination for people. It is the main connector between the Sayniq river and Ein El Helweh camp. It has three main access roads; the entrance road leading to Ein El Helweh camp, the alley leading to the cemeteries, and the narrow alley leading to the agricultural fields. The pedestrian circulation in this zone is continuous despite the absence of sidewalks. The 5 min walk shows that walking from the southern part of the camp to Sayniq river will take approximately 5-7 minutes.

4.4.2.3. Street and Alleys Character of LCZ 1

Figure 49. Streets and alleys character. Source: Author

The current conditions of the roads and alleys played an important role in shaping the intimidating character of the zone. People walking through the wide road of Ein El Helweh will feel the seclusion induced by the segregation wall. The alley leading to the cemeteries is bordered by the segregation wall and the cemetery wall. The alley leading to the agricultural fields is bordered by the 2 meters wall of the concrete mixer manufacture.

4.4.2.4. Darb Esim Cemeteries

Figure 50. Current conditions of the cemeteries. Source: Author

Cemeteries are the most preserved green spaces that we as urban designers should recognize its maximum potential to compensate for the lack of public spaces in the Lebanese cities. Although cemeteries are associated with the sorrow and graving feeling, but through the process of remembering our beloved ones, there is a need to think of these landscapes as multifunctional ones

Darb Esim cemeteries are found at the edge of Sayniq river in Darb Esim administrative boundaries, however, both are commonly known as Ein El Helweh Old and New

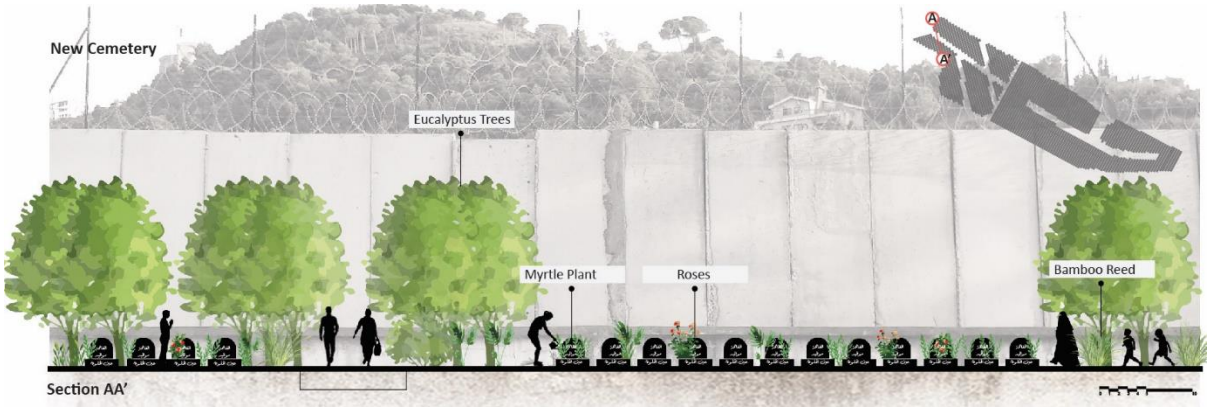


Figure 51. Section showing the character of the New cemetery. Source: Author

cemeteries. The two cemeteries are surrounded with a 2 m wall and the segregation wall of Ein El Helweh camp. The graves in each cemetery are 1m in width and 2 m in length with a headstone that includes the name of the deceased, their date of birth and death.

- Old Cemetery 1980

The old cemetery is approximately 10446 m^2. People enter it through a covered open space, and they can access the graves through a main path. The graves are situated in parallel direction to each other. Also, this cemetery includes two water cisterns found in the middle and the eastern part of the cemetery.

- New Cemetery 2012

The new cemetery is 5798 m^2 and people enter it through a vacant open space. People can access the graves through a main path with secondary ones. Unlike the old cemetery, the graves in the new cemetery are situated diagonally. This cemetery includes three water cisterns found in the entrance open space. Those cisterns are

usually provided through donors for the Palestinian refugees to wash and clean the graves of their beloved ones.

Based on my observation, both cemeteries lack maintenance and upgrading; wastes, broken trees are found in the paths of the cemeteries. The cemeteries lack any urban landscape elements such as benches for people. Once in a while, some initiatives took place through the Palestinian Liberation Organization (PLO) to clean the cemeteries. Both cemeteries are saturated and cannot handle any more graves which encourages re-thinking them as public spaces in the future.

Figure 52. Rubbles and wastes in the cemetery. Source: Author

4.4.2.5. Social and Economic Activities of LCZ 1

The zone is a busy spot on weekdays due to the presence of the army checkpoint at the entrance of Ein El Helweh camp, however several types of social and economic activities are present. As a traditional custom, the cemeteries on Monday and Thursday are crowded with the Muslims refugees who are visiting their beloved ones to wash the graves, water the pots of house plants such as rosemary and myrtle, and to recite surah Al Fatiha and prayers (Dua'a) for them. Other economic activities take place in this

zone such as beekeeping near Al Sayyah factory, and the distribution of cow milk in the farm at the entrance of Ein El Helweh camp.

Figure 53. The social and economic activities of LCZ 1. Source: Author

4.4.3. LCZ 2: Agriculture / River Zone

4.4.3.1. Typology of Agricultural fields

Figure 54. Typology of agricultural fields in LCZ 2. Source: Author

This zone takes the highest part of the study area due to the presence of the large plots of agricultural fields adjacent to the edges of Sayniq river.

Those fields are active until today with relatively lower production. Irrigating those fields depends mainly on the private wells and irrigation canals. The types of these fields are classified into two which are the fruit orchards and greenhouses. The conditions of the greenhouses vary between abandoned and active ones. The greenhouses are used for planting legumes, vegetables, and floral cultivation. The orchards found near Ein El Hilweh camp, the northern edge of the river, vary between the monoculture orchards of banana and the mixed orchards. The southern edge of the

river in Darb Esim includes mixed orchards of citrus and banana. The banana orchards constitute a high percentage of the agricultural fields along the river, particularly in Saida-Dekerman. Replacing citrus cultivation with banana or mixing it with another cultivar is trending in Saida due to the high maintenance cost of citrus trees, including the cost of pesticides and fertilizers (USUDS,2013). Saida, previously known as the Capital of Citrus production, today has lost this character in the absence of any upgrading or development to the urban agricultural strategies in Lebanon. Besides the agricultural fields, there are two major plant nurseries in this zone such as Al Andalaus plant nursery.

4.4.3.2. Landmarks and Circulation of LCZ 2

This zone includes landmarks that are specific to its cultural aspect of Saida such as Al Arabi Soap warehouse, Saida Slaughterhouse, and the old railroad.

Figure 55. Landmarks and circulation of LCZ 2. Source: Author

- Al Arabi Soap warehouse (*http://www.arabisoap.com/)* is located near the Sayniq motorway along Maarouf Saad's main road and it covers an area of 4000 $m^{2.}$
- Saida Slaughterhouse (*Abattoir De Saida*) is located in the Dekerman that was built in 1994, and it covers an area of 9500 m^2 (Kalash, 2001). It includes yarn production, veterinary room, slaughter hall, laboratory, vending hall and a parking lot (ibid).
- In 1891, the railroad was established as a publicly owned rail line by the Ministry of Transportation (ibid). It is an underutilized public domain that has been heavily encroached. The railroad passes through Ein El Helweh camp at El Sekke area, and then it is encroached with the shacks passing over Sayniq river toward Ghaziye.

Figure 56. Un-inviting Features of LCZ 2. Source: Author

The zone is a destination for the people working in the soap factory, slaughterhouse, or the agricultural fields. Due to the slow flow of vehicles, the roads are wide, calm, and walkable.

Based on my site visits, people rarely access this zone due to several un-inviting features;

-The warehouses covering significant areas that varies between 812 m^2 and 3260 m^2

- Walls and fences of the agricultural fields

- Shacks encroaching the railroad

-Absence of any social or economic activity

Those features detached people from accessing this zone, and made it restricted to those working in the industrial factories and warehouses.

4.4.4. LCZ 3: Industrial/Estuary

4.4.4.1. Landmarks and Circulation of LCZ 3

LCZ 3, concentrated at the estuary of Sayniq river, has a unique urban character. It is known for the presence of the solid waste treatment plant and the wastewater treatment plant on the northern part of the estuary and the new industrial area. The

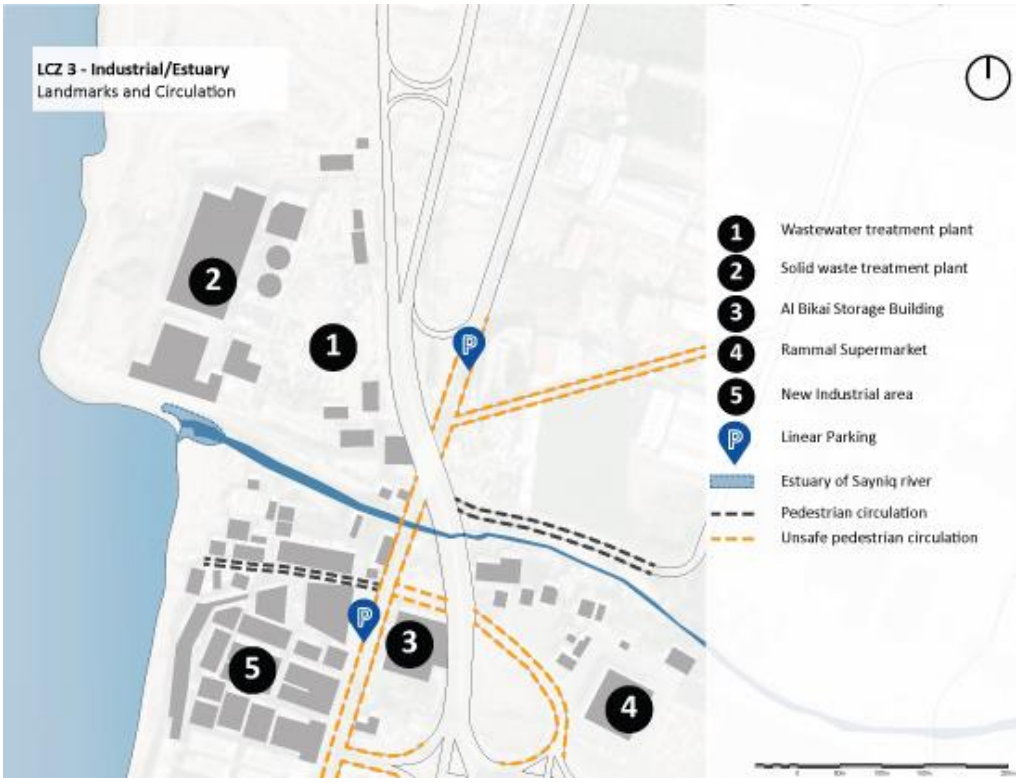


Figure 57. Landmarks and circulation of LCZ 3. Source: Author

naming of the new industrial area is directly linked to the Sayniq river, so it is known as Sayniq industrial zone.

