



Beneath the pavement, the beach

A semantic exploration of time, space, and
their volume of permutations through
Lebanon's littoral

Acknowledgments

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All the drawings in this thesis are drawn by the author
All the photographs in this thesis are taken by the author unless stated otherwise

Abstract

This thesis is about the convergence of two boundlessly enigmatic dimensions; turbulent coastal morphodynamics of a vanishing coastline in the presence of acute geo-political conflict. The Lebanese coastline undergoes a permutation of intertwined anthropogenic and natural forces, ensuing its exponential recession, deterioration, and inaccessibility. Its geographical location on the eastern edge of the Mediterranean exposes it to powerful environmental forces that materialize as destructive storms and pose a significant susceptibility to earthquakes and tsunamis. Its ongoing history of immutable geopolitical conflict has resulted in calamitous wars and corrupt power networks, distorting entitled spatial rights and access to shore space. These problematics culminated in my endeavor to pose and decipher the following research question; How can the understanding of Beirut's coastline as a series of extreme environmental and anthropogenic permutations inform its design agency, programming a coastal space that functions as an autonomous littoral landscape while simultaneously attaining spatial justice for its inhabitants? This project argues that it is imperative to acquire an analytical approach that anticipates the permutation scenarios and their occurrence in conjunction with one another when addressing conflicted littoral landscapes. Focus is then narrowed through the tactical selection, analysis, and design proposal of Beirut's shores and the instances of violation along them, as a unique opportunity to address a microcosm of extremes. Through the synthesis of literature on the perception of territory, indeterminacy, temporal landscapes, and the dichotomy between man and nature, I adopt an approach through which my methods of analysis and design interventions emerge. Thorough investigations lead to the realization that the answer to such a question simply lies in the intrinsic characteristics of the littoral landscape. It possesses power in its innate attributes, which have been completely removed in the context I am investigating through the imposition of fragments on what used to be a coastline but is now reduced to this hard edge, separating two highly contrasting worlds, eliminating the transitional space in between that is necessary to exist for them to coalesce harmoniously. The objective of the project becomes about bringing back the beach; a liminal space that is neither land nor sea, a threshold zone that recognizes malleability and uncertainty in this highly conflicted context, where something so simple could be the answer to such profound complexities. I hypothesize that, in such dire conditions of extremes, achieving this goal would necessitate the adoption of an alternative lens. This lens would identify potentialities and accordingly, maximize them, while questioning the limitations of time, bending it, and treating it as a site of intervention. This is achieved through an analytical approach of cartographic and graphic interpretation, identifying which of these fragments still allow for such a threshold space of liminality to exist, and to what extent. The project would then communicate with these identifications, and accordingly determine the characteristics of this new form of beach that will manage to coexist with the extensively analyzed fragments. This is followed by a set of critical morphological actions and a series of seed interventions, directly reacting to the distinct scenarios manifesting on each fragmented shoreline while interacting with one another in concert to symbiotically generate these fragments of beach conditions as a diffused state of being. These alterations would engender tangible and intangible consequences occurring over various spatiotemporal scales. The culmination of these actions becomes a canvas through which a mere shift in perspective makes room for impact in this case of copious impossibilities.

Key words: Lebanon's littoral, coastal morphodynamics, permutations, liminality, geopolitics, time

Table of Contents

I. Introduction	8	VI. Revised Progression	73
i. Problem statement	8	i. Revised hypothesis	73
A. Permutations & Uncertainty	11	ii. Further research	75
B. A brief summary of the predominant natural forces	11	A. The ecological, cultural, and historical importance of the beach	75
C. A brief summary of corruption, violence, and conflict	15	iii. Definition of the beach	77
ii. Problem scope: the case of Beirut	18	iv. Further assessment and entry point	78
A. Illegal privatization - Beirut	20	VII. Framing the project: The canvas	105
B. Informal coastal slums - Ouzai	24	i. Defining criteria	108
C. Extreme maritime pollution - Ramlet al Bayda	26	ii. Morphological actions	110
D. Post-explosion port - Port of Beirut	28	A. Morph 1: hinging through time_terminal 16/34	114
E. Coastal dumpsites - Costa Brava & Bourj Hammoud	30	B. Morph 3: Morph 2: Hinging through time_Port of Beirut	118
F. Coastal Airport - The Beirut Rafic Hariri Airport	33	C. Morph 3: Subtraction_Bourj Hammoud landfill	118
II. Research Question	33	D. Morph 4: Hinging through time_Biel Waterfront	126
i. Main research question	33	E. Morph 5: Addition_Sandy shores of Ramlet al Bayda and Ouzai	132
A. Analysis subquestions	33	F. Morph 6: Addition_Dalieh rock formation	138
B. Design subquestions	35	iii. Seed interventions	146
C. Design subquestions	35	iv. Intangible elements	169
III. Methodology	35	VII. Conclusion	172
i. Literature and research framework	35	i. Closing	172
ii. Assessment and data collection	37	ii. Reflection	174
iii. Preliminary hypothesis and design outcomes	37	IX. Bibliography	180
IV. Literature Review	43	X. Appendix	185
i. Theoretical underpinning	43		
A. Territory and state	43		
B. Territory as a volume	44		
C. Designing for uncertainty	44		
D. Indeterminacy	45		
E. Human, non-human	47		
ii. Precedents	48		
V. Assessment	50		
i. Studio essentials	50		
ii. Studio intensives - Geographical Urbanism	51		
iii. Monographies - line of inquiry	52		
A. Matter	55		
B. Topos	55		
C. Habitat	58		
D. Geopolitics	62		

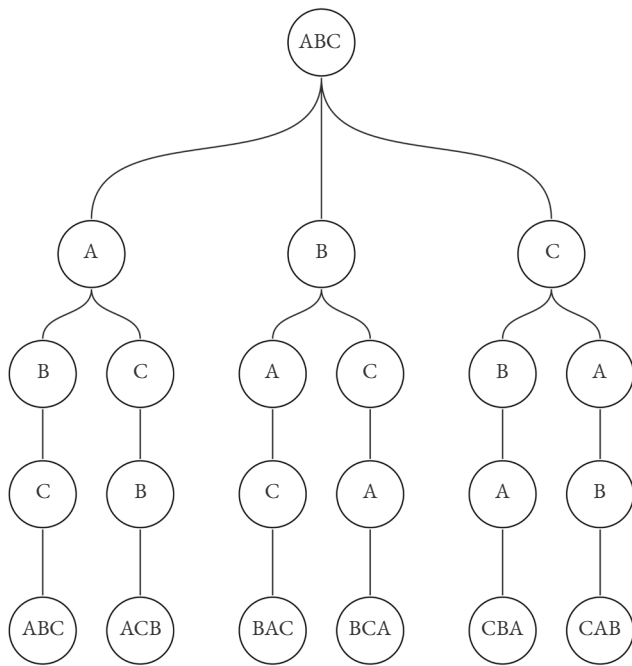
I. Introduction

i. Problem Statement

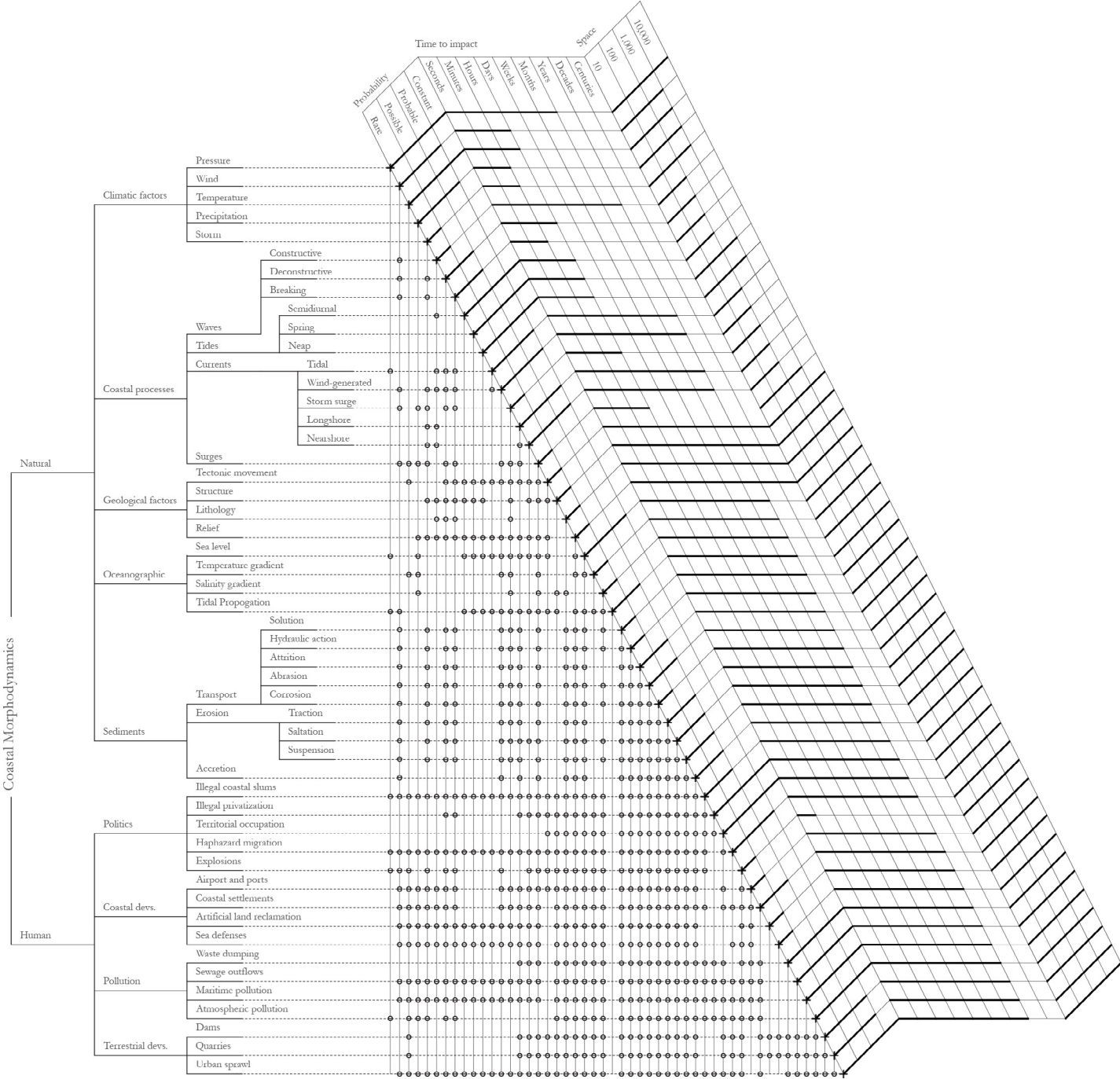
Coastal morphodynamics is determined by [A] a permutation of environmental and anthropogenic mutations, rendering coastal landscapes as highly uncertain and vulnerable. This is especially pertinent and amplified in the context of the Lebanese coastline, as it is defined by its [B] narrow geometry coalesced with powerful natural forces and [C] exceptionally turbulent human activity. Consequently, the uncertainty of coastal natural forces combined with the country’s entrenched political conflict, corruption, and violence has resulted in a largely inaccessible and exponentially deteriorating coastline.

[A] Permutations & Uncertainty

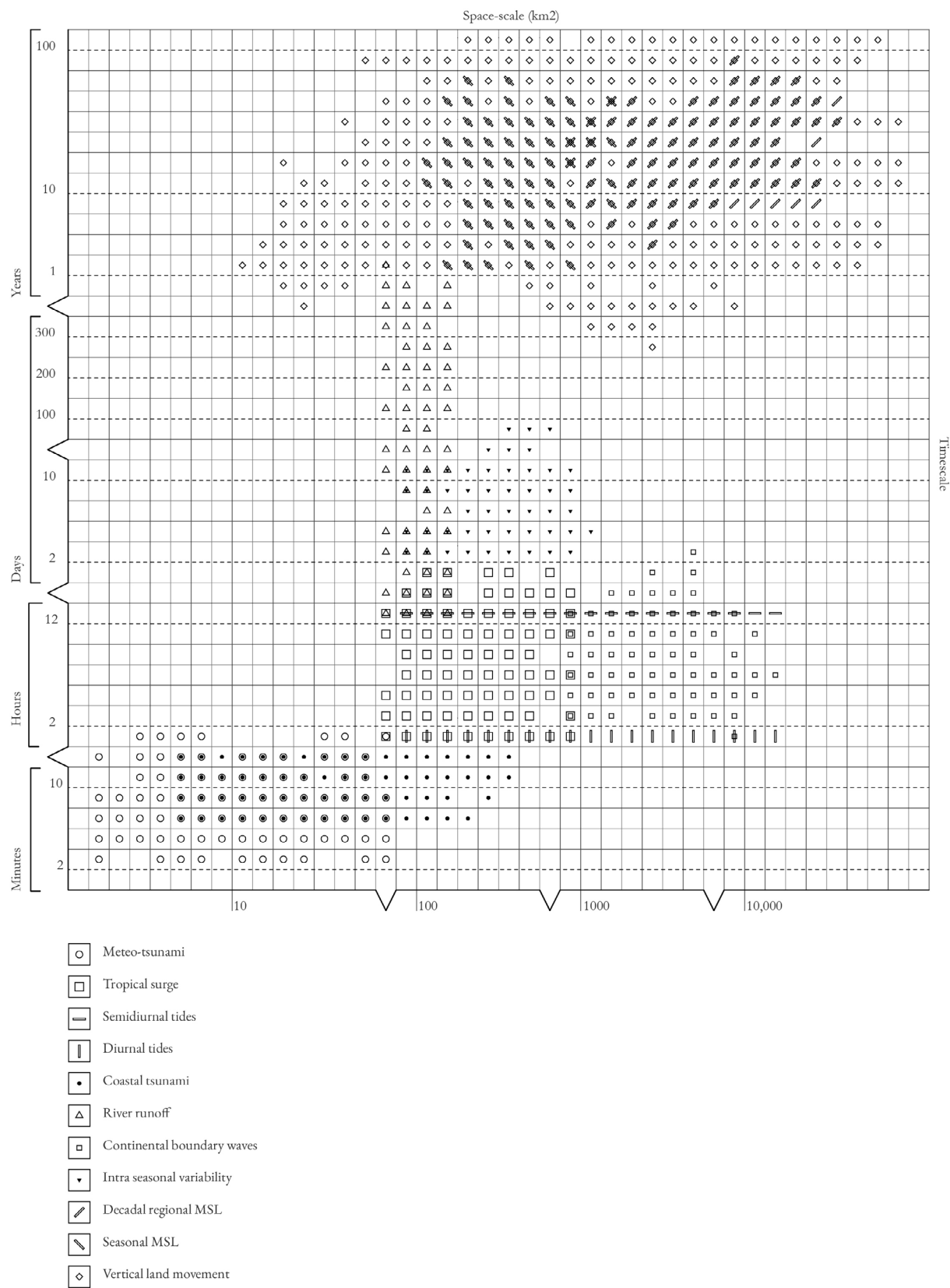
A permutation is a mathematical technique that determines the number of possible arrangements of a set of variables [Drawing 1]. There exists a myriad of factors that determine and influence the morphology of a coastal landscape, conventionally distinguished into anthropogenic and natural forces. While these forces are heavily addressed and studied individually, the probability and consequences of their occurrence in conjunction with one another are overlooked. The large permutation of environmental and anthropogenic occurrences results in a stochastic number of possibilities [Drawing 2], impossible to account for simultaneously, yet crucial to dissect and understand. The coastline under investigation is subject to extreme forms of such forces, which manifest across various temporal and spatial scales [Drawing 3]. Contemporary approaches to address such conditions revolve around attempts to unreservedly control nature through static interventions that neglect both, the uncertainty diagnostic of natural forces in conjunction with anthropogenic disruptions. Furthermore, there exists a lack of planning approaches that can reconcile the varying spatial and temporal scales that are integral to systems operating across coastal landscapes, especially ones consumed with deep levels of conflict.