The Sayniq motorway and Maarouf Saad's main road cuts through this zone causing unsafe crossings for people, especially with the high speed of the vehicles and the absence of proper sidewalks.

4.4.4.2. Social and Economic Activities of LCZ 3

Figure 58. Social and economic activities of LCZ 3. Source: Author

This zone has a high intensity of the social and economic activities. The commercial frontage of shops and espresso cafes, and groceries are found on both edges of Maarouf Saad's road. Due to the shading under Sayniq motorway, people gather along the edges of the road underneath it. The intensity of those activities varies; it is high during the weekdays, and immense on Fridays and Sundays as people spend their weekends away from Beirut in the South.

4.4.5. LCZ 4: River Zone

4.4.5.1. Spatial Conditions of the river channel

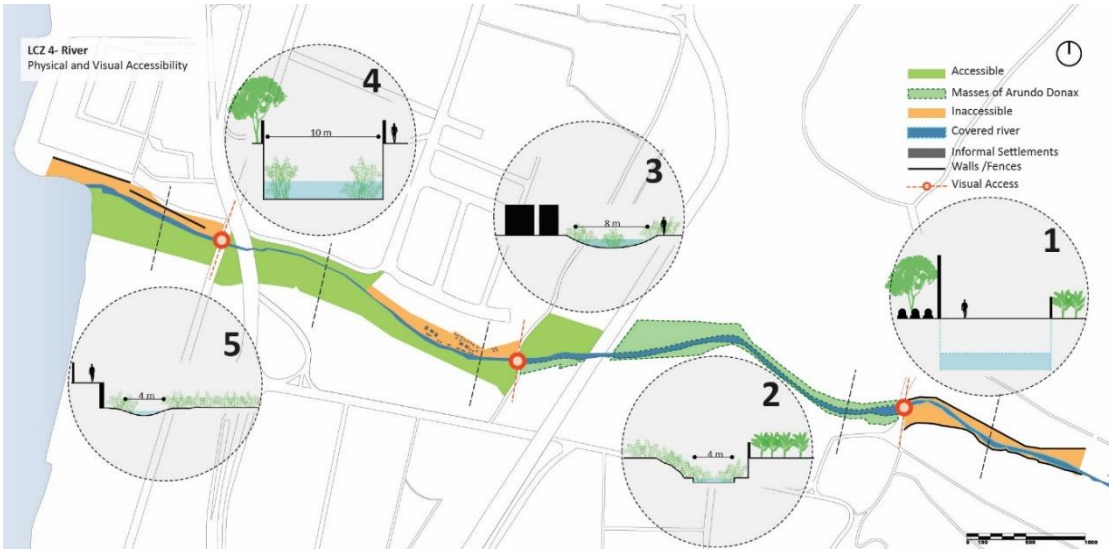


Figure 59. Physical and visual accessibility of Sayniq river in LCZ 4. Source: Author

The channel of Sayniq river changed dramatically due to the abovementioned historical milestones. Sayniq river today flows in culvert near the two cemeteries. The width of the river's channel is 4 m in the agricultural fields, and it increases to 10 m near the informal settlements. At the estuary, the width of the channel decreases to 4 m.

4.5.4.5.2. Physical and Visual Accessibility

In terms of access, the invisible part of the river near the cemeteries is bordered by the segregation wall and the wall of the agricultural field. The riverbanks of the river in between the agricultural fields are visually and physically inaccessible. Visually, people can see the river at three strategic locations; near Ein El Helweh camp, the railroad, and at Maarouf Saad's main road.

Indeed, the lack of access to the riverbanks of Sayniq river obliterated the social perception toward the river as a public space. This is due to the fact that the visual access to the estuary shows the heavily polluted character of the river. So, people became familiar with the unpleasant smelling of the sewage as they are passing by under the Sayniq motorway.

4.4.5.3. River's Ecology

Figure 60. Masses of Arundo Donax along the edges of Sayniq river. Source: Author

The riverbanks are defined by the large masses of *Arundo Donax.* The Eucalyptus trees and other types of riparian vegetation such as *Polygonum Salicifolium*, *Nasturtium Officinale*, and *Ricinus Communis* are present along the channel of the river. Today, the estuary of Sayniq river is highly polluted; the solid wastes such as plastic bottles accumulate along the edges of the estuary. The dark sewage water with the bad-smelling is immense in this zone. People can access the southern edge of the estuary through the New Industrial area while the northern edge is not accessible due to the

presence of walls of the wastewater treatment plant. The vegetation types are few such as *Mathiola Tricuspidata* and *Calystegia Soldanella*.

4.4.5.4. Sewage Infrastructure

The sewage network of Sayniq river is old, and unable to accommodate the needs of the of the increased population since it receives the sewage of villages of the Sayniq watershed. The deteriorated condition of the network is due to the mismanagement and lack of maintenance; the pipelines are placed in the middle of the

Figure 61. Sewage infrastructure of Sayniq river. Source: Author

riverbed that receives the highest pressure during a rainfall event which makes it susceptible to leakage and damage. The wastewater treatment plant in Saida is incapacitated today, so most of the sewage ends up in the sea untreated. Adversely, the north direction of the wind in Saida pushes the waves carrying the sewage to the waterfront of Saida. This in turn spreads the unpleasant-smelling of sewage across the Sayniq river, thus imposing a health risk for the people living in Saida.

4.4.5.5. Solid Waste Dumping

Another risk imposed on the health of the people is the solid waste dumping in the channel of the river. Indeed, the main sources of this issue are the shacks and groceries. The types of the solid wastes vary between masses of rubbles, diapers, plastic water bottles, and bags. Annually, the Union of Saida-Al Zahrani Municipalities cleans the channel of Sayniq river, however the cleaning process is restricted to removing the solid wastes. According to my site visits during summer and winter, the cleaning process should include the removal of the masses of *Arundo Donax*, and identifying the locations of the manholes to clean them from obstacles.

Figure 62. Solid wastes thrown in Sayniq river. Source: Author

4.4.5.6. The Pattern of Illegal Encroachment in the Public Domain of Sayniq river

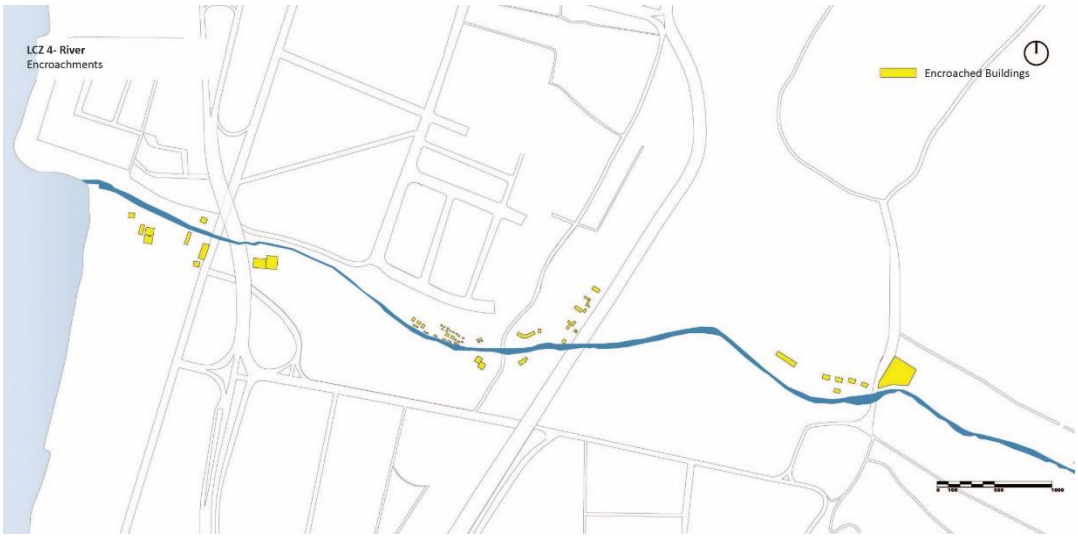


Figure 63. Pattern of encroachment along Sayniq river. Source: Author

The Lebanese water resources, including the terrestrial and underground ones, are public goods as per the Water Resources Law. The Law no. 221/2000 organizes the management, protection, and governance of the water sources in Lebanon through a set of primary and secondary actors (El Hajj et al. 2015). The duties as per Law 221/2000 of these actors are discussed below;

Major Actors

Ministry of Energy and Water

Its role as per Law 221/2000 (El Hajj et al. 2015):

- Develops and conducts national scale studies related to large scale irrigation projects, management of water resources, and hydro-geological studies
- Monitors the work of all the public institutions responsible for the management of water sources in Lebanon
- Monitors the groundwater extraction and issues permits for wells

- Protect the terrestrial and underground water resources from pollution

Water Establishments

The Water Establishments include four establishments; North Lebanon, South Lebanon, Beqaa Valley, Beirut and Mount Lebanon (El Haj et al., 2015). It is responsible for distributing and maintaining the domestic water and wastewater services across Lebanon (ibid).

Litani River Authority (LRA)

LRA, a public institution, is responsible for the management of Litani River Watershed, in addition to establishing the hydro-electric power plants on the Litani river (ibid).

Secondary Actors

Council for Development and Reconstruction (CDR) مجلس الانماء و الاعمار

It is responsible for mobilizing funds and supporting the Ministry of Water and Energy and Water Establishments (ibid).

Ministry of Finance وزارة الاقتصاد

It is responsible primarily for allocating the budgets for implementing projects (ibid).

Ministry of Environment *وزارة البيئة*

The role of the ministry focuses on controlling harmful activities causing pollution and evaluating the Environmental Impact Assessment (ibid)

Ministry of Agriculture *وزارة الزراعة*

Their role focuses primarily on planning, supervising, and monitoring the irrigation projects (ibid)

Council of the South *مجلس الجنوب*

Their role is restricted to establishing water supply systems in the South and West Beqaa regions (ibid)

Ministry of Public Health *وزارة الصحة العامة*

Their role focuses on providing good quality of water to people (ibid)

Central fund for the Displaced *الصندوق المركزي للمهجرين*

Its role is restricted to establishing water supply systems in the villages of Baabda, Aley and Chouf (ibid).

The water sector faces several challenges that lead to the mismanagement of the water sources in Lebanon. The challenges are summarized below;

- The lack of operational decrees that forces the implementation of Law 221/2000 (ibid).
- The overlapping of responsibilities and improper coordination between the public institutions (ibid).
- The lack of data at a national scale, in addition to the administrative and financial issues (ibid).

According to Lebanon's planning regulations, the responsibilities of the water agencies intersect with those of the Directorate General of Urbanism (DGU) and the municipalities that are entrusted with the management and organization of the territories where the water resources fall. The DGU, which is Lebanon's national land use and planning agency, regularly develops land use masterplans that are to regulate building practices and protect waterways. In addition, Lebanon's building law (Law 646/2004) dictates the minimum mandated setbacks from natural waterways (4.5 m from the edge of the waterway) and rivers (10 m from the river edge).[1]

[1] Article 12 of Lebanon's building law (Law 646/2004) lists setbacks from existing buildings.

In the case of Sayniq river planning, the DGU, upon the request of Saida's municipality, placed the Sayniq river as an area under study with 100 m on both sides as per the decision number 05/23107 issued in 2006.

By placing the area under study, the DGU is effectively aiming to freeze the development for the duration required to develop the revised regulations (as per the decree number 9 issued in 1983 of the Lebanese Urban Planning Law). This measure is renewable only once for 10 years. It is noteworthy that during this period, the DGU can issue "exceptions", in which it has more freedom because the regulations are effectively suspended. Therefore, placing Sayniq river as an area under study is not an operational mean for protecting the public domain of the river, it only freezes the development for a certain period of time, with the assumption that a solution will be devised to the current pattern of illegal encroachments along the riverbeds.

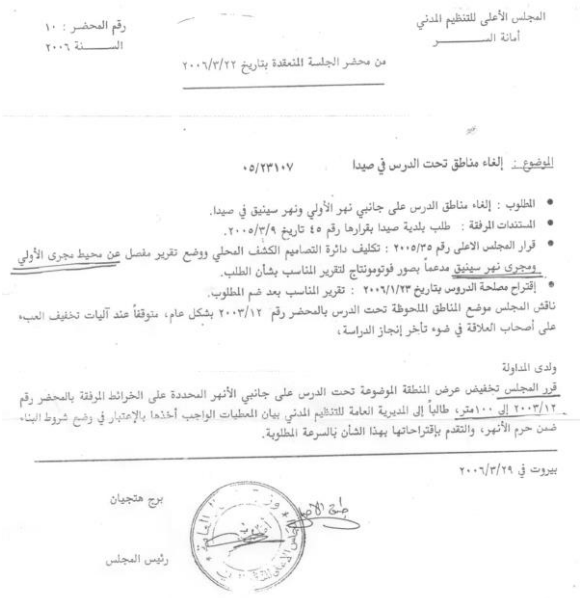
This in turn reflects also the complexity of managing the water sources in Lebanon, in specific the public domains, where several public institutions have overlapping and vague roles in this process that obstructs the sustainable management of these resources.

So, the thesis will abide by the building law (Law 646/2004) and consider a 10 m setback from the edge of the Sayniq river. The riverbed is encroached by 13 multi-story residential buildings, and 44 shacks with temporary materials.

- The shacks are located directly on the edge of Sayniq river and near the entrance of Ein El Hilweh camp. They are covered with a zinco surface. The Syrian

refugees living in those shacks suffer from hard living conditions, especially in the winter season due to the recurrent flooding of the river.

- The multi-story residential buildings are located mainly in the industrial area at the estuary. Those buildings are in good condition and made up of less than 6 floors.
- Cemeteries are located at the administrative limit of municipal Saida.



المجلس الأعلى للتنظيم المدني
أمانة السـر

رقم المحضر : ١٠
السنة ٢٠٠٦

من محضر الجلسة المنعقدة بتاريخ ٢٠٠٦/٣/٢٢

الموضوع : إلغاء مناطق تحت الدرس في صيدا ٠٥/٢٣١٠٧

- المطلوب : إلغاء مناطق الدرس على جانبي نهر الأولي ونهر سينيق في صيدا.
- المستندات المرفقة : طلب بلدية صيدا بقرارها رقم ٤٥ تاريخ ٢٠٠٥/٣/٩.
- قرار المجلس الاعلى رقم ٢٠٠٥/٣٥ : تكليف دائرة التصاميم الكشف المحلي ووضع تقرير مفصل عن محيط مجرى الأولي ومجرى نهر سينيق مدعماً بصور فوتومونتاج لتقرير المناسب بشأن الطلب.
- إقتراح مصلحة الدروس بتاريخ ٢٠٠٦/١/٢٣ : تقرير المناسب بعد ضم المطلوب.

ناقش المجلس موضع المناطق الملحوظة تحت الدرس بالمحضر رقم ٢٠٠٣/١٢ بشكل عام، متوقفاً عند آليات تخفيف العبء على أصحاب العلاقة في ضوء تأخر إنجاز الدراسة،

ولدى المداولة

قرر المجلس تخفيض عرض المنطقة الموضوعة تحت الدرس على جانبي الأنهر المحددة على الخرائط المرفقة بالمحضر رقم ٢٠٠٣/١٢ إلى ١٠٠متر، طالباً إلى المديرية العامة للتنظيم المدني بيان المعطيات الواجب أخذها بالإعتبار في وضع شروط البناء ضمن حرم الأنهر، والتقدم بإقتراحاتها بهذا الشأن بالسرعة المطلوبة.

بيروت في ٢٠٠٦/٣/٢٩

برج هتجيان
رئيس المجلس

Figure 64. Decision 05/23107. Source: DGU-Saida

4.5. Social perception of Sayniq river

As a Palestinian refugee living in Ein El Helweh camp in Saida, I believe that the current conditions of the landscape of Sayniq river in terms of the walled cemeteries, enclosed agricultural fields, and the segregation wall reflected an intimidating and fear relationship between the people and Sayniq river.

Based on testimonies from the site, people from Saida refer to the Sayniq river as an open sewer with bad-smelling that marks the end of municipal Saida. During my site visits, I found it challenging to reach the riverbanks of the Sayniq river, so upon asking the question, “how I can access the edges of the Sayniq river? People were surprised when knowing that Sayniq is a river.

4.6. Issues of Each Landscape Character Zone (LCZ)

After the extensive reading of the four identified landscape character zones, the issues facing each one are summarized into social, environmental, ecological, and economic.