Drawing 1. Permutation of possibilities for scenario “ABC”



Drawing 2. Permutation of forces determining the coastal morphodynamics of the Lebanese littoral



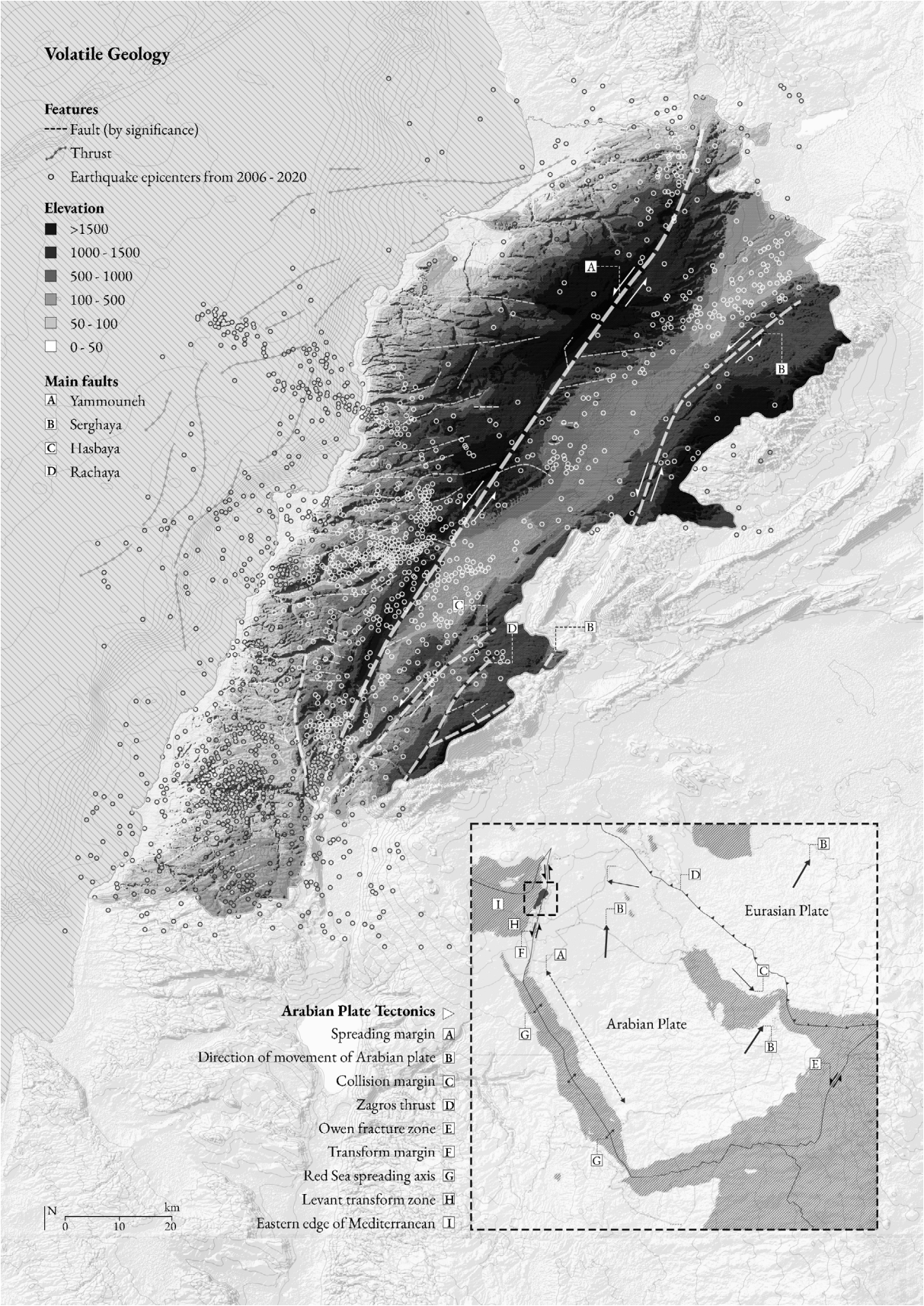
Drawing 3. Time-space matrix of natural forces occurring on the coast, the space they occupy, and the time it takes them to do so, on a logarithmic scale

[B] A brief summary of the predominant natural forces

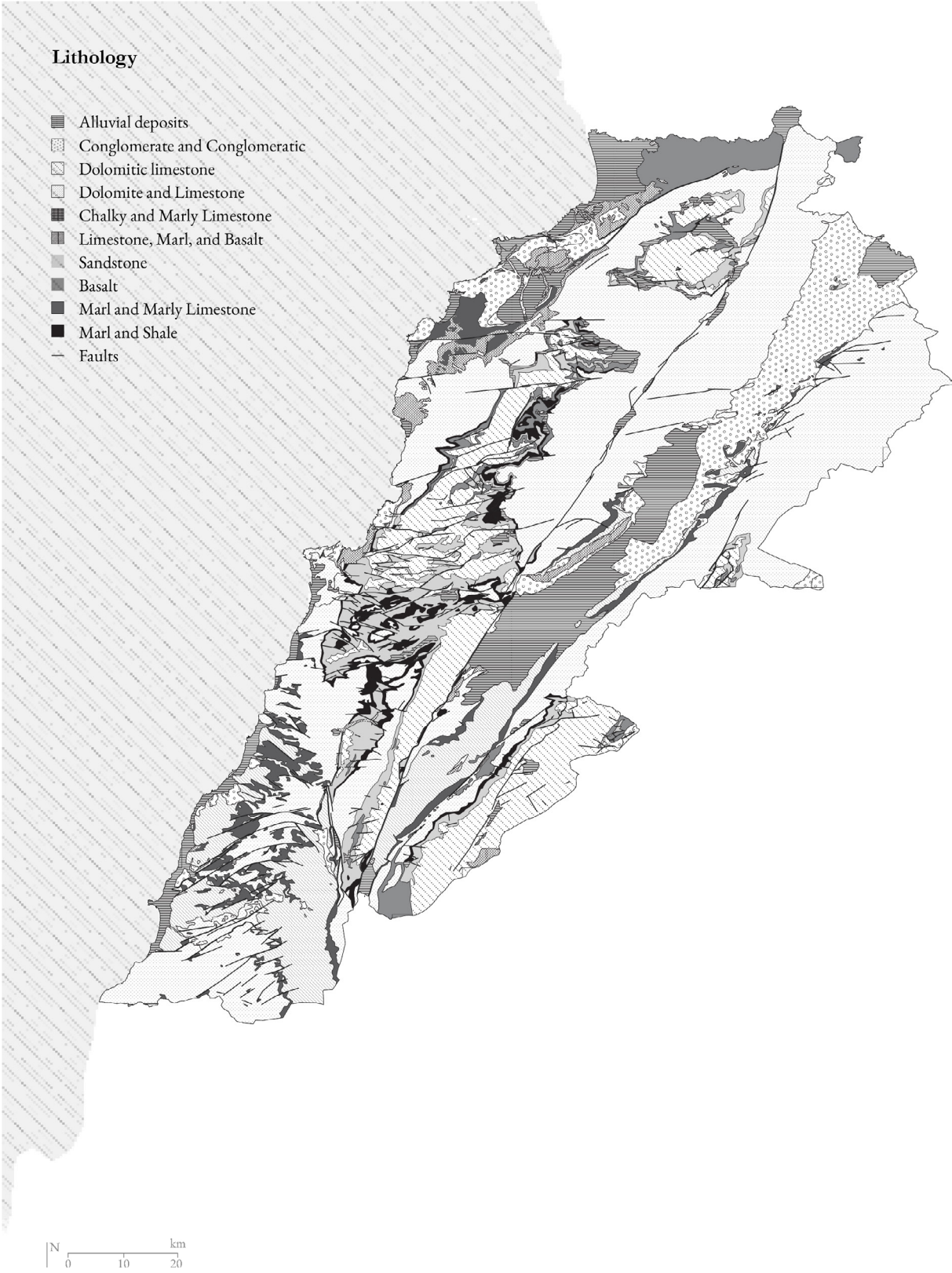
The Lebanese coastline extends about 230 kilometers in length from south to north, characterized by its narrow continental shelf (a maximum width of ten kilometers dropping abruptly to water depths of 1500m) and geolocation between the Mount Lebanon mountain range and Mediterranean Sea (Ministry of Environment & UNDP, 2011) (Walley, 1998). The coastline's particular location on the eastern edge of the Mediterranean makes it vulnerable to varying magnitudes of natural forces, hazards, and disasters manifested in the form of heavy rainfall, drought, flooding, earthquakes, tsunamis, and landslides [Drawing 4]. The shoreline is affected by an erosion rate of 45.24%, primarily due to its exposure to massive winter storms, generated by North-Eastern high-speed currents (Faour & Hamzé, 2014). Coastline erosion is aggravated by the plethora of embankments and sand extraction, which also heavily fragment the coastline. Flooding in Lebanon is mainly caused by irregularities in rainfall patterns instigated by the globally rising temperatures and the predominance of impermeable surfaces. In terms of its geology, Lebanon lies astride an active plate boundary, known as the Levant Fault System (where the eastern Arabian plate is sliding northward and clockwise relative to the Sinai plate) while simultaneously facing another significant plate boundary over Cyprus, known as the Cyprus Subduction Zone (Elias, 2015). Lebanon is situated amid these active zones, highly influenced by the relative motion of these plates, making the occurrence of earthquakes highly probable (Hawie et al., 2013) [Drawing 6]. Studies have revealed that such formations can generate the largest earthquakes (of magnitudes equal to or more than 8), consequently resulting in secondary coastal and inland hazards, such as tsunami waves and landslides. Such occurrences would completely obliterate the littoral zone and all its anthropogenic traces, as it is already subject to soil liquefaction due to the heavy construction on its alluvial plane (for instance, the airport) (Elias, 2015).

[C] A brief summary of corruption, violence, and conflict

Lebanon's modern history is characterized by its corrupt sectarian political and religious strife combined with its ongoing conflict with neighboring states (such as Israel, Syria, and Iran). The succession of such conflicts accumulated into a series of wars, economic collapses, and increased sectarian polarization, resulting in the current state of general chaos and loss. A few of such numerous occurrences include the fifteen-year civil war (1975-1991), the Israel invasion (1982-1985), the assassination of the prime minister (2005), the July war with Israel (2006), the October uprising (2019), and the August 4 port explosion (2022). As a result of the accumulation of conflict in the region, the coastline is highly fragmented, inaccessible, and hosts copious forms of contraventions with deep complexities. This includes distinct scenarios, each manifesting independently, but contributing to the collective disintegration of the 230-kilometer coastline. In addition to the country's severe lack of public spaces, the littoral zone is scarcely accessible despite its legal public nature.



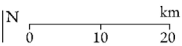
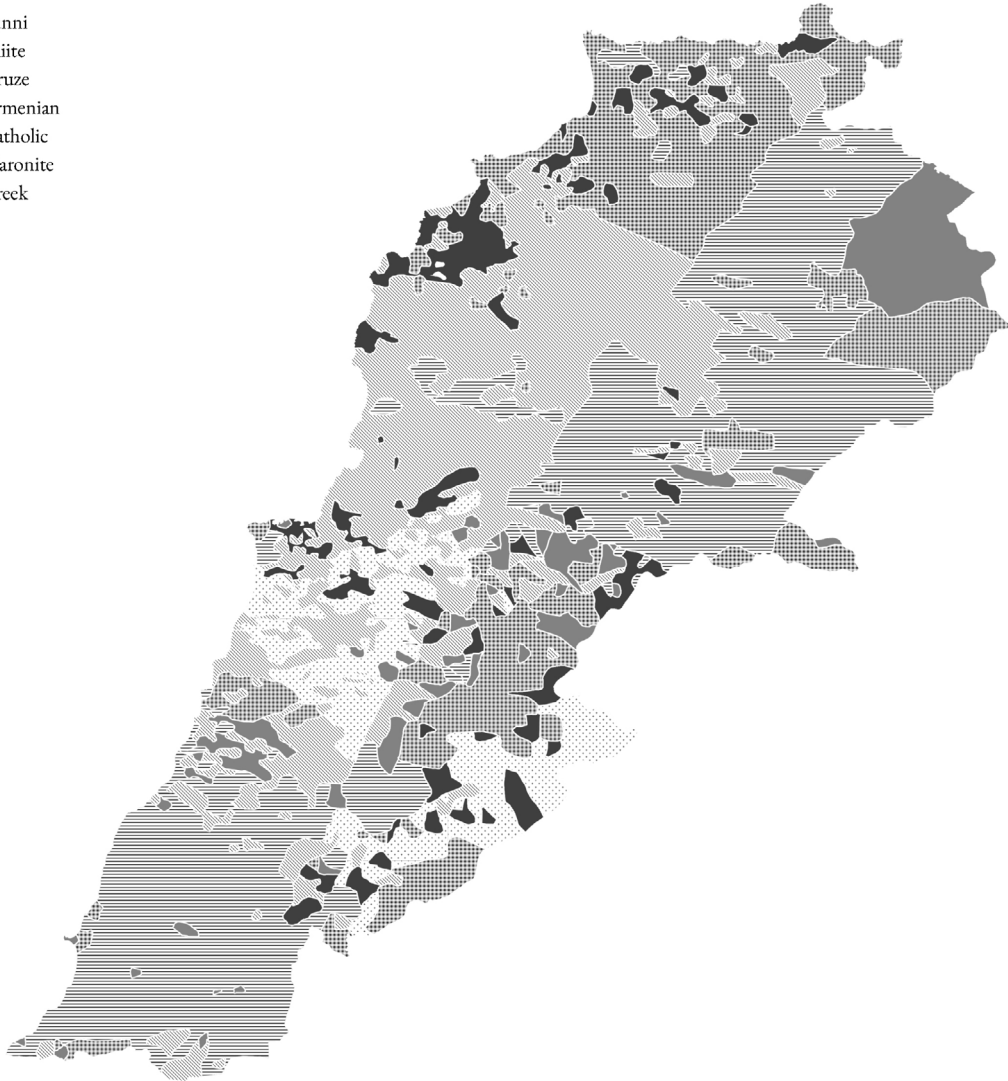
Drawing 4. Geological features and unstable tectonics



Drawing 5. Lithology in relationship to the fault lines

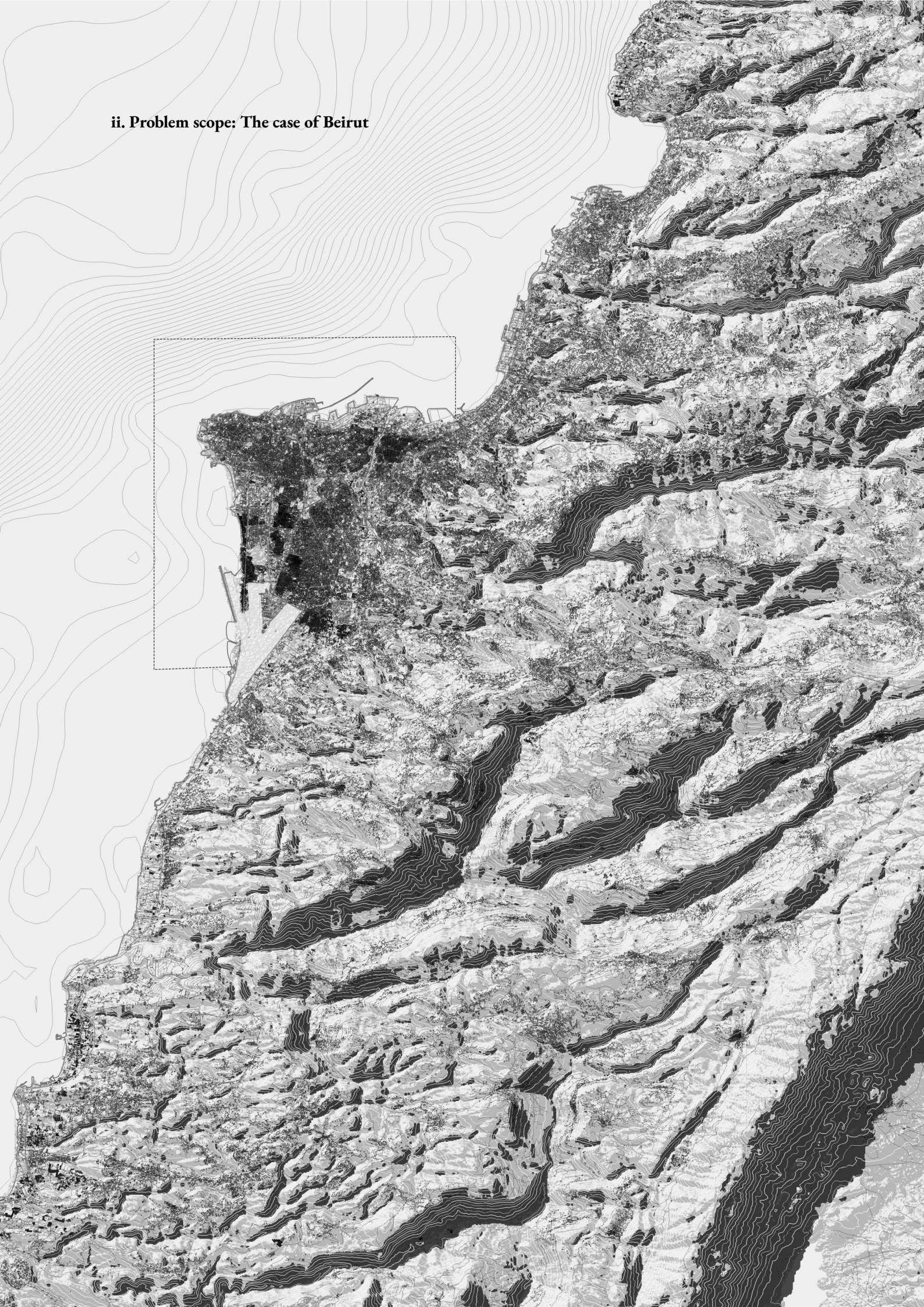
Geopolitics - Confessional Geographic Division

- Sunni
- Shiite
- Druze
- Armenian
- Catholic
- Maronite
- Greck



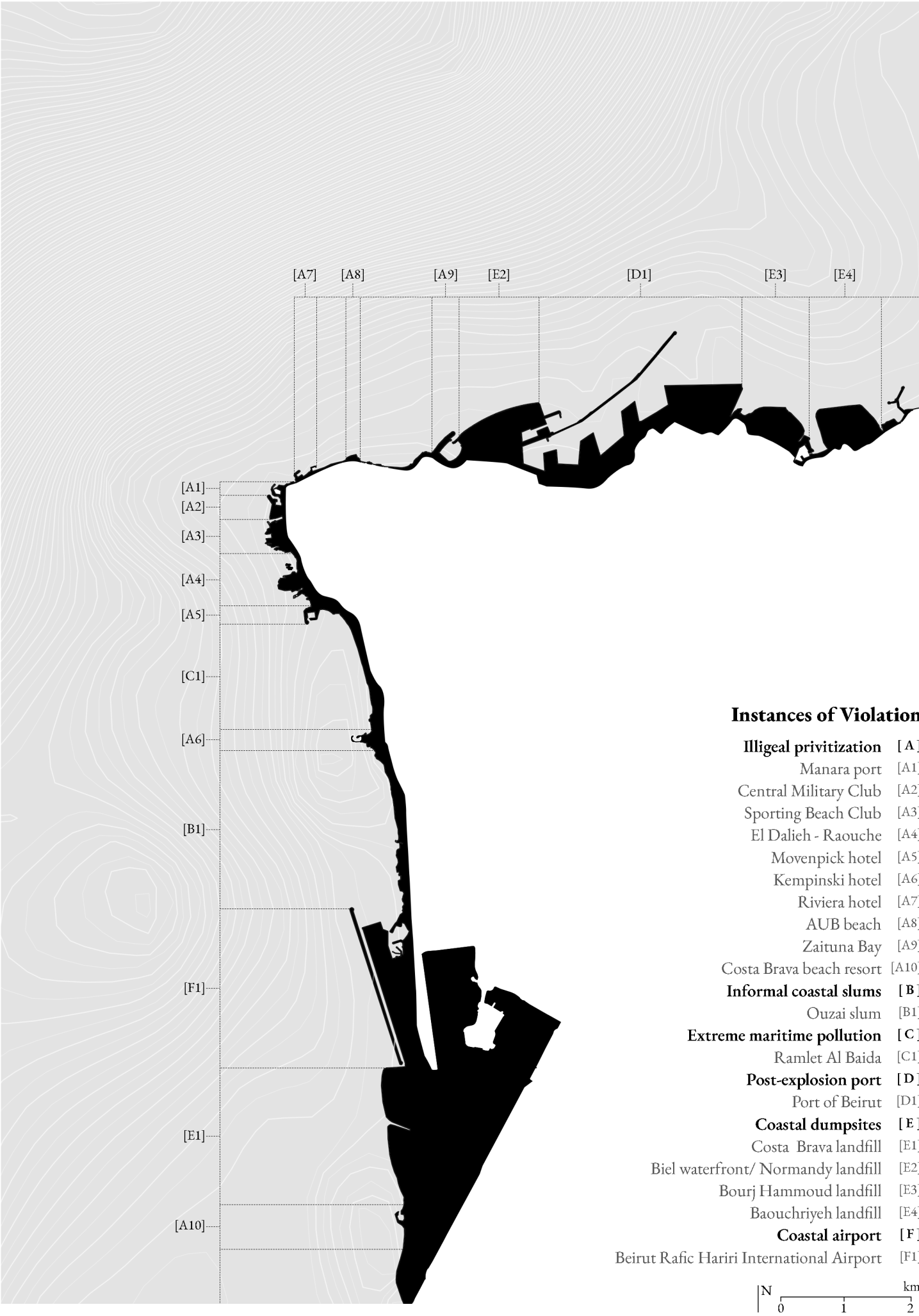
Drawing 6. Division based on religious groups

ii. Problem scope: The case of Beirut



ii. Problem scope: The case of Beirut

The region delineated as Greater Beirut serves as an embodiment, or a microcosm, of various forms of violations that could possibly occur on a coastline, making it an optimal area of focus and a unique opportunity of a case study for extremes. The coastline is composed of fragmented shorelines, each harboring a distinct variation of infringement, yet united by the continuous mutation of the sea [Drawing 7]. The 6 instances of these violations are composed of [A] illegal privatization, [B] informal coastal slums, [C] extreme maritime pollution, [D] a post explosion port, [E] coastal dumpsites, and [F] the capital’s airport.



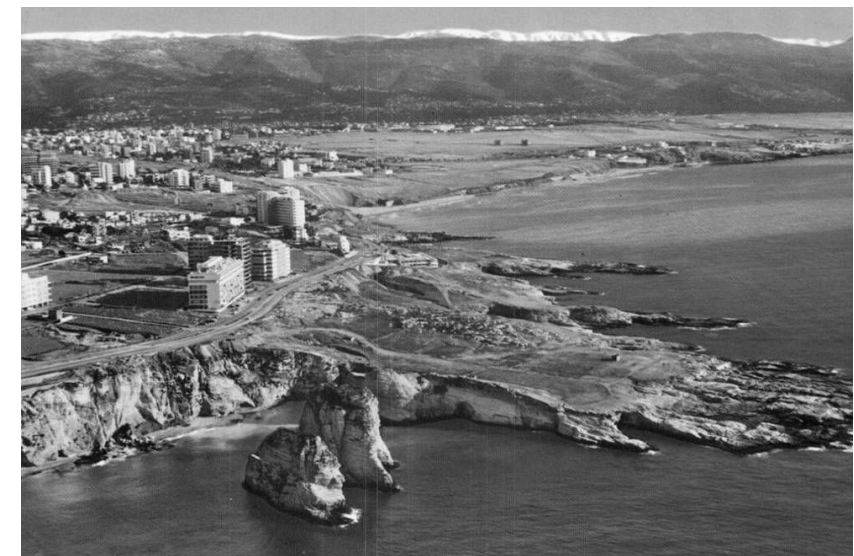
Drawing 7. The six instances of violation along Beirut’s shoreline

[A] Illegal Privatization - Beirut

Beirut's coast is inarguably the city's main asset, serving as the capital's landmark of a rich heritage and cultural identity. The 12-kilometer shoreline operates as the most important public space for Beirut's inhabitants who wish to escape the city's bustling bounds, especially due to the scarcity of accessible public spaces within. While the World Health Organization advocates for a minimum of 9m² of green public space per capita, Beirut has a mere 0.6m², many of which have limited accessibility (Nazzal & Chinder, 2018). The seafront now serves as the principal source of recreation and leisure such as swimming, jogging, fishing, and simply socializing. Additionally, according to a plethora of international studies and conventions, it hosts unique terrestrial and maritime ecological values (Makhzoumi et al., 2012) (Fawaz & Debs, 2018). "This public practice of the seafront is threatened by the private nature of its property ownership... where the maritime public domain is immediately adjacent to the promenade, a buffer of mostly privately held land lots separates the south-western sections of the city from the sea" (Fawaz & Debs, 2018, p. 10). Following a sequence of administrative decisions taken over the years (144/S of 1925), the Maritime Public Domain (MPD) is defined as the land extending from the shoreline to the point reached by the highest wave in the winter season (Khaddaj & El Halawani, 2022). As the name insinuates, the MPD is a public space, yet, the lack of law enforcement and the abundance and incongruous development strategies, amplified by private economic interests has led to its illegal privatization (Khaddaj & El Halawani, 2022). As a result of the post-war pandemonium, private ownership of coastal lots was placed in the hands a few powerful individuals and private companies, resulting in the public coast's transformation into a series of fragmented private resorts. Additionally, substantial sections of the northeastern coast is completely closed off by port facilities and an industrial zone that stretches over several kilometers, including a dumping site (Fawaz & Debs, 2018). To exacerbate matters, modern building restrictions which historically prohibited construction along the entirety of the capital's coast (decree 6285/1954) were overturned as of the mid-1960s, following a tempting model of a tourist development plan in the form of private resorts (Hazbun, 2008). "Since then, regulatory changes as well as a combination of legal and ad-hoc exceptions typically introduced by influential members of the political class have intensified the private exploitation of the city's coast, leading Beirut to gradually lose its seashore's openness and continuity: public access is cut-off in innumerable locations while over half the seafront boulevard is visually and physically blocked from the sea." (Fawaz & Debs, 2018).



[Nassar, 1940]



[The 961, 1970]



[The 961, 2020]

1940

1970

2023

[B] *Informal coastal slums - Ouzai*

The creation of slums was but one of the numerous consequences stemming from the aforementioned conflicts, defined as areas in the city composed of illegal settlements with precarious economic and political conditions, particular vulnerability to environmental threats, and insufficient living conditions. The coastal slum of Ouzai is located in the Southwestern suburb of Beirut, previously known as the private beaches of Saint Simon and Saint Michele, historically characterized by its pristine shores and rich culture. The civil war and the Israeli attacks on the south relocated an influx of displaced families into Ouzai, densifying the neighborhood. With the help of a militia, the displaced settled in the abandoned chalets on the shore and established the slum. The settlement quickly transformed into a shanty town, composed of haphazardly built concrete homes, piling garbage, sewage leaks, lack of fresh water, extreme maritime pollution, hazardous flooding, and the implications of climate change catching up to it. This site has been neglected by authorities and any potential nongovernmental organization due to its complex situation stemming from the illegality of its nature and armed militia stronghold. This has left the misplaced inhabitants residing in dreadful conditions resulting in severe physical, psychological, and social strain. This has left the coastal strip extremely vulnerable, deteriorating exponentially and receding at a dangerous pace as the sea levels rise globally. This coastal strip confers a sense of temporariness, indeterminacy, and imprecision, generated by the blurred edge between the dense urban fabric and the ever-changing coastline. Considering the inhumane living conditions consolidated with the eminently narrow and minuscule available spaces within the settlement, the space of the seashore becomes a major component in these inhabitants' lives



[Davie, 1960]



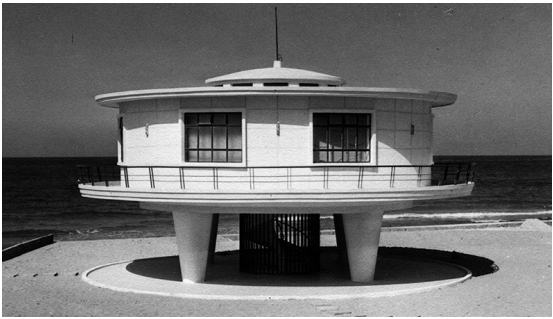
[Burri, 1971]



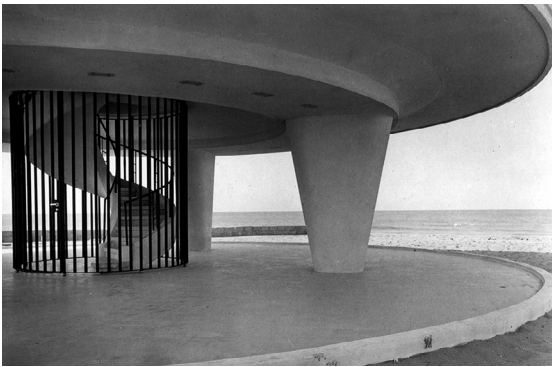
[Kanj, 2019]



[Kanj, 2019]



[Arbid, 1953]



[Arbid, 1953]



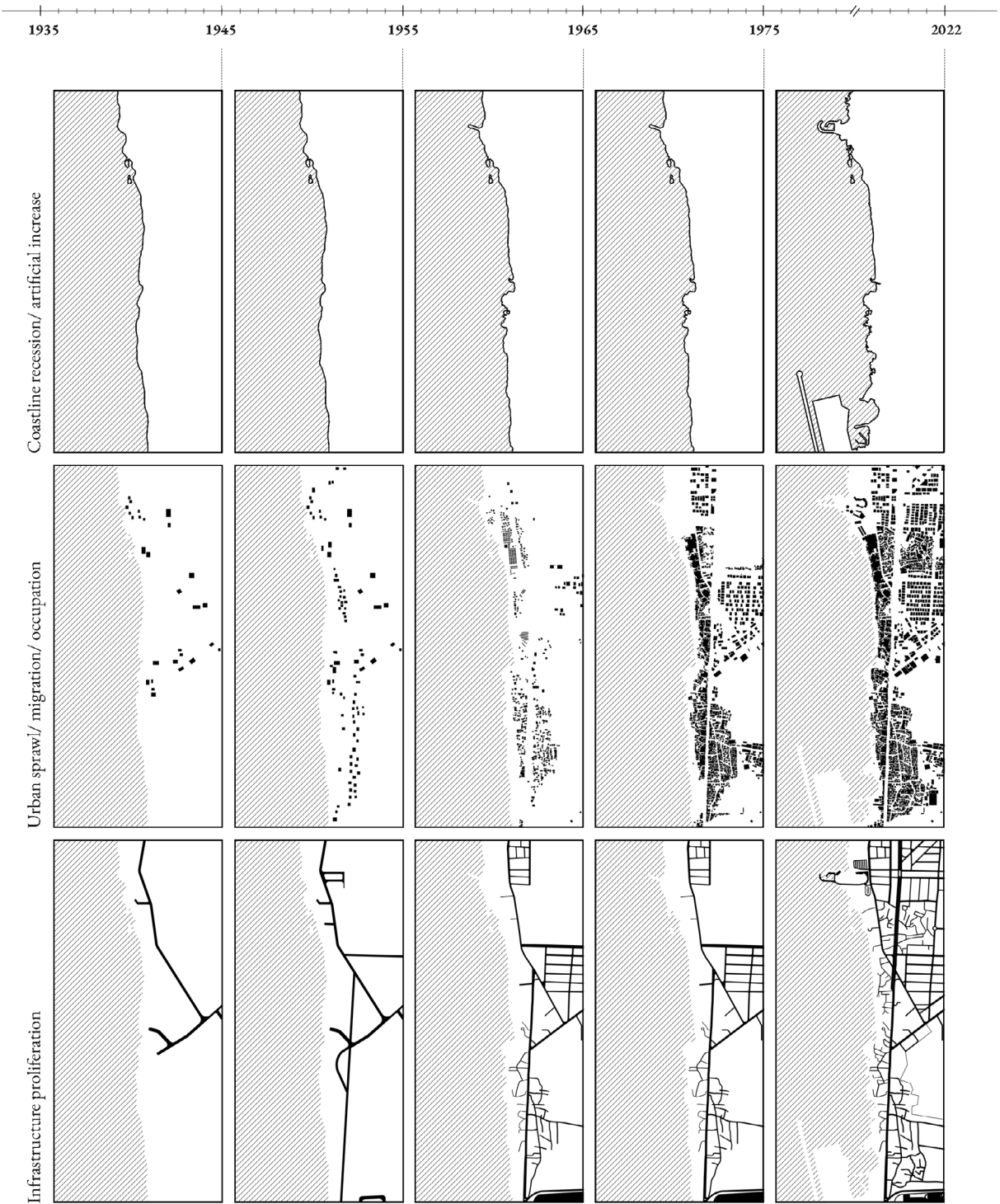
[Harb, 2023]



[Harb, 2023]

1950

2019



Drawing 8. History, morphology, and occupation; the evolution of the coastal slum of Ouzai

[C] Extreme maritime pollution - Ramlet Al Bayda

The only remaining sandy public beach in Beirut is recorded to hold the highest levels of terrestrial and marine pollution in Lebanon (UNDP, 2020). According to the State of environment report conducted by the UNDP, the level of bacteria present in the water surpasses 10,000/100ml (CFU/100ml), while it should strictly not exceed the 100/100ml level set by the World Health Organization. Currently, there are 2 major and 2 minor untreated sewage outflows, located at opposite ends of the beach, directly released on the shore. Additionally, ease of access to the beach from the surrounding neighborhood is interrupted by 4 high-speed car lanes, without designated pedestrian crossings.

This beach is called Ramlet al Bayda, the name (paradoxically) translated into “the white grain of sand”. The unpleasant stench of fecal matter and piling solid waste is evident while walking on the promenade adjacent to this public beach and progressively becomes unpleasantly (almost unbearably) potent as one approaches the water. Merely being present on this beach, let alone swimming in the wastewater, poses as a major health hazard. Despite the appalling conditions, as Ramlet al Bayda remains the last open shore space accessible to low-income citizens, it is still heavily accessed. Most of which do not have access to appropriate health care and do not have the means to treat the health repercussions that arise through merely spending a Sunday picnic on the toxic, yet free sands of Ramlet al Bayda.

Furthermore, this public beach is threatened by the private ownership of the majority of properties in this zone; comprised of four lots, and only one is publicly owned (Fawaz & Debs, 2018). Consequently, the areas north and south of the beach are under an impending threat of privatization and development (most likely through the creation of private resorts), completely closing the beach off and further severing the city’s connection to the coastline.