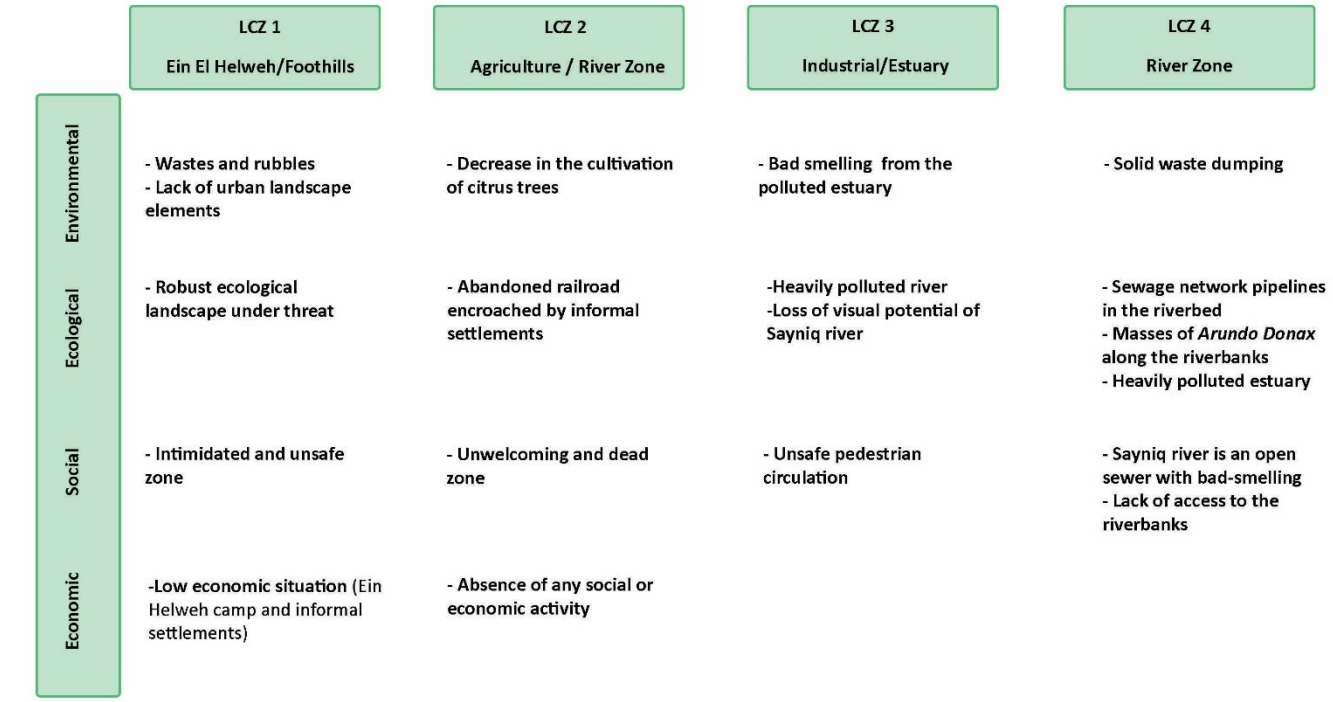


Figure 65. Issues of each Landscape Character Zone (LCZ). Source: Author

CHAPTER 5

SAYNIQ RIVER LANDSCAPE IN MUNICIPAL SAIDA: URBAN DESIGN INTERVENTION

The previous chapter presented an in-depth analysis of the four identified landscape character zones along the Sayniq river; with their distinctive landscape features.

This chapter will build on those zones to propose new heterogeneous Landscape Character Zones (LCZs) that will be the main pillars for the general strategies and the urban landscape design intervention. The chapter will also present the broad design strategies and the six detailed urban landscape design interventions along the Sayniq river.

5.1. Proposed Landscape Character Zones

This section will present the newly proposed LCZs; Ein el Helweh Reflection Garden, Ein el Helweh Productive Garden, Railroad Garden, and Sayniq Estuary Garden.

- LCZ 1-Ein El Helweh Reflection Garden: The cemeteries of Ein El Helweh camp reflect the collective memory of the Palestinian refugees because it was established in line with the displacement of the Palestinian refugees since 1984. The difference in elevation coupled with the landscape elements of the cemeteries encourage re-imaging them as

Figure 66. Proposed Landscape Character Zones. Source: Author

- memorial public spaces. This in turn will require a regular maintenance of the cemeteries, a protection of the robust ecological landscape, and it will decrease the intimated feeling of this zone.
- LCZ 2- Ein el Helweh Productive Garden: As per the recommendations of USUDS strategy (2013), the agricultural fields along the Sayniq river are envisioned as recreational and productive ones. This zone will be re-configured as a multifunctional public space that will provide recreational and economic benefits to the people especially the Palestinian women living in the camp.
- LCZ 3- Railroad Garden: Similarly, the agricultural fields in this zone are envisioned as recreational and productive ones (USUDS, 2013). Being the most iconic and abandoned public domain along Sayniq river, the railroad will cut through a pine forest that extends toward the Sayniq motorway.

- LCZ 4- Sayniq estuary garden: Being a hotspot zone that connects the waterfront of Saida and Tyre, the estuary will be re-configured as an overlooking ecological public space.

5.2. Broad Design Strategies: Riparian Remediation and Community Landscapes

To activate the proposed landscape character zones, the thesis considers a set of strategies within the public domain of Sayniq river that will re-conceptualize it as a focal destination for people from Ein El Helweh camp, Saida, and Ghaziye. The proposed strategies aim to rehabilitate the Sayniq river as an urban ecological corridor, a clean environment, and a linear amenity space that can improve the quality of the urban environment and enhance the urban living qualities in Saida.

The broad design strategy is divided into two parts: environmental and ecological remediation of the riparian corridor; and urban landscape design intervention to enable local community to use and enjoy the landscape of Sayniq river. For the Sayniq river to restore back its ecological integrity, there is a need to integrate a remediation aspect to reverse its dilapidated state.

5.2.1. Remediation Strategy

The remediation strategy of Sayniq river includes;

- the removal of the sewage infrastructure from the riverbed of Sayniq river to place it along the edge of the river.
- the re-location of 44 Zinco shacks and 13 multi-story residential buildings that encroached the riverbed.

- the restoration of Sayniq estuary to ensure its ecological integrity.

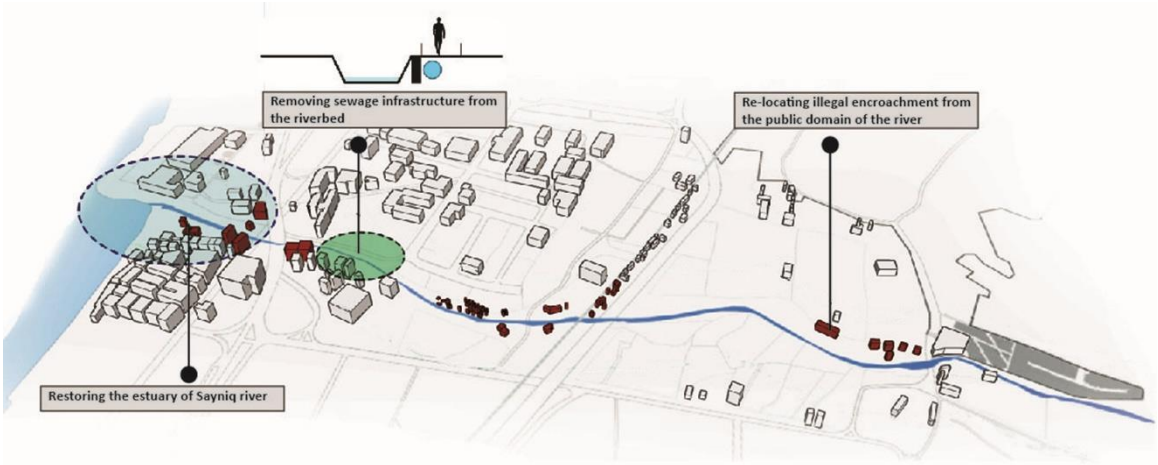


Figure 67. Remediation Strategy for Sayniq river. Source: Author

5.2.2. Urban landscape Design Strategy

The second part of the strategy aims to salvage the public domain of the Sayniq river from further illegal encroachments by creating a functional and recreational riverfront.

The strategy will provide an experiential journey along the river that connects the four proposed LCZs by providing an interactive and multifunctional network of open spaces, friendly pedestrian streets, and pedestrian pathways.

5.2.2.1. Open Spaces Network

The strategy will provide a series of ecologically engaged public spaces that will offer educational, recreational, and economic opportunities. The network of public open spaces will reconnect the public domain of Sayniq river to its context to create a vibrant

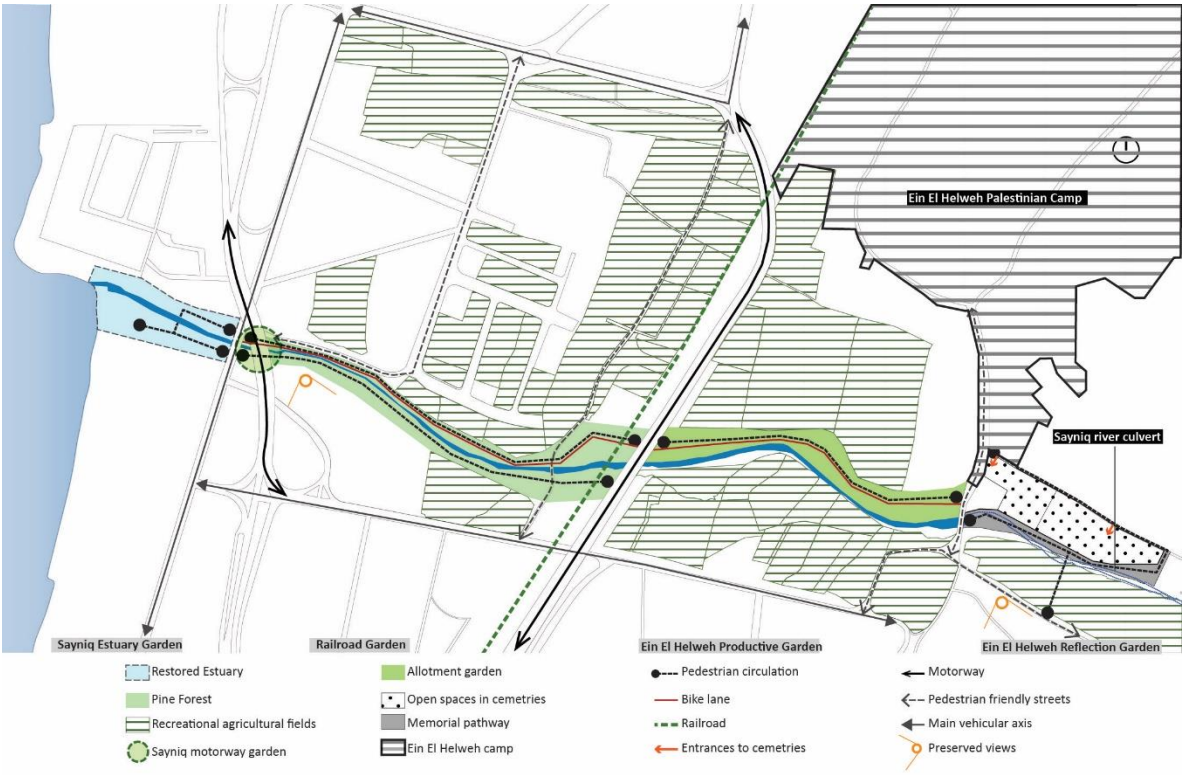


Figure 68. Urban landscape design strategy for Sayniq river. Source: Author

riparian landscape. The typologies of the open spaces differ at each zone in terms of their functionality and activity programs.