[Qadiman, 1960]



[Digitalyeti, 2014]



[Nasser, 2015]



[Kanj, 2020]

1960

2014

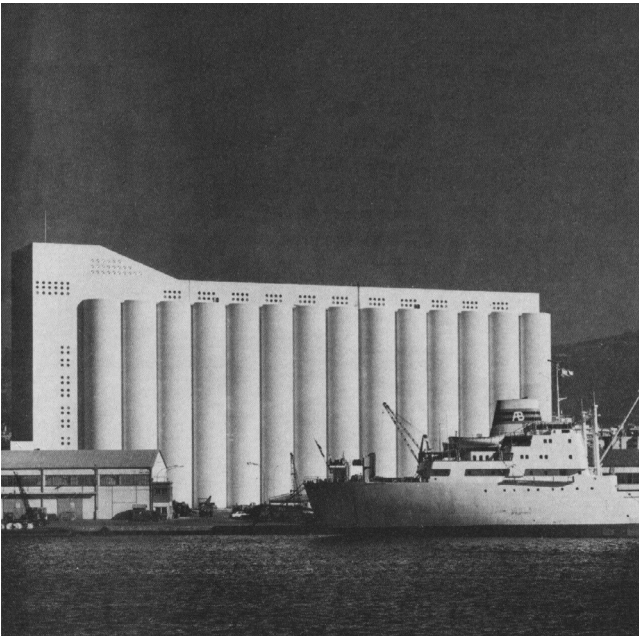
2015

2023

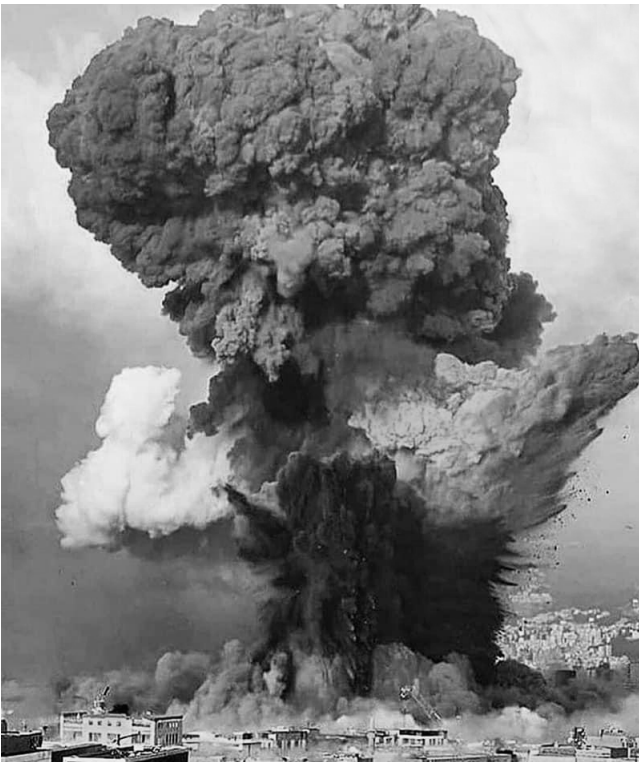
[D] Post-explosion port – Port of Beirut

On 4 August 2020, 2,750 metric tons of ammonium nitrate carelessly warehoused at the Port of Beirut, in Hangar-12, exploded causing the largest non-nuclear chemical explosion, and the third most devastating explosion in world history (Cheaito & Al-Hajj, 2020). To put it into perspective, the reported amount of 2,750 tons of ammonium nitrates is equivalent to around 880 tons of trinitrotoluene (TNT) (T. Nemer, 2021, p.2). The shockwave of the explosion extended peaked at a 4km radius from the epicenter of the explosion (Hangar-12) obliterating an estimated amount of 86,000 residencies and businesses, with over 300,000 people ending up homeless (Aouad & Kaloustian, 2021).

Prior to the explosion, there existed extensive fragmentation in the neighborhoods around the port, with a complete disconnection from the waterfront, blocked by a highway and port barricades. Located on the edge of the port, the neighborhood of Karantina was one of the areas most severely damaged by the blast. Karantina was named after the purpose it served during the Ottoman empire, it hosted quarantine facilities in the 1830s. Since then, its purpose constantly shifted throughout its history, from a destination for rural migrants to a place of refuge for Armenians, Kurds, and Palestinians, seeking refuge during the Armenian Genocide of 1915, World War I, and the 1948 Nakba, respectively (Take et al., 1974). During the 1975 civil war, it became a battleground. Since then, Karantina’s haphazard formation has resulted in its dismantled urban fabric and major lack of spatial justice. The blast aggravated an already enduring condition, shedding light on the instability of Beirut’s urban development and complete disconnection of coastal neighborhoods to the waterfront.



[Hemr, 1953]



[CNN, 2020]



[Durand, 2023]

1953

2020

2023

[E] Coastal dumpsites – Costa Brava and Bourj Hammoud

A national strategy for waste management was drawn up in 1997 following the civil war, allocating all waste from the Beirut region to a single temporary landfill, a short-term facility with a maximum capacity of two million tons of solid waste. 18 years later, the site held 15 million tons of waste, culminating into the 8-month garbage crisis of 2015, where streets were piling with garbage while the nation protested (Sawaya et al., 2022). As a response, the government constructed two coastal landfills; Costa Brava, located just south of the capital’s airport, and Bourj Hammoud, located north of Beirut Port. This “solution” provoked further protests, as both sites obliterated marine biodiversity, violating the Barcelona Convention on the Protection of the Marine Environments adopted in 1995, and were yet another “short-term solution” (Sawaya et al., 2022). As such, the Bourj Hammoud dumpsite still persists and spreads its smells and harmful effects over an area where inhabitants reside. The Costa Brava dumpsite does the same, except at the presumed entrance of the country. It is common practice, almost a tradition, to seal all windows while driving along the highway leading to and from the airport, connecting Beirut to the south.



[Harmandayan, 1910]

1910



[al-akhirah, 2017]

2017



[Environmental Justice Atlas, 2020]

2020

[F] Coastal Airport – The Beirut Rafic Hariri Airport

Established in 1954 and located on the coastline 9km south of the capital, Beirut Rafic Hariri International Airport is the only operational commercial airport and the main point of entry into Lebanon, covering a total area of around 7 million square meters (Ladki & Bachir, 2018). Its location on the coast results in a significant radius of environmental and social implications including maritime and atmospheric pollution and yet again halted access to the coastline. The particular geography and topography surrounding the airport play a significant role in extending emissions to larger distances, through the complex interplay between powerful sea and mountain breezes and the topography (Mokalled et al., 2022). An extensive study on Atmospheric dispersion modeling of gaseous emissions from Beirut international airport activities observed that the Beirut Airport contributes to the severe degradation of air and water quality well beyond the bounds of its vicinity; the western seashore of Beirut has significantly higher NO2 concentrations than the eastern part, primarily due to aircraft landing on Runways 16 or 17, located directly at the seashore (Mokalled et al., 2022). The concentration of Volatile Organic Compounds and Nitrogen dioxide disperse up to a 9km radius and are most concentrated within a 2 km radius (up to 110 µg.m-3), well exceeding the World Health Organization’s annual guidelines (Mokalled, 2016). In addition to its environmental implications, the airport and its surroundings are highly unstable and vulnerable. Since Lebanon is a subject to ongoing political conflicts, the airport becomes a primary target during regional wars, having been bombed in the 1968 Israel raid, in 1893 during the Israel invasion, and again underwent a missile airstrike attack during the 2006 Lebanon war.



[Chamouni, 1937]



[GFTAF, 2020]



[Weiss, 2021]

1937

2020

2021

I. Introduction

II. Research question

III. Methodology

IV. Literature Review

V. Assessment

VI. Revised Progression

VII. The Canvas

VIII. Conclusion

IX. Bibliography

X. Appendix

II. Research Question

Research Question

How can the understanding of Beirut’s coastline as a [A] series of extreme environmental and anthropogenic permutations inform its [B] design agency, programming a coastal space which functions as an autonomous littoral landscape while simultaneously [C] attaining spatial justice for its inhabitants?

[A] Analysis sub questions

- What are methods to attain a requisite understanding of how a coastal system will evolve when its morphology is determined by a set of highly volatile permutation of variables?
- How can methods of quantitative analysis inform decisions for qualitative measures?
- How do you investigate a context whose data has constantly been erased throughout its history? / What methods could be implemented to analyze a site that is devoid of data?

[B] Design sub questions

- How to program robustness embedded within the coastline of Beirut to react to different contingencies by learning, evolving, and accordingly, adapting?
- What are strategies of intervention to establish an autonomous littoral landscape?
- What are strategies of intervention for highly uncertain futures?

[C] Design sub question

- What methods of intervention can disrupt entrenched corruption and ameliorate the precarious lives of city dwellers?

I. Introduction

II. Research question

III. Methodology

IV. Literature Review

V. Assessment

VI. Revised Progression

VII. The Canvas

VIII. Conclusion

IX. Bibliography

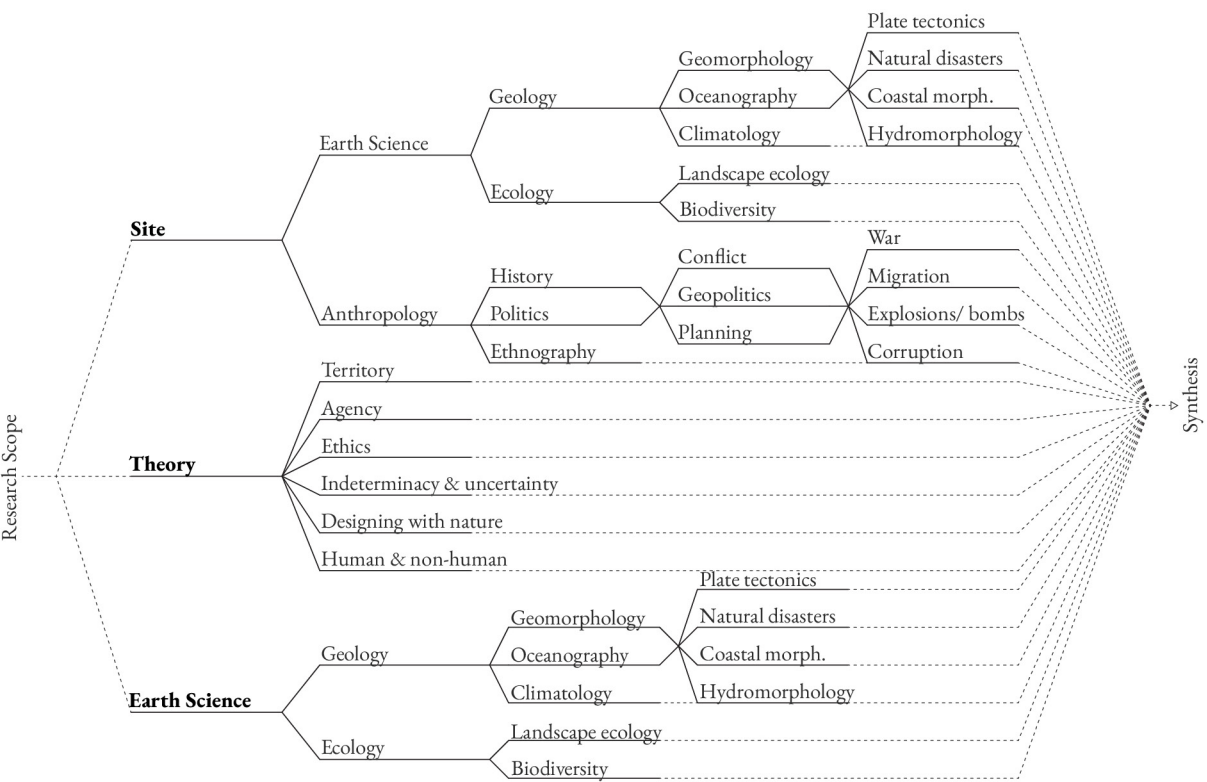
X. Appendix

III. Methodology

Throughout this process of research by design, the projected outcomes will include a literature review, an assessment, and a design proposal, elaborated on below.

i. Literature and research framework

The research comprises three overarching categories of readings on site, theory, and earth sciences [Drawing 9]. Research on my site includes a thorough contextual review of published literature to gain the requisite understanding of Lebanon’s history, politics, social conditions, natural systems, and geology. This will be accompanied by writings on theories that apply to both the topic of focus and the context under investigation, such as readings on “territory” and how it has been addressed throughout literature, on indeterminacy and designing for uncertainty, on the conception of time and landscapes, on the dichotomy between man and nature and designing with nature, and finally, on the ethics of designing in the presence of vulnerability towards social and environmental justice. Lastly, this project requires research on certain categories of earth science, such as geology, oceanography, and ecology, to first gain a comprehensive understanding of how the systems addressed throughout the project operate and to consequently have a scientifically informed analysis and design proposal. A summary of the literature utilized is stated in the table below [Drawing 10], and the theories extracted are discussed in further detail in the Literature Review section.



Drawing 9. Research topics framework

	Research themes	Main bodies of literature
Site specific	Lebanon coastline	(Badreddine, 2018; Bou-Hamdan, 2020; Faour & Rizk, 2005; Fawaz & Debs, 2018; Hawie et al., 2013; Hazbun, 2008; Khaddaj & El Halawani, 2022; Ministry of Environment & UNDP, 2011)
	Lebanon Ecology	(Darwish, n.d.; Darwish et al., 2005; Faour & Hamzé, 2014; Itani et al., 2020; Makhzoumi et al., 2012; Verdeil et al., 2013)
	Lebanon Natural disasters	(Gomez et al., 2001; T. Nemer et al., 2008; T. S. Nemer, 2019; T. S. Nemer & Meghraoui, 2020)
	Lebanon Geology	(Bedir, 2017; Elias, 2015; Nader et al., 2018; Walley, 1998a, 1998b)
	Lebanon politics	(Buccianti-Barakat, 2004; Faour & Mhawej, 2014; Fawaz, 2009a, 2009b)
	Lebanon urbanization	(Bakhos & Verdeil, 2019; Bou Akar, 2018; Faour, 2015; Hanna, 2016; Mohsen et al., 2020)
	Lebanon slums	(Dionigi, 2016; Fawaz & Peillen, 2002; Jaafar et al., 2019; Lorens et al., 2022; Zaiter, 2019)
	Beirut public spaces	(Aramouny, 2021; Fawaz & Debs, 2018; Hein & Hanna, 2022; Karizat, 2019; Khaddaj & El Halawani, 2022; Nazzal & Chinder, 2018; Sinno, 2020)
	Beeirut explosion	(Al-Hajj et al., 2021; Aouad & Kaloustian, 2021; Cheaito & Al-Hajj, 2020; Hanna & Alaily-Mattar, 2021; Nemer, 2021; Take et al., 1974)
	Beirut Rafic Hariri airport	(Ladki & Bachir, 2018; Mokalled, 2016, 2018; Mokalled et al., 2018, 2021, 2022)
	Ramlet Al Bayda	(El Khoury, 2016; Mounzer, 2020; UNDP, 2020)
	Lebanese landfills	(Sawaya et al., 2022; Stephan, 2011)
Theoretical underpinning	Landscape & time	(Corboz, 1983; Ingold, 1993; Latour, 1993; Wall, 2017)
	Ethics	(Danilovic Hristic, 2022; Puig de la Bellacasa, 2017)
	Designing for uncetainty	(Berger, 2002; Koolhaas, 1995; Marchau et al., 2019; Patteeuw et al., 2011; Stanton & Roelich, 2021; Wall, 1999; Yago, 1994)
	Indeterminacy	(Cage, 1961; Waldheim, 2016; Yago, 1994)
	Territory	(Casey, 2013; Elden, 2009, 2010, 2013; Galindo & Oloriz Sanjuan, 2017; Landscape as Territory, 2019; Weizman, 2008, 2012)
	Age of the athropocene	(Bélanger, 2013; Brenner & Katsikis, 2020; Crutzen, 2002; Swyngedouw, 2018; Waters et al., 2016)
Scientific backing	Geology	(Erickson, 2009; Marchant et al., 2007; Marker et al., 2003; Seibold & Berger, 2017)
	Coastal processes & dynamics	(de Vries et al., 2020; Kamal, 2021; Pintado et al., 2020; Whitehouse et al., 2009; Woodworth et al., 2019; Yulianto et al., 2019)
	Coastal ecology	(Boaden & Seed, 1985a, 1985b; John et al., 2017)
	Theories on ecology	(Adams, 2014; Garmestani et al., 2009; Hearnshaw et al., 2022)

Drawing 10. Research topics framework

ii. Assessment and data collection

The general assessment outcome is to gain a thorough understanding of the context from the lens that views the littoral landscape as a volume of permutations. Furthermore, a detailed analysis of the coastline’s morphology and the underlying forces that shape it will be conducted to deepen this understanding. A tactical graphical approach is employed to address the intricate task of representing multiple overlapping layers of data on a single drawing while maintaining clarity of the information contained within each layer. Furthermore, the assessment methods utilized in this study encompass digital interpolation and simulation techniques, providing additional depth and accuracy to the analysis.