5.2.2.2. Spatial Connectivity

The strategy will provide a safe access for people to the public domain of Sayniq river by walking through the pedestrian friendly streets toward the river. People will walk along the Sayniq river through the continuous pedestrian pathways that will make them enjoy the different recreational, educational, and social experiences at each open space. They will also enjoy around 20 minutes of walking from the cemeteries toward the estuary. The pedestrian circulation includes a bike lane that extends about 1 km from the entrance of Ein El Helweh camp toward Maarouf Saad road. Working with the

existing topographic conditions, the strategy will ensure the visual connectivity by preserving the views of Maghdouche hills along the Sayniq river.

5.3. Framework for the Urban Landscape Design Intervention

5.3.1. Six Strategic Urban Landscape Design Interventions

Figure 69. Strategic framework for Sayniq river. Source: Author

The urban landscape design intervention along Sayniq river will provide a memorable and experiential journey for people who will enjoy the different functions and activities within the public domain of the river. The journey will start from the upper stream of Sayniq river in municipal Saida by walking down the stairs through the rows of tall pine trees to enjoy the seating platforms near the segregation wall.

The design will offer two options for the people; either they can walk to the memorial public plaza of the cemeteries or continue their walk toward the public spaces along the river. The public spaces near Ein El Helweh camp will not provide only social benefits, but also economic ones. This idea will be achieved through the integration of the bee keeping activity, in addition to the garden allotments that will act as an extension of the adjacent agricultural fields. During the walk, people will reach the rail

road pine forest that will be mainly used for picnics and social gatherings. The shading of the Sayniq motor way facilitated introducing a public plaza underneath it. Finally, the journey ends at the Sayniq estuary where people will overlook the densely vegetated terraces of the estuary, and enjoy the panoramic view of Saida and the hills surrounding it.

5.3.2. LCZ 1: Ein El Helweh Reflection Garden / Site 1

Figure 70. Ein El Helweh Reflection Garden, Site 1, Plan. Source: Author

The urban landscape design intervention of the cemetery aims to create a vibrant welcoming plaza for the Palestinian refugees visiting the graves of their beloved ones

Figure 71. Ein El Helweh Reflection Garden, Site 1, Section. Source: Author

weekly especially on Mondays and Thursdays. The design of the plaza offers the remembrance of Sayniq river by introducing water features that will be also used for cleaning the graves. The plaza includes organic pedestrian pathways, and the concrete benches with *Lagerstroemia Indica* tree planters and myrtle shrubs.

5.3.3. LCZ 1: Ein El Helweh Reflection Garden / Site 2

The urban landscape design intervention in this area will provide a series of concrete platform steps integrated with pine tree planters. The design aims to create a focal and vibrant destination that will recall the presence of the Sayniq river underneath it. It will also provide a rich aromatic experience for the people walking through it due to the pleasant smelling of the jasmine climbers covering the segregation wall of Ein El Helwe camp. Those climbers aim to break the rigidity of the wall to create a welcoming space for people.

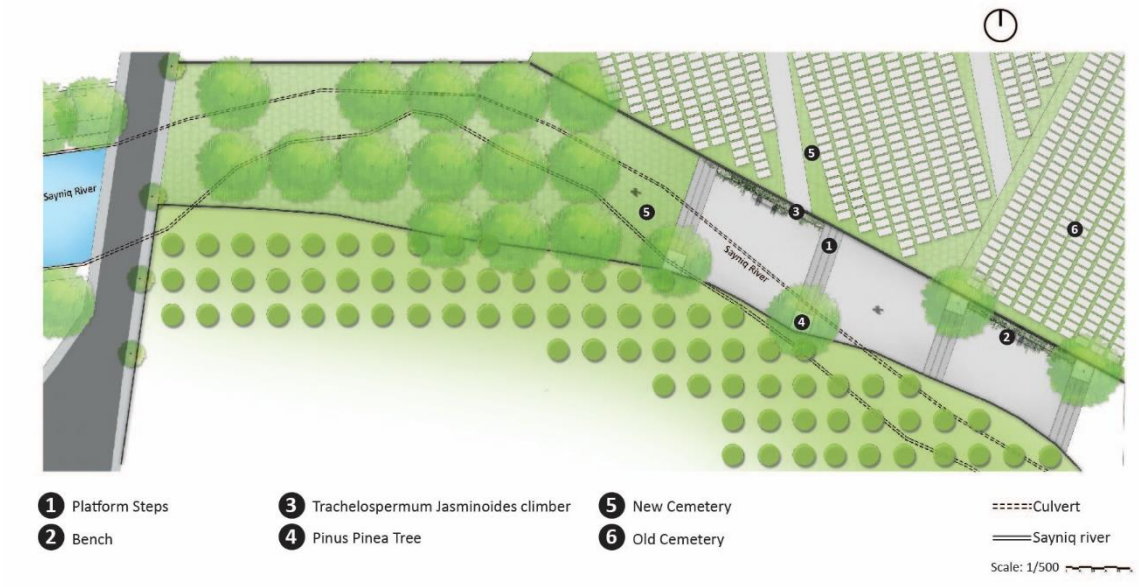


Figure 72. Ein El Helweh Reflection Garden, Site 2, Plan. Source: Author

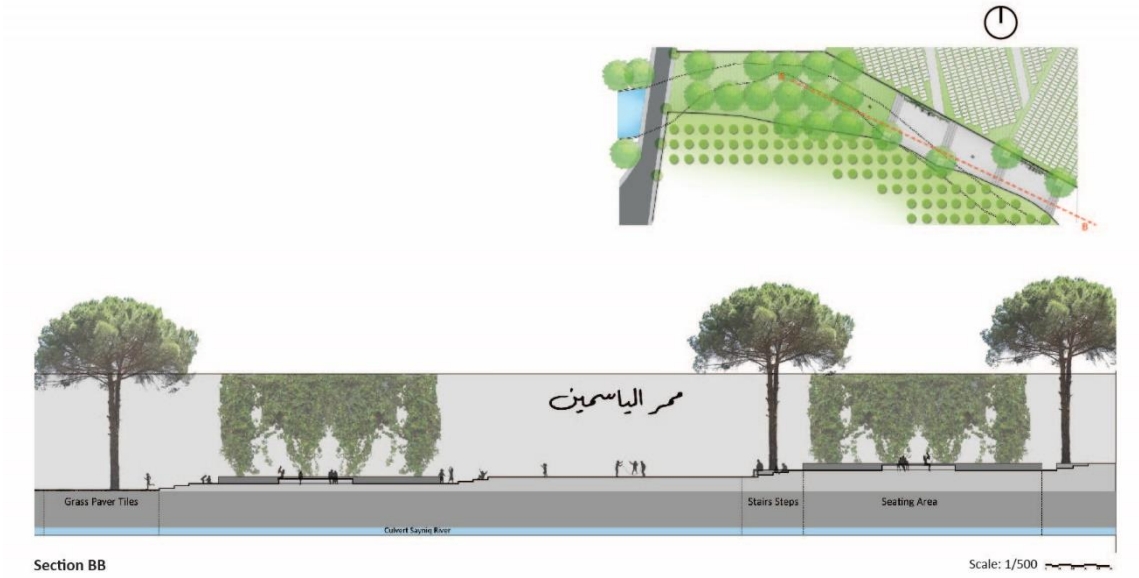


Figure 73. Ein El Helweh Reflection Garden, Site 2, Section. Source: Author

5.3.4. LCZ 2: Ein el Helweh Productive Garden / Site 3

This zone acts as the most active one among the networked open spaces. It is divided into two platforms of 0.5 meter difference. The top platform includes the garden allotments, seating areas, and bike lane while the bottom platform has the wide seating areas with a pedestrian pathway covering the sewage infrastructure. The riverbanks in this zone are stabilized with riparian plant species such as *Spartina Alternofolia* plant (Plants in Estuary Biomes, n.d) to prevent their erosion.

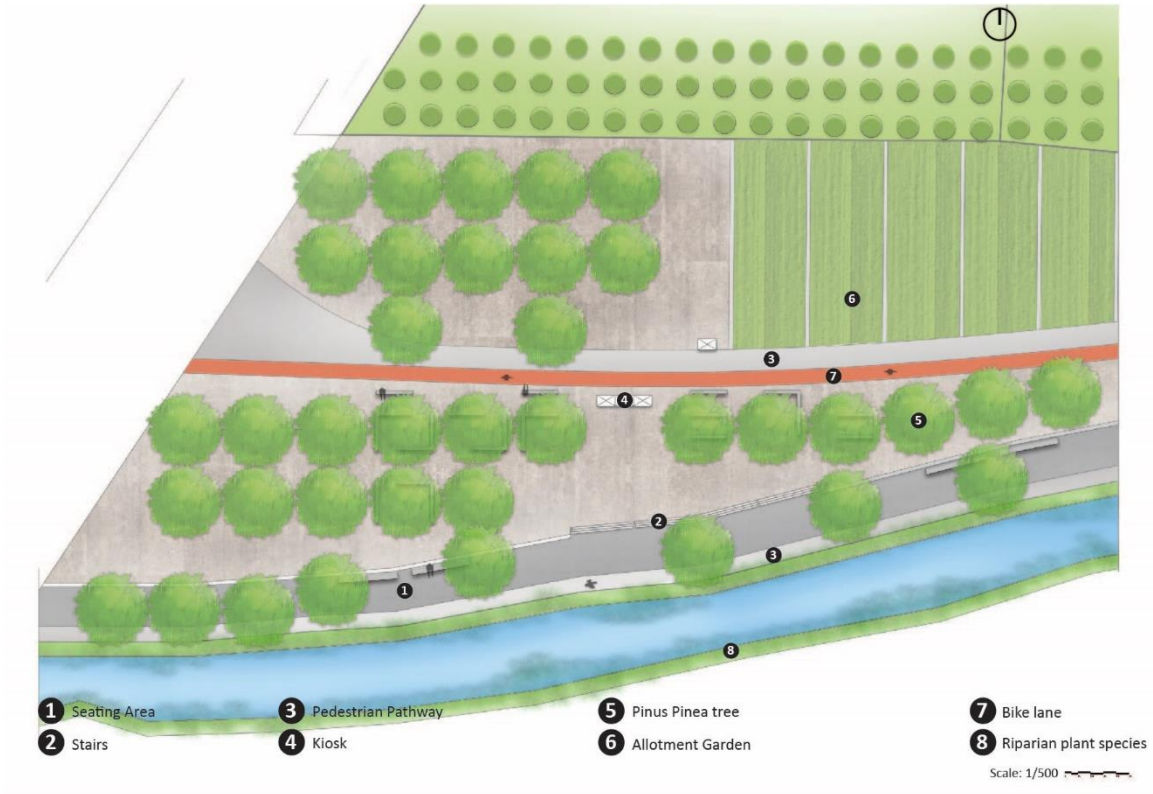


Figure 74. Ein El Helweh Productive Garden, Site 3, Plan. Source: Author

5.3.4.1. The Management of Garden Allotments

The underlying reason behind introducing these allotments adjacent to the agricultural fields is to create job opportunities mainly for the Palestinian women living in Ein El Helweh camp to empower them and emphasize their social role in the

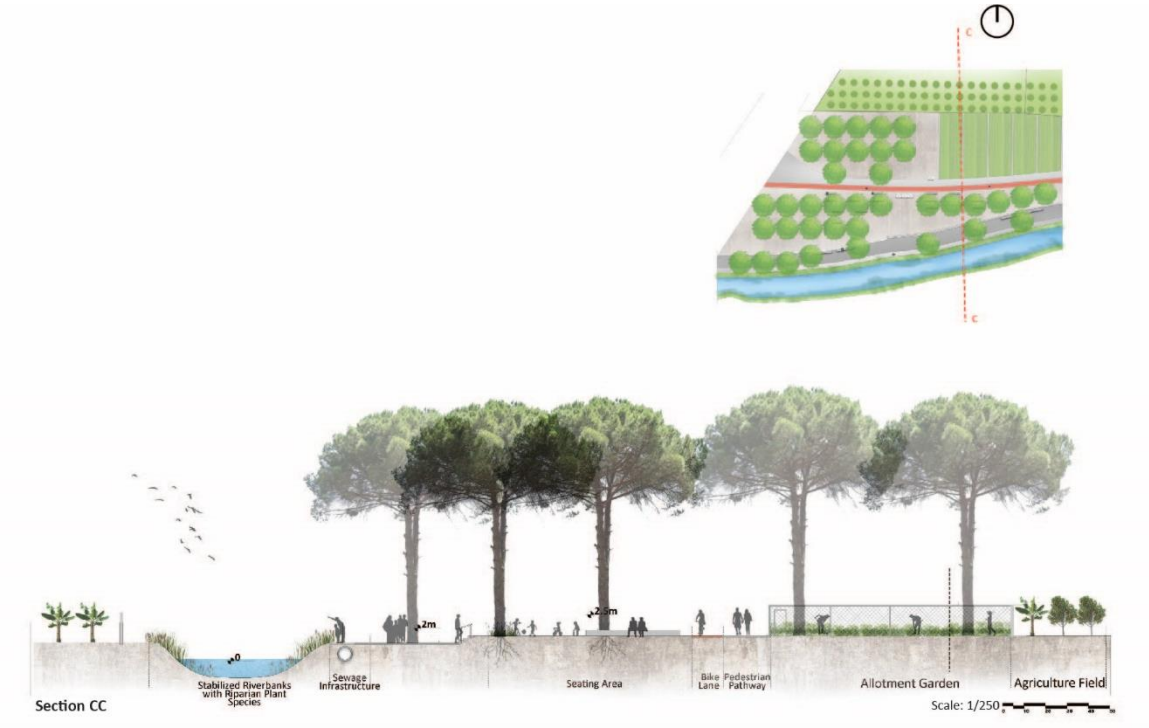


Figure 75. Ein El Helweh Productive Garden, Site 3, Section. Source: Author

Palestinian community. However, the management of these allotment in terms of renting the land, providing the vegetables seeds and maintenance requires joined efforts from the interested stakeholders which are;

- Saida's Municipality
- Women's Program Associations (WPA) in Ein El Helweh camp is an association introduced through UNRWA in 1953 that provides social services for women to empower them so they can enhance their living conditions (WPA, n.d).
- Palestinian Liberation Organization (PLO)
- Agricultural fields Landowners

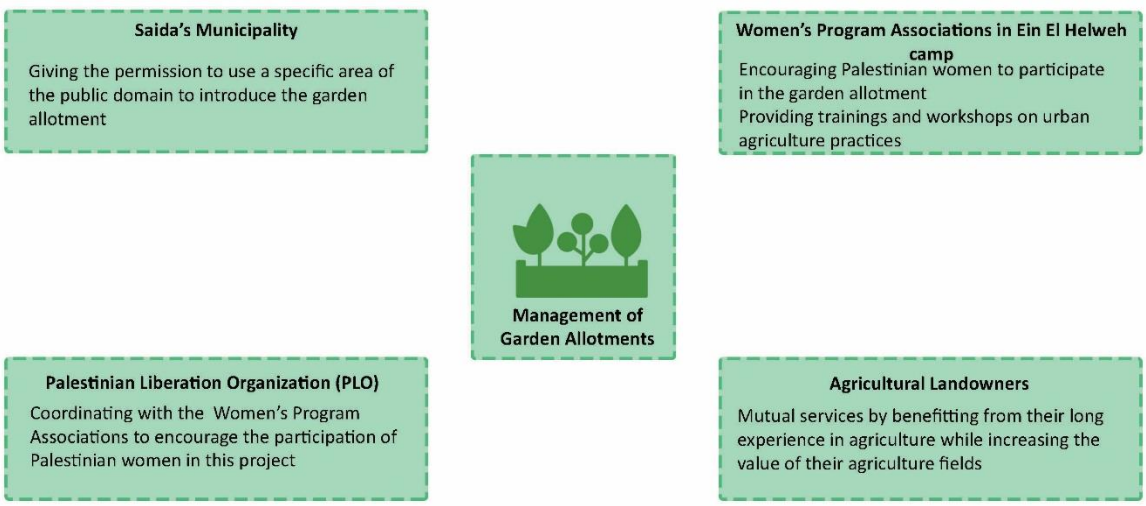


Figure 76. Stakeholders for managing the garden allotments. Source: Author

5.3.5. LCZ 3: Railroad Garden / Site 4

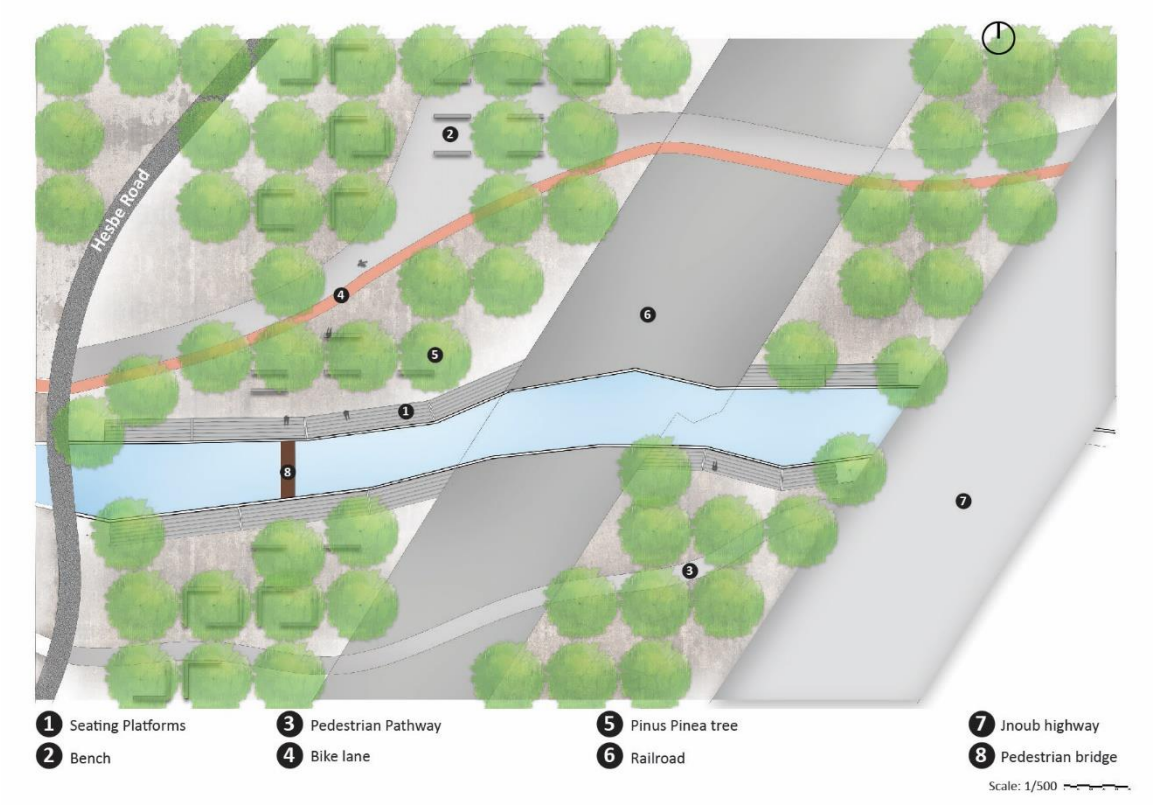


Figure 77. Railroad Garden, Site 4, Plan. Source: Author

Figure 78. Railroad Garden, Site 4, Section. Source: Author

The design in this zone offers a dense forest of tall pine trees, and it includes seating areas, pedestrian pathways and bike lane. The function of this area is predominantly social and recreational such as preparing picnics and attending social gatherings. People will enjoy walking along the railroad surrounded by the pine trees while overlooking the Sayniq river. The typology of the riverbanks consists of stairs steps toward the river that connects both edges with a pedestrian bridge.