As mentioned previously, Lebanon is politically unstable and is subject to an ongoing history of wars, therefore, it is characterized by a repeating cycle of erasure and formation. Battles, explosions, and chaos lead to the obliteration of states, data, and matter. This, combined with ambiguity and the clandestine nature of corrupt politics, results in a major lack of accurate data. This provokes the following inquiries: How is life in the sequence of different intervals, between what remains, what is erased, and what has transformed? How do you investigate a context whose data has constantly been erased throughout its history? [Drawing 11] I plan to do this through the following methods:

- A temporal analysis of the coastal physiography, with an ethnographic reading of how the quality of private, collective, and public life are shifting throughout these cycles and in the moments of pause in between. This will require the thorough collection of raster data, its subsequent (manual) transformation into vector data, and the superimposition of the different layers collected to draw conclusions.
- The extraction of high-resolution satellite imagery, drawing conclusions through relational spaces.
- Methodical filming using drones, attaining high-resolution aerial imagery. Such imagery could reveal numerous layers of information encompassing spatial, social, and environmental patterns.
- Site visits, including the manual transcription of conditions, interviews, and systematic surveys.
- A thorough investigation of online databases.

iii. Preliminary hypothesis and design outcomes

[A] Hypothesis

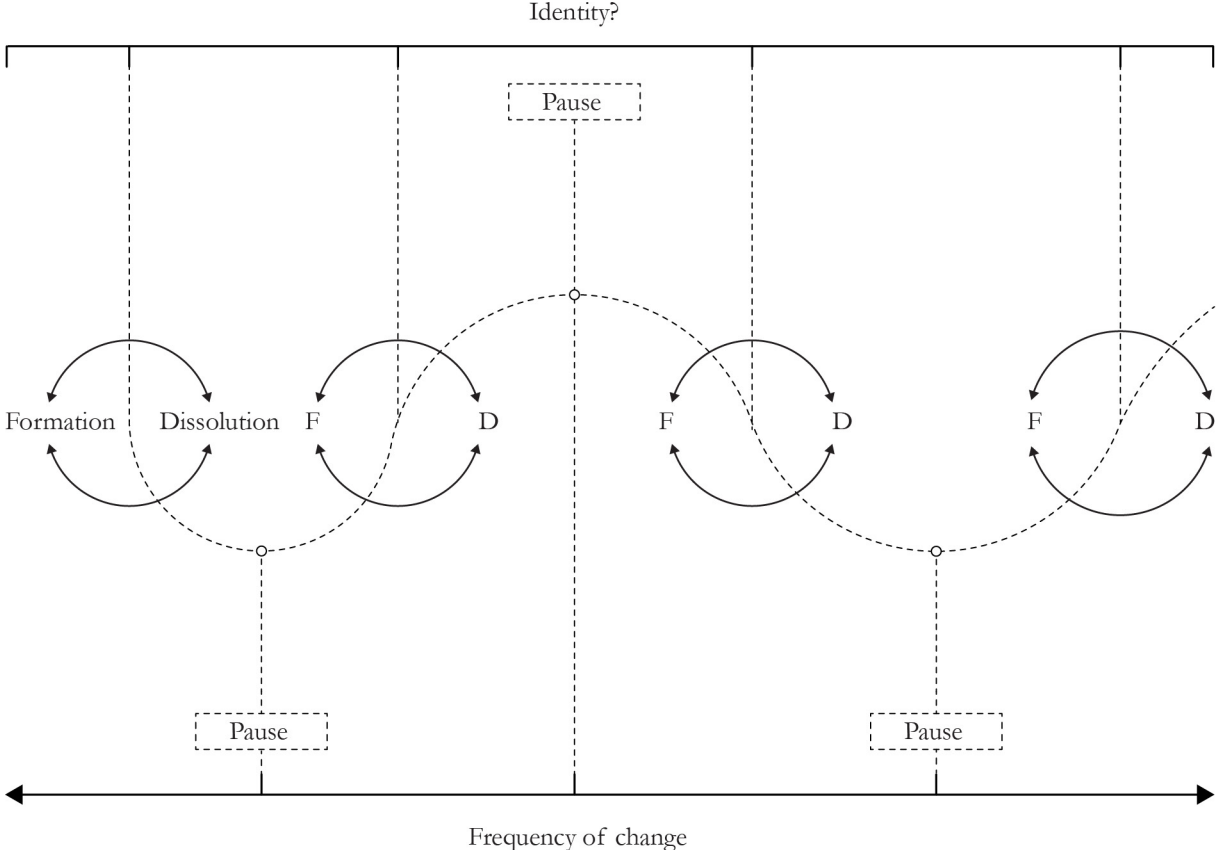
I hypothesize that the understanding of the littoral landscape in question as a temporal volume of permutations will serve as a guideline for an approach which will be proposed. This understanding should be integral to the process of assessment and design proposal. This approach of a temporal reading of the landscape as a volume of permutations will guide my future inquiries through which I will constantly ask: What are the residuals after a new event that quite substantially modified the coastal landscape? What was left of the past from a tangible and intangible perspective? What remains as defining physical and geomorphological constitutions? What has been radically modified? What are the political and social structural dimensions that remained from the past that figured out a way to coexist with this newly established physical form? Thus, in that sense, when I foresee the design strategy of this project through which I seek to establish autonomy, it would then revolve around this understanding of the littoral landscape as a volume of permutations with tangible and intangible

residues which have been carried out throughout time. To establish autonomy, a profound understanding of the intrinsic identity of the littoral landscape is paramount, as it harbors an inherent form of autonomy within itself. I hypothesize that first, identifying identity, then building on this existing autonomy will reap a far more powerful form, one that is able to compensate for the shortcomings of the previous. Adjacently, highlighting the tangible and intangible elements that resisted and adapted to the major drivers of change on-site becomes the principal components of identity. After all, the goal is to achieve spatial justice through the establishment of an autonomous and resilient landscape through the design of space in a way that will afford this specific form of habitat and quality of life to unfold.

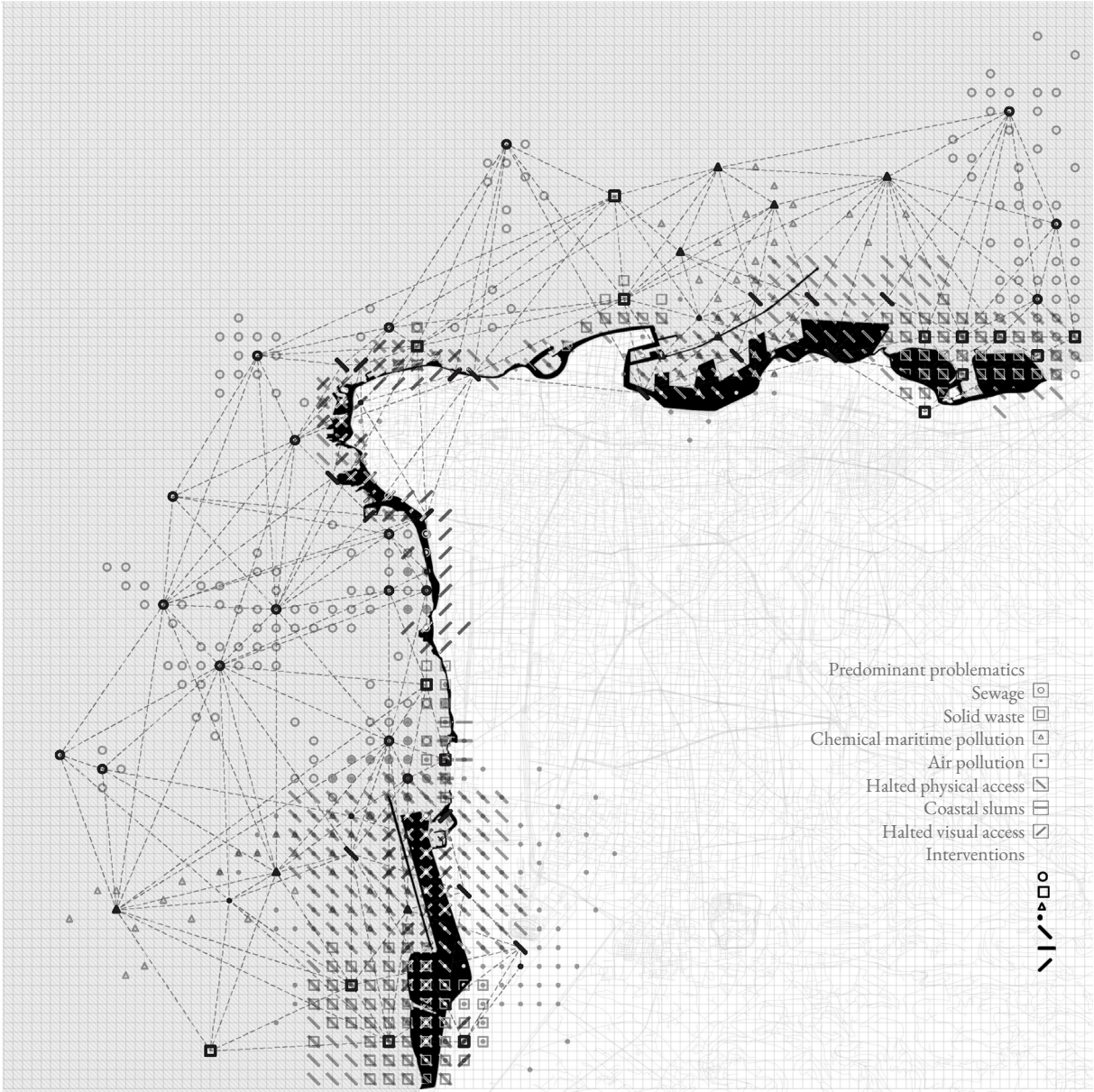
The selection of the coastline of Beirut as an area of focus was due to the diversity of infringements it harbors in a relatively small amount of coastal space. The tactical selection of the six scenarios previously mentioned would result in a unique opportunity to gain a holistic understanding of a coastal landscape that has well surpassed its limits. Consequently, this will result in a design proposal for them, directly reacting to unique the problematics each one possesses, but following a unified set of criteria. Preliminary ideas, goals, and criteria of such an approach are listed below:

[B] Preliminary project goals

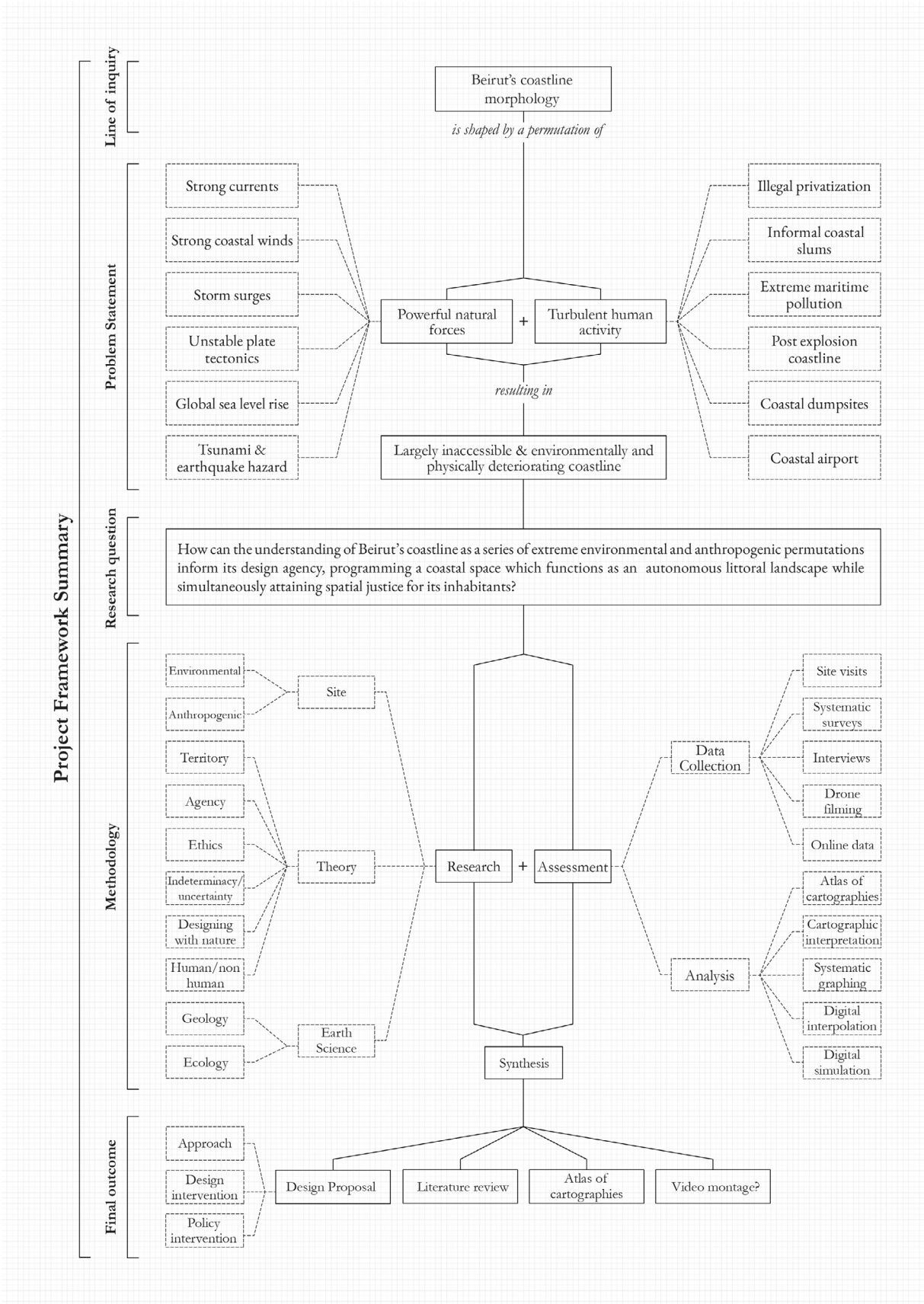
- The design approach and proposals will include a set of key design objectives and their interventions; small-scale installations that through the evolution of time, natural processes, and perhaps their interaction with one another, will result in large-scale alterations. This will be used as a method to circumnavigate spatial limitations set by political strongholds. [Drawing 12]
- The interventions will symbiotically evolve with natural processes, metamorphosing hybrid structures which simultaneously accommodate social and environmental problematics.
- The interventions will result in spatial justice by establishing access to a previously inaccessible coastline, through a set of methods that does not compromise the natural regeneration and functionality of the landscape.
- The proposals will set the stage for uncertainty, leaving room for discovery.
- The interventions are scalable, and the method of their implementation can be retrofitted in other locations with similar characteristics.
- The proposed approach will address the shore space’s constantly fluctuating morphology as a tool rather than an obstacle.
- Annul the employment of all special regulations which allow for exceptional development rights on the Maritime Public Domain.
- Establish an economic model for the capital’s littoral zone which relies on the attraction of its (newly established) open spaces, as opposed to the current model, which relies on a private resort-based economy.
- Re-establish a coastal economic model which thrives on sustainable fishing and marine farming practices.



Drawing 11. Conceptual diagram of the process of formation and dissolution lens



Drawing 12. Draft of possible seed interventions directly reacting to site specific problematics, and the permutation of their lines of communication.



Drawing 13. Preliminary project framework

I. Introduction

II. Research question

III. Methodology

IV. Literature Review

V. Assessment

VI. Revised Progression

VII. The Canvas

VIII. Conclusion

IX. Bibliography

X. Appendix

IV. Literature Review

i. Theoretical underpinning

The following literature review is formulated as an amalgamation of theories that characterize the theoretical underpinning of my thesis project. The selected theories are grouped based on an overarching theme and how they are addressed by different scholars. This is followed by precedents from which I took inspiration while composing my design goals.

[A] Territory and state; The enigmatic idiosyncrasy of “territory” within Lebanon

In the context of Lebanon, the quality and quantity of space, namely public space, is predominantly dictated by constantly shifting territorial claims stemming from political conflict and corruption. Thus, the delineation, and perhaps, the definition of territory in Lebanon remains ambiguous. This is most pertinent in the littoral zone, as it remains the last standing public space in a country that suffers from a severe lack of public spaces. These unstable territorial claims seem to mimic the dynamic nature of coastal landscapes; they are constantly changing and highly unpredictable. The enigmatic idiosyncrasy of territory in Lebanon has led me to investigate the concept’s origin and perception in the field of Landscape Urbanism. As the incessant division of territory in Lebanon has resulted in a myriad of spatial, social, and environmental repercussions, especially in instances where those imaginary lines intersect, it is imperative to question the existence of this division and perhaps, aim to abolish it. As mentioned in the article Towards a territorial praxis, Oloriz Sanjuan and Galindo elaborate on the lens that they have adopted for the program they teach at AA Landscape urbanism, “whereby urban environments are understood not as discrete independent collections of objects but rather as interconnected and related landscapes with specific and far-reaching implications at local and global scales (Galindo & Oloriz Sanjuan, 2017, p.49).” Therefore, in this context, the territory is a concept through which calculative strategies, such as cartography, are complicit agencies in its design. “Acknowledging this, they argue about the possibility of engaging with a territorial praxis through architecture and the ability to design, organize, coordinate and choreograph spaces that can and should go beyond the reductive relation between architecture and land”(Galindo & Oloriz Sanjuan, 2016).

Stuart Elden’s extensive investigation into the idea of territory revealed that it is generally understood and defined in two ways; “as territoriality and as a bounded space” (Elden, 2019, p.21). Territoriality, derived from the dimension of animal ecology, is understood as the space that animals occupy and claim as their breeding and hunting grounds. Territory as a bounded space is defined as a “bordered area of the Earth’s surface to which people lay claim” (Elden, 2019, p.5). Sociologist Anthony Giddens elaborates on the conceptualization of territory by defining a state as “a bordered power container” (Giddens, 1987, pp.5-6,11). But while these interpretations are rather general, what does that mean in contexts of constant conflict where the perceptive diversity of territorial claims is so ambivalent? On what basis can a territory justifiably be claimed, governed, and planned? As Elden inquires “Have we always thought the same way about how we lay claim to these portions of land and police them?” (p. 22) Such inquiries will constantly guide the attitude of my interrogation of the perception of territory throughout my investigation.

[B] Territory as volume

In his book *Terror and territory*, Stuart Elden expresses the idea that too often, territory is perceived as a surface delineated on a map in the form of boundary lines differentiating distinct states (Elden, 2009). He supports this notion by describing how the largest reverberations on territory have been in the form of aerial attacks, namely mentioning the airplanes of September 11th, 2001, Hezbollah's Katyusha rockets launched against Israel, hot air balloon bombs at the beginning of the 20th century, bomber airplanes in the Second World War, the Atomic Bombs of Hiroshima and Nagasaki, and intercontinental ballistic missiles (Elden, 2009). "It has been argued that it was taking the lid off the state, as this simple bordered power container, because you could not control attacks from above" (Elden, 2019, p.24), hence, concluding that it is imperative to consider the vertical dimension and regard territory as a volume, rather than simply an area. This perception was inspired by the Israeli architect, Eyal Weizman, who specifies that it is impossible to comprehend the complexities of territory, especially those that are conflicted, without deeply accounting for the vertical dimension, particularly in cartography (Weizman, 2012). In his book *The politics of verticality*, Weizman states: "In both the Oslo and Camp David peace proposals, the intertwined patchwork of territories made it impossible to draw a feasible continuous boundary between Israelis and Palestinians without dismantling the Settlements. It was only by introducing the vertical dimensions, through schemes of over-and-under-passes, that linkage could be achieved between settlements and Israel, between Gaza and the West Bank. These solutions did not reject the map as a geopolitical tool. Instead, they superimposed discontinuous maps over each other" (Weizman, 2002, p.2) Therefore, throughout my thesis, it is vital to examine territory as volume while investigating the permutation of possibilities that dictate coastal morphodynamics. Vertical actions on the Lebanese territory have extensively influenced the territory's morphological state, stability, and health, in the form of both, vertical geopolitics (previously denoted as anthropogenic mutations) and geology (previously denoted as natural forces). In terms of vertical geopolitics, territory has been altered through numerous military actions such as aerial attacks, submarine missiles, torpedoes, airspace violations, subsurface explosives, and extensively deep tactical tunnels and barrier walls. Geologically, Lebanon lies astride an active plate boundary and is classified as a high earthquake hazard zone [Drawing 4].

[C] Designing for uncertainty

"If there is to be a "new urbanism" it will not be based on the twin fantasies of order and omnipotence; it will be the staging of uncertainty; it will no longer be concerned with the arrangement of more or less permanent objects but with the irrigation of territories with potential; it will no longer aim for stable configurations but for the creation of enabling fields that accommodate processes that refuse to be crystallized into definitive form; it will no longer be about the meticulous definition, the imposition of limits, but about expanding notions, denying boundaries, not about separating and identifying entities, but about discovering unnamable hybrids; it will no longer be obsessed with the city but with the manipulation of infra-structure for endless intensifications and diversifications, shortcuts and redistribution." (Koolhaas, 1995, p.29)

This section primarily addresses the paradigm shift which occurred in the discipline of urban planning, from the design of static entities to the manipulation of large-scale urban surfaces. In his essay *Programming the*

Urban Surface, Alex Wall explains how the exponentially increasing rate of urban sprawl in the 1950s blurred the distinction between city and countryside, where he states: "Here, the term landscape no longer refers to prospects of pastoral innocence, but rather invokes the functioning matrix of connective tissue that organizes not only objects and spaces but also the dynamic processes and events that move through them" (Berger, 2002). Alex Wall (1999) states that the urban realm began to be recognized as an evolving entity, rather than a permanent scene, and, therefore; "This is less design as a passive ameliorant and more as an active accelerant, staging and setting up new conditions for uncertain futures." (Wall, 1999, Ch.15) In his essay "Whatever Happened to Urbanism?", Rem Koolhaas comments on how the rapid growth in population and sprawl outpaced the discipline of urbanism, therefore stating that paradoxically it has disappeared precisely in an era where it is supposed to prevail.

[D] Indeterminacy

In the attempt of designing for uncertainty, one of my design criteria is setting the stage for indeterminate futures, leaving room for a certain amount of flexibility. For this section of my theoretical underpinning, I searched beyond the sphere of urbanism to find precedents where indeterminacy was utilized as a successful design agent and found it in John Cage's graphic score. Cage, an American composer and music theorist used the term indeterminacy to define the process used in his musical compositions. In his book *Silence*, he describes indeterminate music as a composition in which chance operations are used to compose a score, but also music in which relevant sections of the composition are left vague and open to interpretation (Cage, 1961). In both scenarios of indeterminate music, no two performances of the same composition will sound the same. Cage's composition *Fontana Mix* [Figure 1] is a wonderful instance of indeterminacy in music. The score is composed of 10 sheets of paper and 12 transparencies, containing graphic notations of lines, curves, points, and a grid with varying thicknesses.

Fontana Mix is a manifestation of indeterminacy through the manner in which the sheets are superimposed, determined by chance operations before each performance, in a copious number of possible iterations. Cage left all aspects of this composition up for interpretation, including the number of performers and instruments to be used. Furthermore, he left the grids, lines, and points completely undefined; a point might represent a 5-second-long violin note in one performance, or a 5-minute drum solo in another. A line could represent a sequence of pitches in one performance or dictate the assemblage of the musicians on the stage in another. With such a highly indeterminate composition, Cage did not conventionally compose the music score, but rather composed the chance for it to exist. In his book, *Architecture for the Indeterminacy*, Yago Conde describes Cage's notational system by stating that: "In effect, his graphic scores organize the disposition of events in space, in their concentration or dispersion, their rhythm, timbre, form, volume, etc. They are 'maps', 'cartographies' of events" (Yago, 1994). Conde proceeds to state that such visual interpretations should inspire their adoption in non-musical scenarios; "... but choreographies, landscapist interventions, war strategies, firework displays, or architectonic relations" (Yago, 1994).

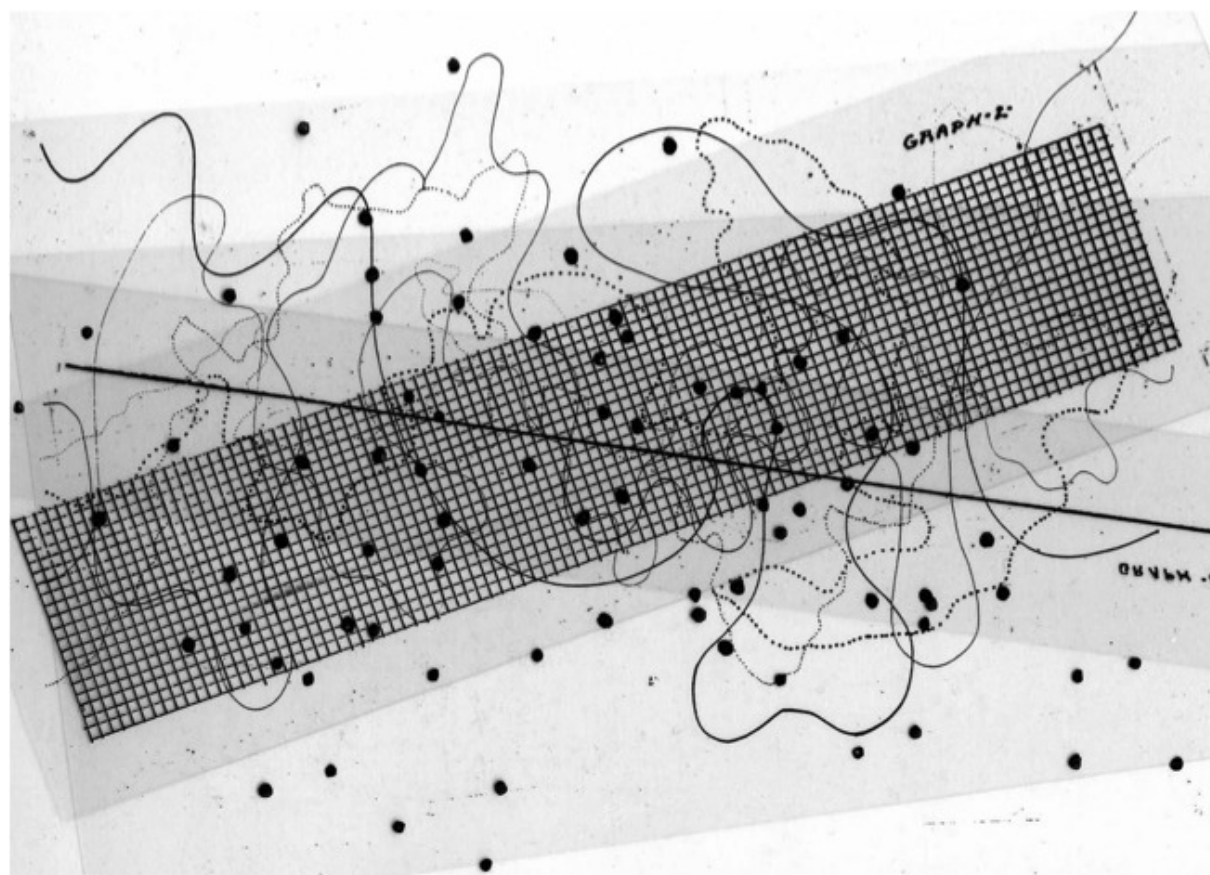


Figure 1. (Cage, 1961) Fontana Mix score

[EW] Human/ Non-human

I was introduced to the dichotomy of man and nature through Bruno Latour and his criticism of the distinction between nature and society, where in his novel *We Have Never Been Modern*, he states that sciences emphasize the distinction between subject-object and nature-culture, whereas in reality, the line is blurred, and these phenomena often cross these lines (Latour, 1993). description of land and its inhabitants resonated well with me as I was attempting to decipher the complicated state of the Lebanese coastline. In his essay, “The Land as Palimpsest”, Corboz states that Land is a result of the combination of spontaneous transformation (which he denotes as dominant natural forces) and human activity and that the result of the interaction of such forces manifests over a prolonged period of time, one that is so large that it masks the impacts of their coalescence (Corboz, 1983). He then concludes by stating that “from this comes the immutable character normally connoted by “nature”” (p.17), thus contributing to and inspiring my outlook and (re)definition of “nature”. This was reaffirmed by Tim Ingold’s writings in “The Temporality of The Landscape”, further stating that the landscape is composed of an enduring record of lives that have dwelt within it, leaving an accumulation of traces throughout generations (Ingold, 1993). This revealed to me the importance of studying time when addressing any form of land, let alone a territory that is so heavily shaped by generations of war, inhabitation, migration, and natural disasters. As Ingold (1993) emphasizes, “To perceive the landscape is, therefore, to carry out an act of remembrance and remembering is not so much a matter of calling up an internal image, stored in the mind, as of engaging perceptually with an environment that is itself pregnant with the past” (p.153). Throughout this thesis, I argue that it is imperative to observe the intersection of human and non-human alterations on land throughout the progression of time and space as reciprocal entities, rather than isolated occurrences of change.

ii. Precedents

[A] *Oyster-tecture – Scape*

Commissioned to generate adaptation strategies for New York City to tackle sea level rise and climate change, Oyster-texture envisions an evolving oyster reef that enhances benthic marine biodiversity and adds recreational value to the New York Harbor. Oyster-texture proposes a living reef comprised of intertwined rope that caters for marine habitats, attenuates waves, and through biofiltration, cleans millions of gallons of water (Orff, 2016). The resulting cleaner and calmer water enables safer use of the littoral zone where a regional park emerges in anticipation of the city’s return to the waterfront. My inspiration for this project stems from the use of oysters as a living architectural building material. The oyster is an ecosystem engineer, and its integration into this design proposal results in an intervention that is capable of transforming symbiotically with natural processes, attaining a level of resilience that could not have been achieved had the structure been merely composed of concrete. This is the type of approach that I believe should be adopted in the context of the Lebanese coastline.

[B] *Parc de la Villette - Bernard Tschumi*

Bernard Tschumi’s Parc de la Villette serves as a poetic precedent of an interpretation of designing for uncertainty, where “The proposed project is not for a definitive park, but for a method that - combining programmatic instability with architectural specificity - will eventually generate a park.” (Koolhaas, 1982). The imaginatively determined “point, line, and surface” systems confer unpredictability, while concurrently maintaining an internal logic, establishing the paradoxical unity of certainty and uncertainty (Chen & Li, 2021). This serves as a poetic precedent addressing uncertain scenarios as an opportunity rather than resulting in a sustainably adaptable design.

I. Introduction

II. Research question

III. Methodology

IV. Literature Review

V. Assessment

VI. Revised Progression

VII. The Canvas

VIII. Conclusion

IX. Bibliography

X. Appendix

V. Assessment

The thematic assessment and focus of this thesis unfolded in tandem with the curriculum and lexicon of the Transitional Territories studio, encompassing first, the introductory Studio Essentials, followed by the Geographical Urbanism studio intensive, and culminating in the development of the monographies.

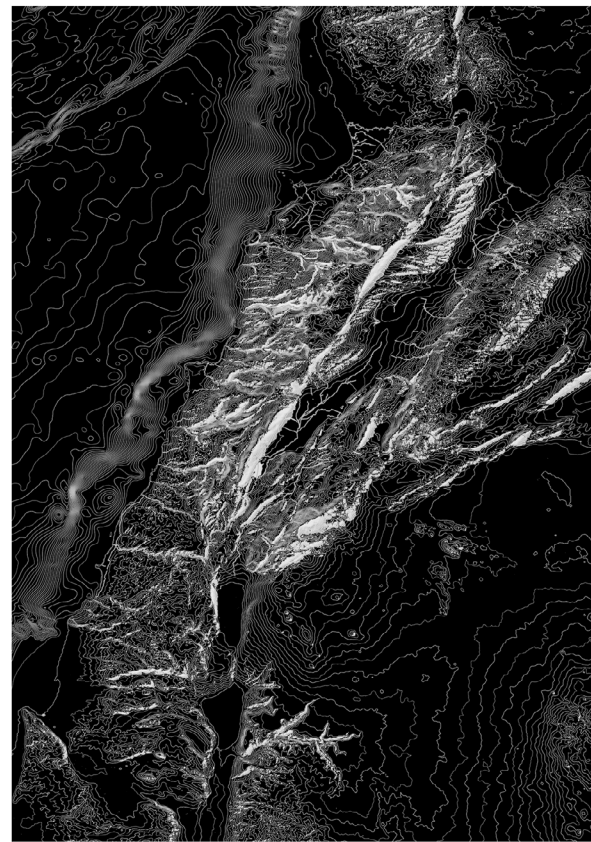
i. Studio Essentials

[A] Accumulation and clearance

The studio essentials introduced the perception of the site through the lens of accumulation and clearance, establishing a preliminary idea of the predominant problematic and potential clearance that could occur through quick visualizations. At that point, in line with the studio's theme, I had set the littoral landscape of Lebanon as my site of focus. By simply illustrating the country's anthropogenic footprint as "accumulation" and accentuating the main natural features as "clearance", I was able to attain an overview of where the predominant problematics and potentialities lie. The drawings are inversely related. The pressure present on the coastline is highly evident, while the emphasis on the natural forces gives a sense of hope and the possibility of reliance on processes far more powerful than the damage caused, as clearance.