5.3.6. LCZ 3: Sayniq Motorway Garden / Site 5

The design of this public plaza offers a platform of 15-meter length that covers the Sayniq river thus acting as a vibrant public plaza with seating areas and kiosks for people. This plaza will help in decreasing the vehicular traffic along Maarouf Saad road since it will offer the people, sitting on the sidewalks, with a shaded public plaza.

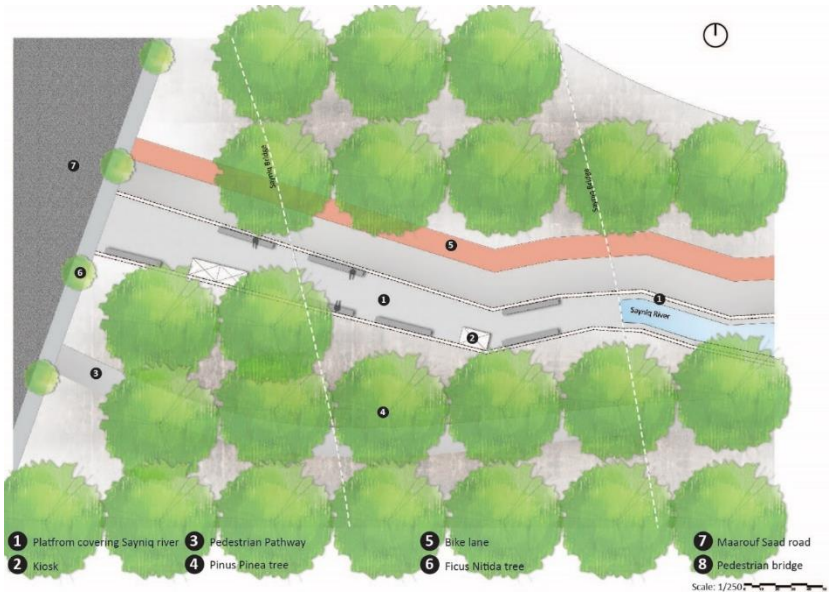


Figure 79. Sayniq Motorway Garden, Site 5, Plan. Source: Author

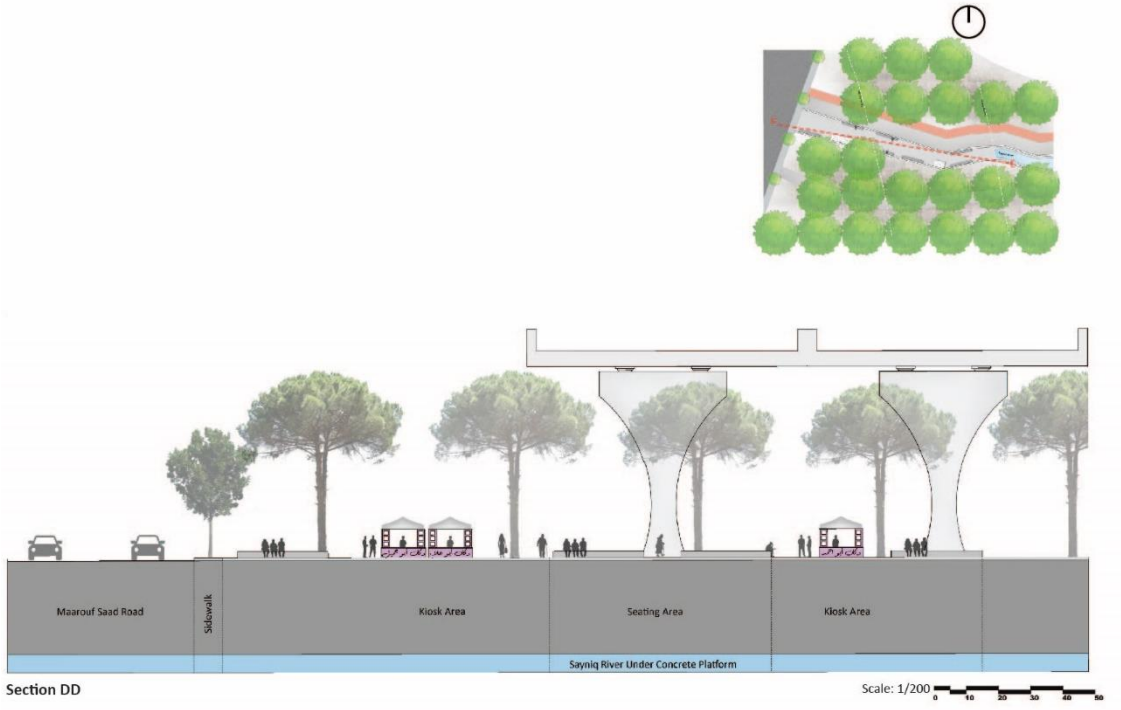


Figure 80. Sayniq Motorway Garden, Site 5, Section. Source: Author

5.3.7. LCZ 4: Sayniq Estuary Garden / Site 6

The design will restore the Sayniq estuary to act as an overlooking panoramic vista. The restoration of the estuary includes working with the existing topographic

conditions, and modifying the channel of the river to introduce vegetated terraces with different riparian plant species such as Tamarisk trees. The elevated platform over

Figure 81. Sayniq Estuary Garden, Site 6, Plan. Source: Author

Sayniq estuary will offer the opportunity to walk between the Tamarisk trees, while enjoying the panoramic view of the sea. Consequently, the estuary on the long term will be an attraction spot for fauna such as *Larus ridibundus birds* (Wild Lebanon, n.d) and flora such as *Spartina Alterniflora plan* and *Lythrum Salicaria* (Plants in Estuary Biomes, n.d). It will also recall and mimic the picnics and social gatherings that had been taking place along the estuary in the past times.

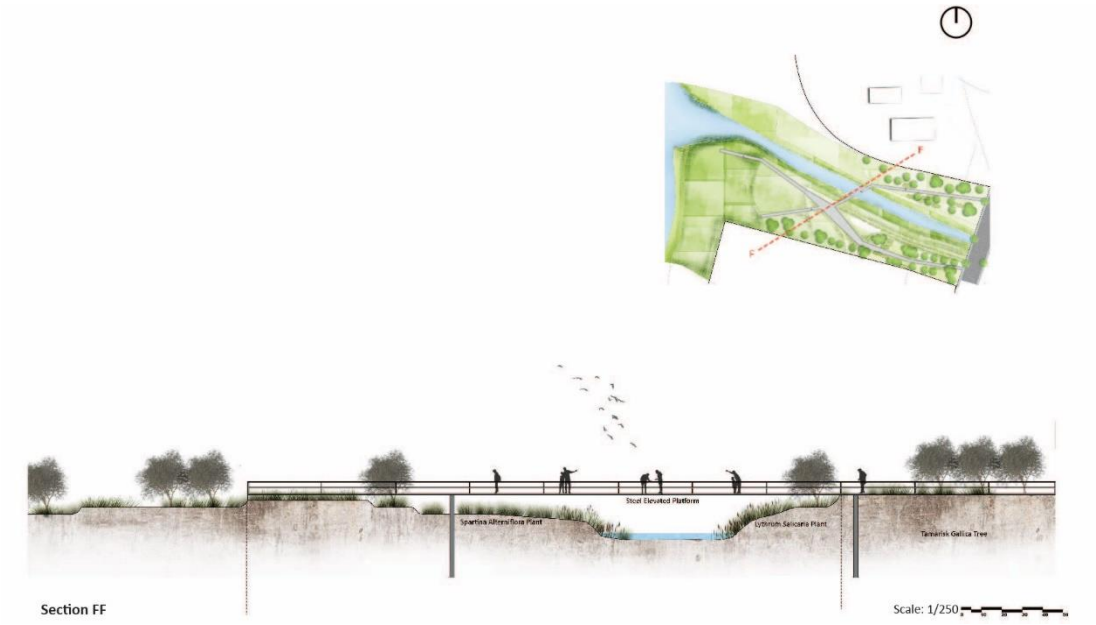


Figure 82. Sayniq Estuary Garden, Site 6, Section. Source: Author

5.4. The Management of Sayniq river

The management of Sayniq river initially falls under the responsibility of the Saida-Zahrani federation of municipalities. The political deadlock in this union act as a challenge toward implementing any efficient management practices for Sayniq river. Therefore, an alternative management schemes must be adopted that include the main and secondary stakeholders.