Drawing 14. Accumulation: the anthropogenic footprint of built space and infrastructure



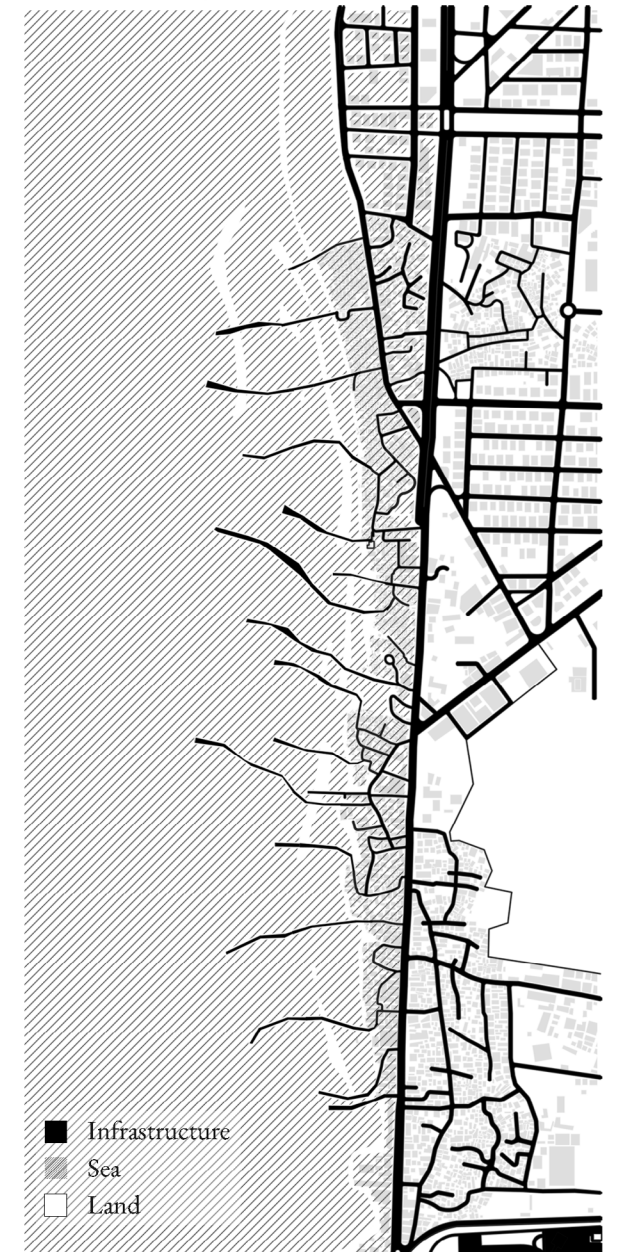
Drawing 15. Clearance: the accentuation of bathymetry, topography, and water bodies - as an inverse of Accumulation

[B] palimpsest, transposition: disruption

At this stage, I envisioned an interdisciplinary project encompassing environmental, social, geopolitical, and spatial structures in the context of vulnerable coastal communities. Therefore, the formation of a position on the extent of the reciprocal interdependence of man and nature through time, as active forces in shaping territories, was necessary to develop at this stage. Reflecting on it now, the illustration of the palimpsest of the Ouzai coastline provoked a series of questions and their subsequent hypotheses, through transcribing what has been erased, what is permanent, what resisted, and what has transformed. The strategy in the following potentiality drawing was to highlight the elements that persisted, in this case, the pattern of the road infrastructure and the sea, and to build on them as a form of autonomy and resilience already embedded within the landscape.



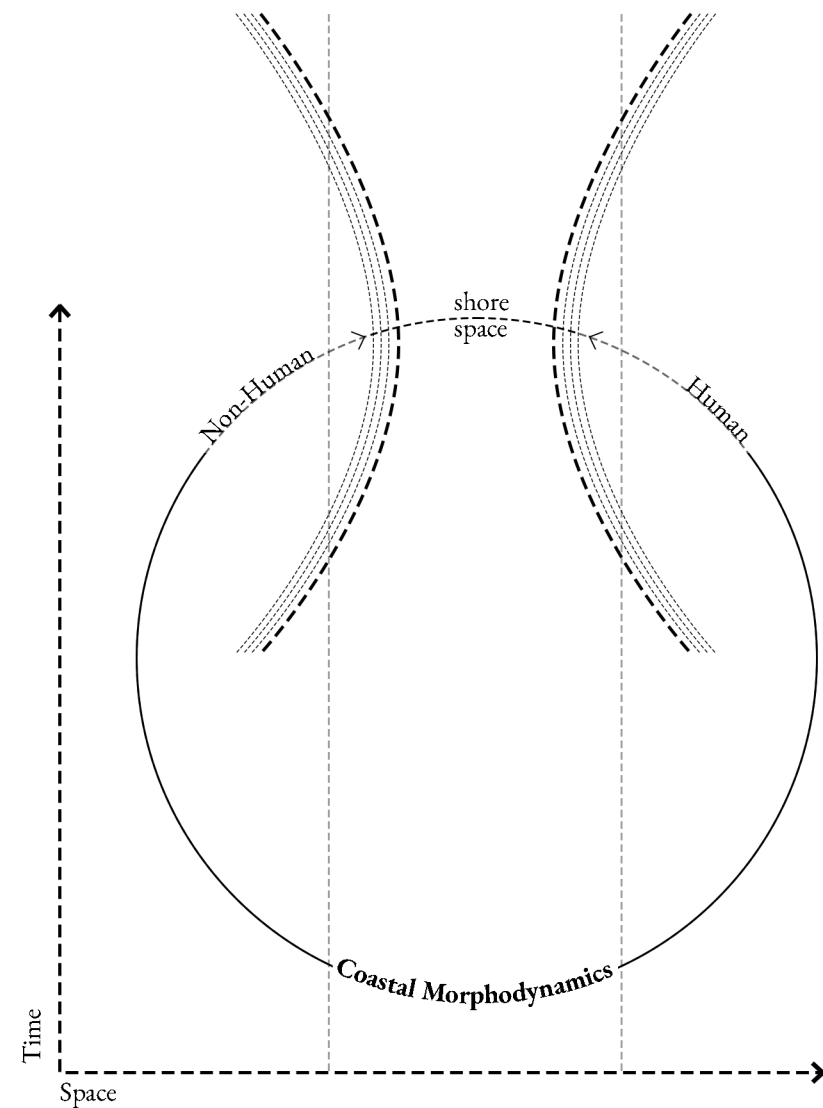
Drawing 16. Palimpsest of the Ouzai coastal slum



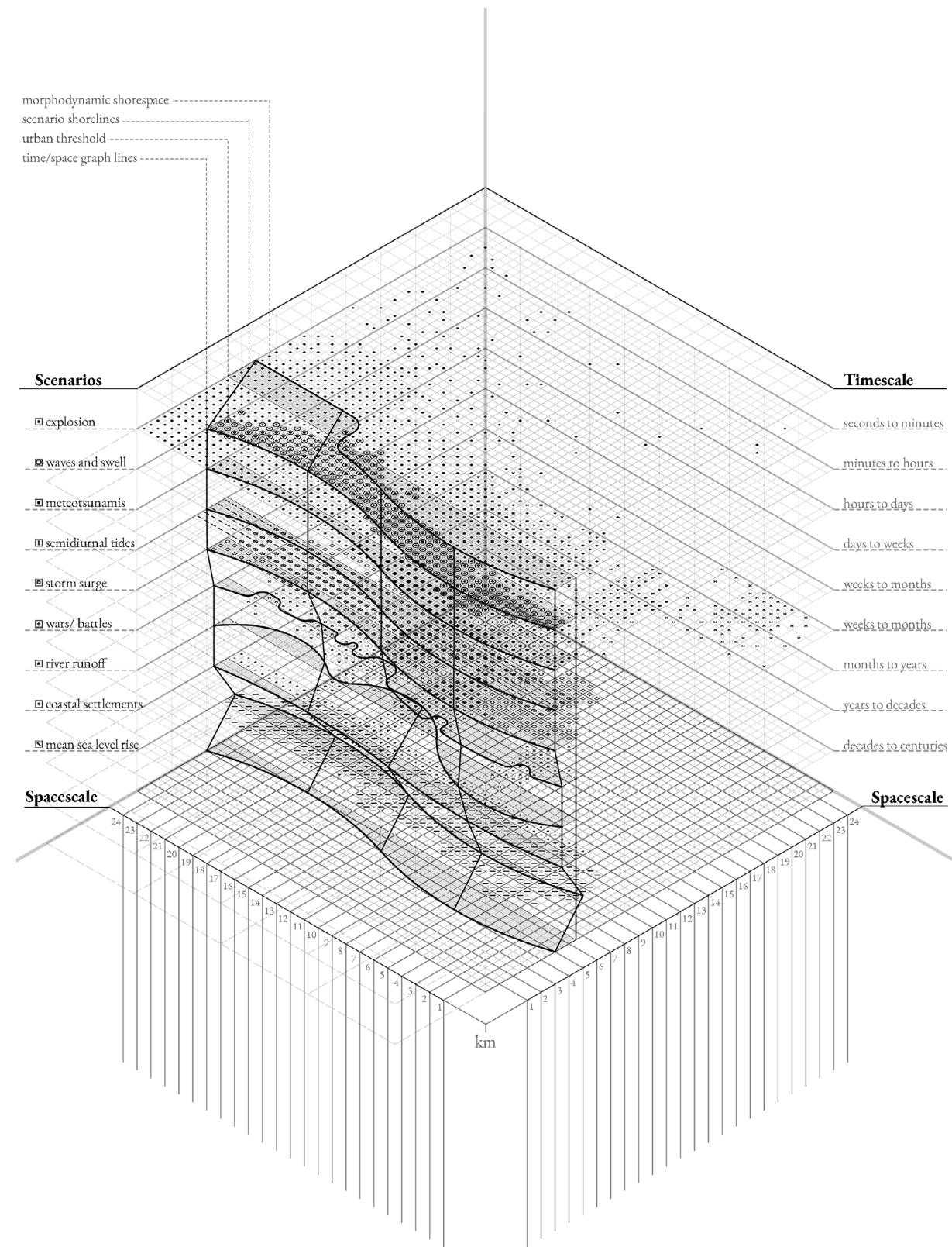
Drawing 17. Transposition, disruption

ii. Geographic Urbanism - a process of focus

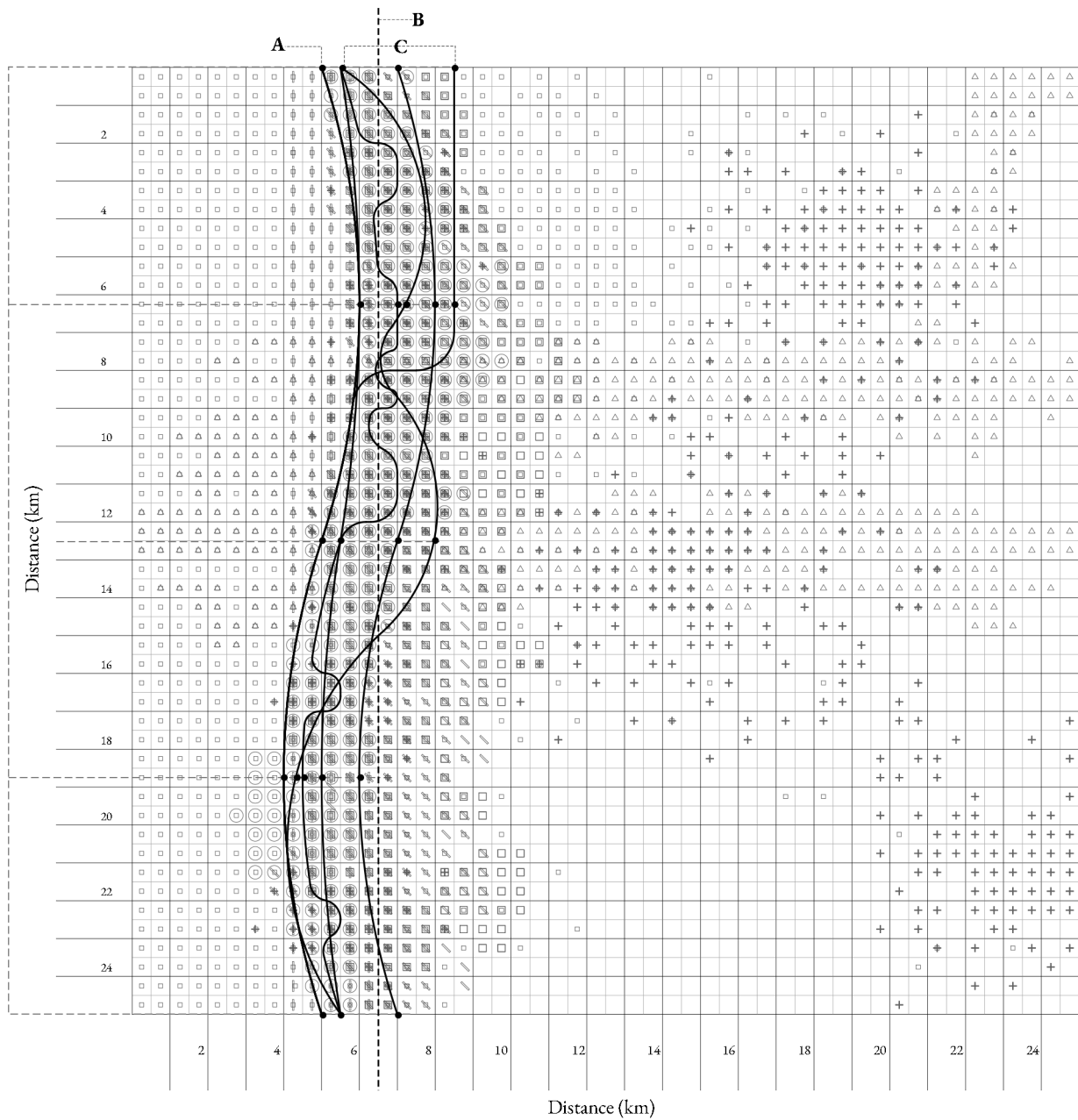
The studio intensive was initiated through the selection of a “process” that is significant to our thesis project and elaborating on it with a series of thematic drawings. This selection notably benefited me because the process that I selected would turn out to be my main subject of focus throughout the whole project. The process selected is coastal morphodynamics, which involves a system of processes and landforms operating over variable spatial and temporal scales in an environment, where the hydrosphere, lithosphere, and atmosphere meet to form one of Earth’s most complex systems [Drawing 17]. The result of this studio was a visualization of a 3-dimensional matrix displaying phenomena that contribute to the formation or destruction of the Lebanese coastline, the space each occupies, the time it takes them to manifest, and the consequential shoreline they produce [Drawing 18]. This produced scenario is juxtaposed with the average coastline in a hypothetical situation of no disruption, deduced from averaging measurements of the historical coastlines. The resulting scenarios on the Z axis serve as a coherent understanding of the extent of fluctuations that this coastline endures, which I argue is imperative to consider while addressing littoral zones of conflict.



Drawing 18. Process of focus diagram



Drawing 19. Synthetic drawing of potential coastlines, the events that shape them, the time it takes them to do so, and the space they occupy. (Isolated layers are displayed in the appendix



- A** Average coastline
- B** Urban threshold
- C** Scenario coastlines
- ▣ Incident Explosion - *milliseconds to seconds*
- Meteotsunami - *millisecond to hours*
- Waves & Swell - *minutes to hours*
- ▲ River runoff - *days to years*
- ⌈ Semidiurnal Tides - *minutes to hours*
- Storm surges - *hours to days*
- ▼ Coastal settlements - *months to decades*
- ⊕ War battles - *days to years*
- ↘ Mean Sea Level rise - *decades to centuries*

Drawing 20. Plan view of synthetic drawing delivers a clear reading and juxtaposition of possible coastlines

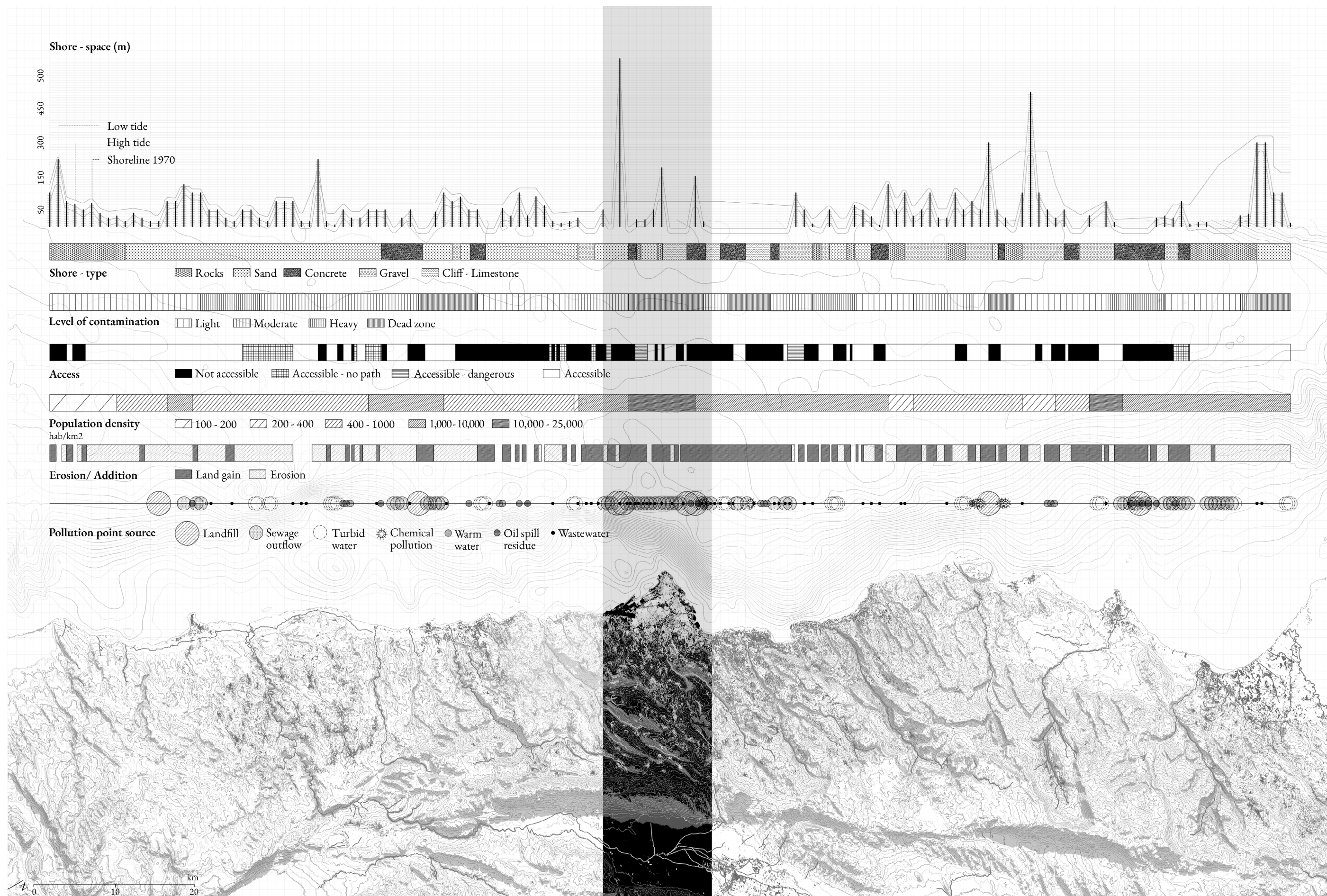
iii. Monographies - line of inquiry

The Transitional Territories studio proceeded with the proposal of the formation of an analytical investigation through a specified lens, derived from the selection of a line of inquiry, in the form of a set of thematic drawings encompassing matter, topos, habitat, and geopolitics. This section of the report will elaborate on some of the results of this exercise which helped me draw critical conclusions. The line of inquiry that I formulated is coastal morphodynamics in the presence geopolitical repercussions. Through this exercise, I narrowed my focus down to the high influence of corrupt politics on the morphology and spatial quality of the Lebanese coastline.