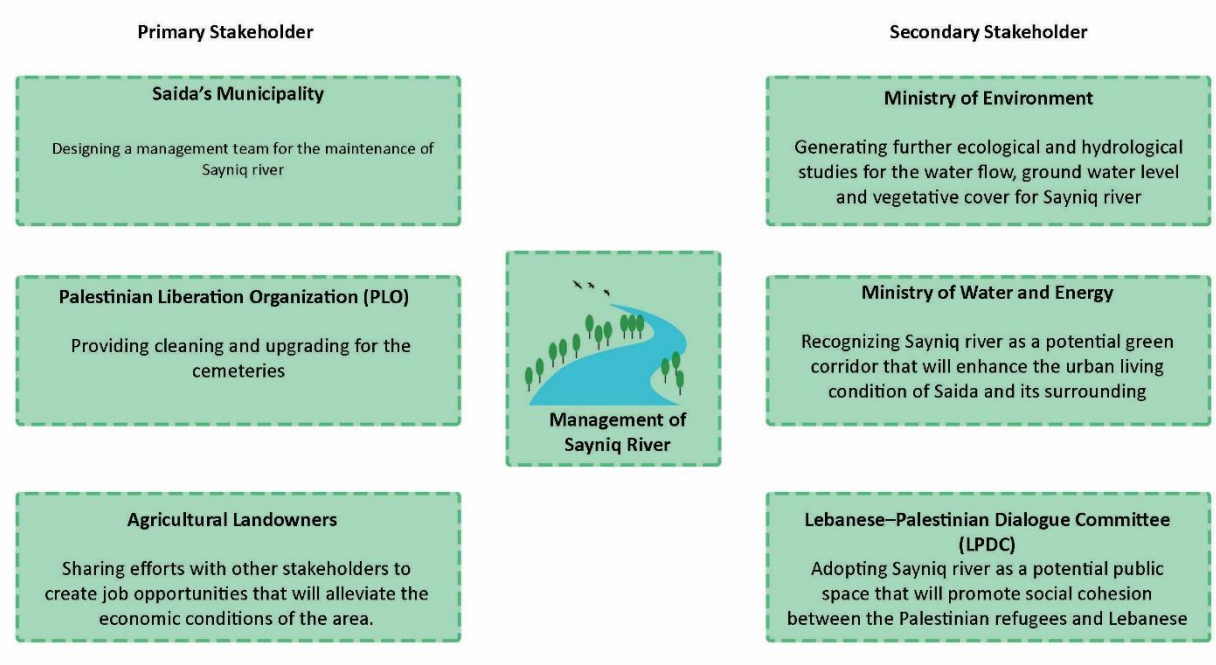


Figure 83. Primary and secondary stakeholders for managing Sayniq river. Source: Author

CHAPTER 6

CONCLUSION

6.1. Recommendations for the Management of Sayniq Watershed

My original intention was for the thesis research to generate a framework for sustainable management of the Sayniq River that builds on the natural and cultural assets of the watershed. By identifying Ecological Landscape Associations, the ecological landscape design methodology served; (a) as an analytic tool, a framework for understanding the complexity of riparian natural systems (geomorphology, hydrology and natural vegetation) and cultural layers (settlements, agriculture, infrastructure), and (b) as components that structure the urban design and can be integrated into the proposed intervention.

The key throughout research and analysis, concept development and design of the Sayniq river has been the integration of built-up and open landscapes, natural and cultural components, environment and local communities. Although the recommendations proposed are structured into ecological, cultural and planning dimensions, the overlap between the three is a given.

6.1.1. The Ecological Dimension

- **Reclaiming the remaining woodlands in Sayniq watershed as part of the natural reserves in Lebanon**

This recommendation targets predominantly Woodland/foothills Ecological Landscape Associations (ELA 1). The first step is to remove the unidentified land mines from these woodlands. The second step is to connect the remaining woodlands in the

upper stream of Sayniq watershed as an extension of Al Rihane biosphere reserve (*https://www.jabalrihane.org/)* found at the eastern limit of the watershed. The steep topography at higher altitudes, coupled with the fluctuations in the water level of Sayniq river will leverage a robust ecological landscape. This in turn will retain back the watershed as a focal destination for eco-tourism and recreational activities.

- **Integrating the garrigue scrubland as part of the Sayniq riparian corridor**

This recommendation targets predominantly Scrubland/ Foothills Ecological Landscape Association (ELA 2) and Built/ Foothills Ecological Landscape Association (ELA 5). The aim is to integrate the garrigue scrubland concentrated along Sayniq river and its tributaries as part of a green ecological corridor at the scale of the watershed. This recommendation has a double effect since it will also protect the river from the urban expansion in the foothills.

6.1.2. The Cultural Dimension

- **Upgrading and supporting the agricultural sector**

This recommendation targets Agriculture/ Foothills Ecological Landscape Association (ELA 3) and Agriculture/Coastal Ecological Landscape Association (ELA 4). The thesis recommends preserving the existing agricultural fields (arable and terraces) of olives and citrus trees since they represent significant cultural landscapes for the Sayniq watershed. Preserving the agricultural fields entails introducing trainings and workshops to the farmers on advanced urban agricultural practices (Ministry of Agriculture, 2000), organic farming (FAO, n.d) and integrated pest management (FAO, n.d). In addition, it is necessary to encourage small businesses related to agro-industries

(USUDS, 2013) such as local grocery markets and olive oil pressing industry. These recommendations are in line with actions to combat Global Warming and the eminent threat of desertification (Ministry of Agriculture, 2000). The marginal terrain in the Sayniq watershed is better suited to small farming enterprises rather than the large-scale, mechanized agriculture of the Beqaa Valley.

- **Reclaiming the tributaries of Sayniq watershed and restoring the cultural significance of the springs**

Diverting the sewage infrastructure from the riverbed of Sayniq river, in addition to relocating the quarries away from the channel of the Sayniq river and its tributaries. This in turn will favor using them as hiking trails seeping through the valleys of Sayniq watershed.

With the drastic drop in ground water table, and the extensive use of mechanical pumping, the source springs in the watersheds, often in and close to towns and villages, have lost their significance. The recommendation is to protect the springs because of their historical and cultural significance as a communal space even if most have lost their significance as a waterhole.

- **Integrating the mixed land uses in ELA 6**

The thesis recommends integrating mixed land uses such as restaurants and cafes besides the existing industrial land uses in Saida-Dekerman. This in turn will support the recreational and leisure uses of Sayniq river.

6.1.3. The Planning Dimension

Seeing that the Sayniq watershed spreads across three Union of Municipalities (Saida-Al Zahrani, Jezzine, and Eqleem El Toffah), to avoid duplication, I recommend that a committee is established by a state decree XXX/2021 representing all three Unions of Municipalities to manage Sayniq watershed. It is only through an integrative governance framework for the Sayniq watershed that the collaboration of all three Union of Municipalities can be secured. The joined efforts between Jezzine and Eqleem El Toffah municipal unions in resolving the issue of sewage infrastructure in Sayniq river shows the willingness for effective coordination and cooperation toward the efficient management of Sayniq watershed.

The legal committee will strive to protect the Sayniq river as a green ecological corridor while maintaining its ecological integrity in the watershed. The responsibilities of this committee will be;

- Proposing new environmental policies that will protect the public domain of Sayniq river at the watershed scale, thus maintaining its ecological integrity in the watershed.
- Securing an effective coordination between the municipalities of the three municipal unions.
- Monitoring the process of implementing the strategic recommendations needed including protecting woodlands and scrublands and removing the sewage infrastructure.

The management of the watershed will remain inefficient, unless the involved ministries such as the Ministry of Environment and Ministry of Water and Energy approve the mission of the legal committee and support it.

6.2. A Prototype for Rehabilitating Rivers in Lebanese Coastal Cities

Rivers are multifunctional and interconnected corridors that require the contribution from the several overlapping disciplines, ecological science, landscape ecology, and urban development strategies. The Ecological Landscape design and planning approach encouraged a flexible, holistic and responsive aspect to the urban planning recommendations and the urban landscape design intervention for Sayniq river.

6.2.1. Sayniq River: A threatened watershed

The analysis of the Sayniq watershed depicted the changes in the role of the watershed from a recreational into a threatened one. It highlighted the natural assets in terms of the dense woodlands, and garrigue scrubland, in addition to the cultural assets in terms of the agricultural lands, springs and the built up areas. The efficient management of the watershed builds on these assets as an underlying foundation for its cultural and ecological performance. The analysis also portrayed the natural and anthropogenic stressors that suppress the efficiency of the watershed.

The sustainable management of the watershed builds on the Ecological Landscape Associations as main pillars for proposing a set of recommendations from an ecological, cultural, and planning dimensions.

6.2.2. Sayniq River: A Municipal Space

The analysis of the Sayniq river in Saida, focus area of the urban and landscape design intervention, reflected the complexity of the river and its great potential in alleviating the urban qualities for the inhabitants in Saida. The case study demonstrated the Landscape Character Zones (LCZs) of the river including the existing conditions and their social, ecological, environmental, and economic issues.

The urban landscape design intervention entailed proposing new Landscape Character Zones (LCZs) as the guiding principles for the proposed strategies. The urban landscape design intervention answered the research questions through the proposed broad strategies and the five strategic design interventions. The proposed strategies included a riparian remediation and created community landscapes along the Sayniq river in Saida. The remediation process aimed to mitigate the impact of the environmental problems and re-locate the illegal encroachments along the Sayniq river. The urban landscape design strategy aimed to provide an accessible and interactive riverfront. It ensured the spatial integrity of Sayniq river by retaining back the pedestrian access to the river. The six strategic sites for the urban design intervention provided different functions and activities along the Sayniq river.

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