[A] Matter

The selected subject of focus through which these lines of inquiry are investigated is coastal morphodynamics which involves a system of processes and landforms operating over variable spatial and temporal scales in an environment, where the hydrosphere, lithosphere, and atmosphere meet to form one of Earth's most complex systems, in the presence of geopolitical repercussions. Matter here refers to the physical shore space and the tangible and intangible characteristics that dictate it. Such parameters include the type of shore space, its dominant pollutants, the level of contamination, the extent of access, and spatial fluctuation through different timescales. The superimposition of such parameters offers conclusive deductions on the general state of the coastline, as well as a thorough understanding of the interaction of different parameters with each other. For example, it is noticeable that the locations with the largest amount of shore space, paradoxically harbor the largest amount of pollution and are completely inaccessible. As a conclusion, understanding the relationships of these conditions resulted in the tactical selection of Beirut as a focus area, which displays the stochastic permutation of conditions, containing the highest combination of violations and volatility.

This was followed by the representation of a 3-dimensional matrix displaying phenomena that contribute to the formation or destruction of the Lebanese coastline, the space each occupies, the time it takes for them to manifest, and the consequential shoreline they produce. This produced scenario is juxtaposed with the average coastline in a hypothetical situation of no disruption, deduced from averaging measurements of the historical coastlines. The resulting scenarios on the Z axis serve as a coherent understanding of the extent of fluctuations that this coastline endures, which I argue is imperative to consider while addressing littoral zones of conflict.



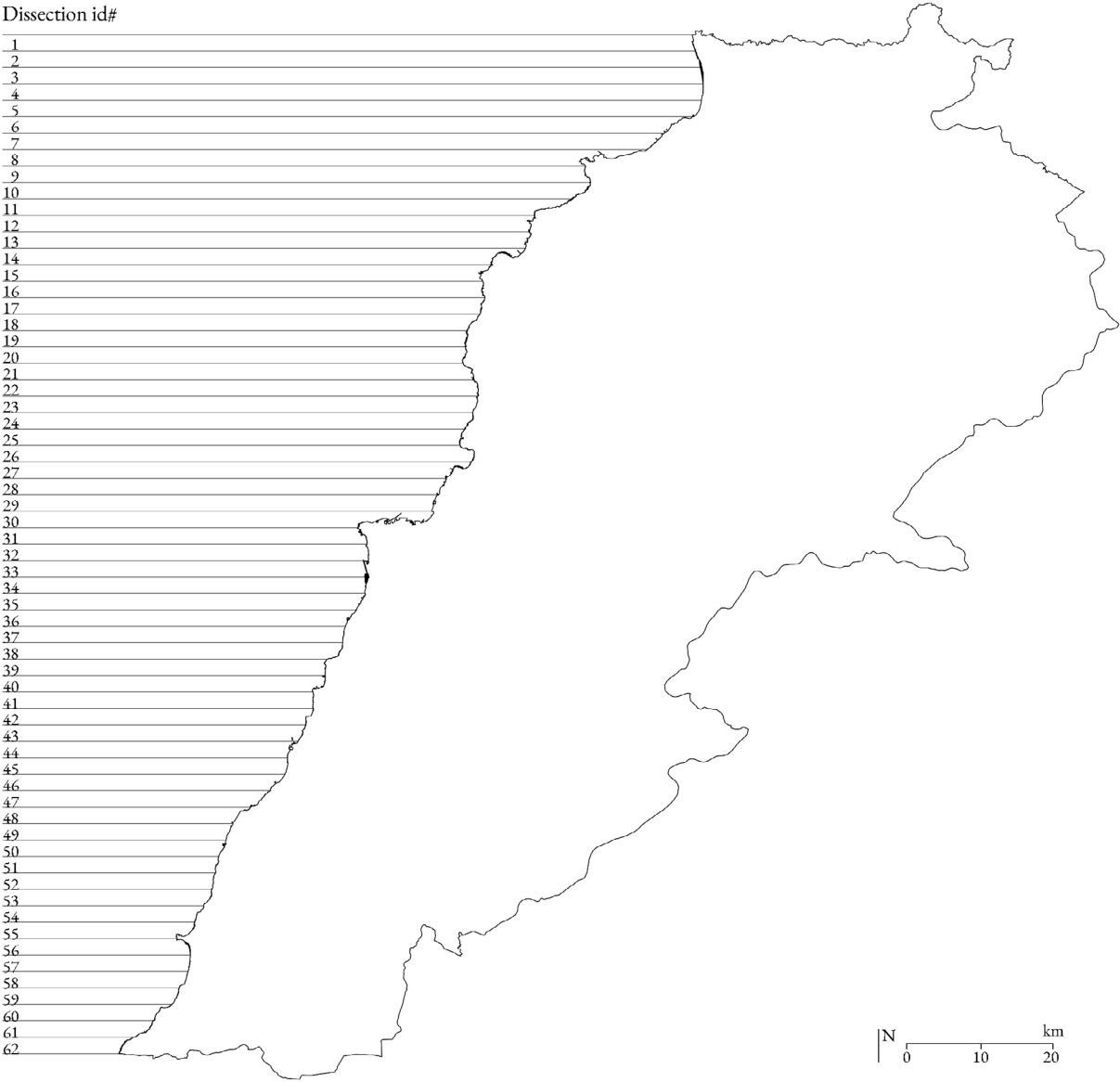
Drawing 21. **Matter/composition** a composition of the constituents of matter defining the Lebanese coastline and the deduced tactical selection of Beirut as the area of focus; the area with the most turbulent overlaps

[B] *Topos*

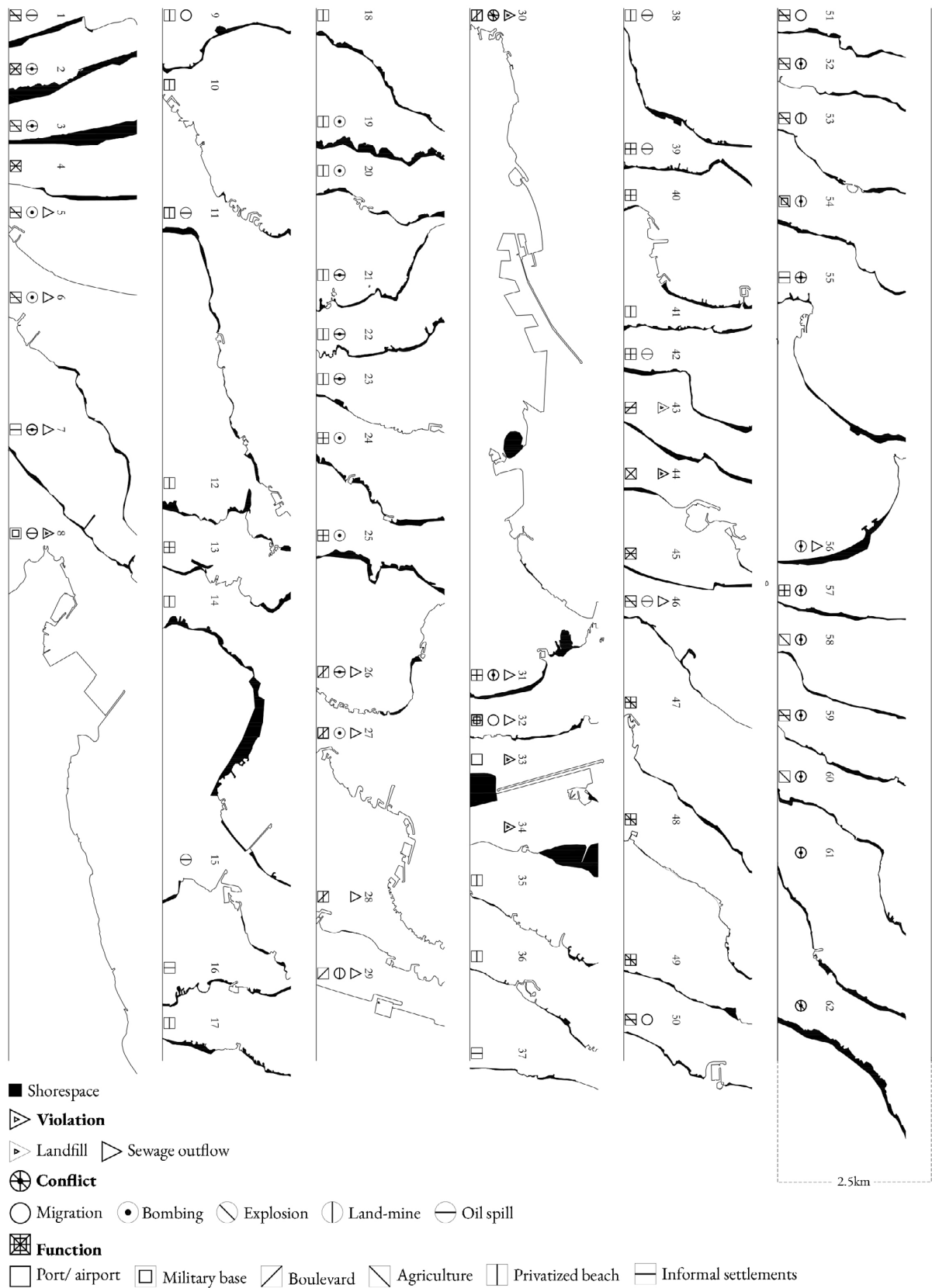
In the context of coastal morphology, topos is defined as the forms of space and the processes that govern it. Throughout this line of inquiry, I investigated the distinct tangible and intangible forms, forces, and processes which influence the Lebanese coastline morphology. To reconcile with the scale, the coastline was dissected into increments of 25 km, where each was assessed according to their spatial, political, and environmental conditions.

To visualize the extent of alteration on the landscape, I deemed it necessary to analyze territory as a volume and to investigate the vertical forces that contribute to its form, as the forces that result in the most drastic changes the topos of the landscape occur on the vertical axis. This was visualized by illustrating an axonometric of a selected location that is least inhabited, yet most volatile due to its proximity to the Israel border south of Lebanon. The axonometric displays the interaction of both vertical and horizontal forces that contribute to this coast’s morphodynamics. The vertical forces are illustrated as the stratigraphic log of sedimentary facies, the faults that are occurring along them, and the era of their formation. The horizontal forces are labeled as pivotal currents, rate of coastline recession, predominant wind direction, and patterns of inhabitation. This drawing argues that the intersection of these forces is vital to assess, generating a new lens through which I will perceive the project.

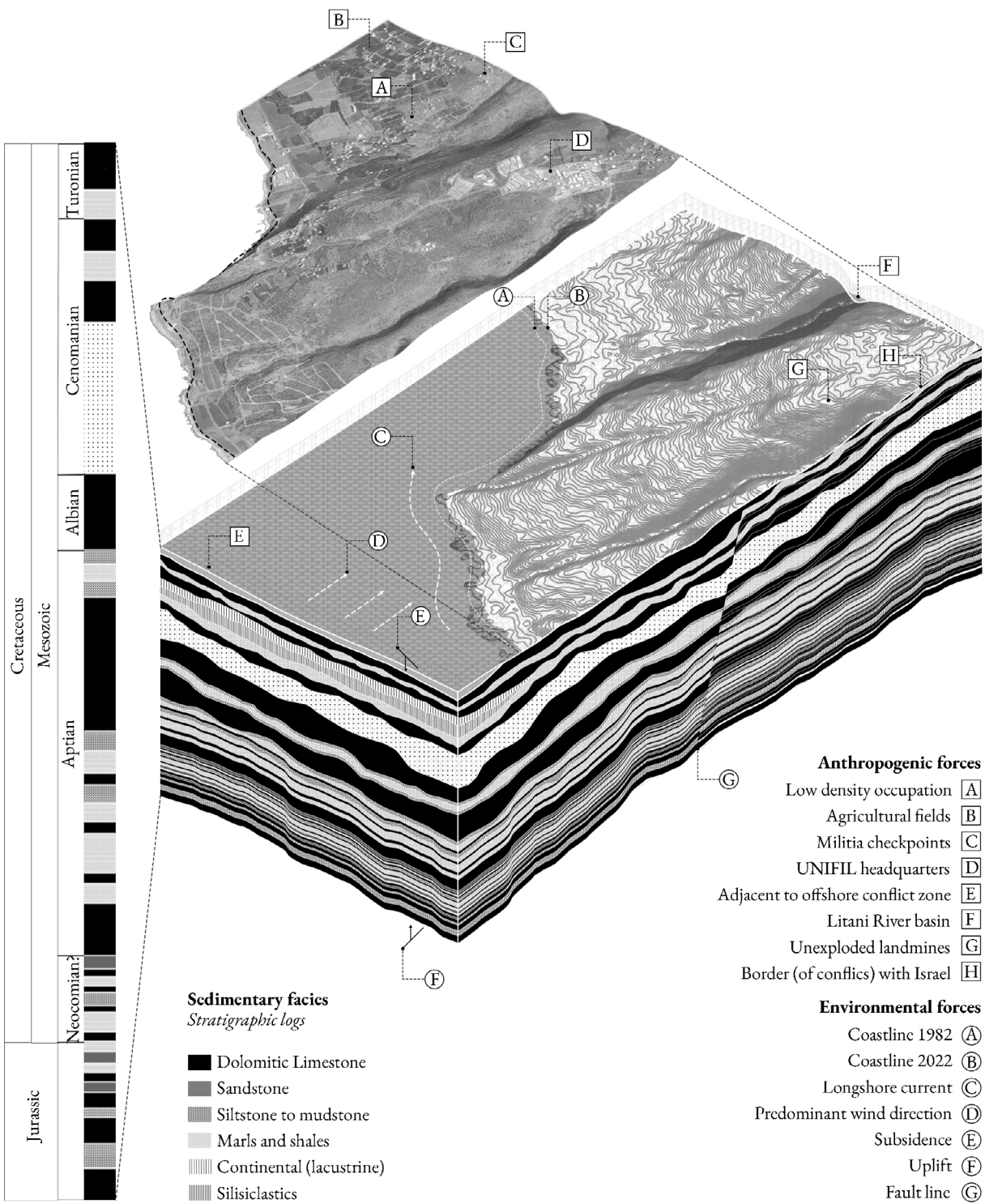
Another conclusion extracted from this section is the extent of the volatility of the coastline, where geological forces, which are slow acting and take millennia to manifest spatially are exceedingly dynamic in the context of the Levant basin, where the Lebanese coastline is situated. It is highly active geologically with elevated risks of earthquakes and tsunamis and accelerated subsidence and uplift.



Drawing 22. *Topos/ composition_* method of dissecting shoreline - key plan



Drawing 23. **Topos/composition**_dissected shorelines, their amount of shore space in a black fill, and their characteristics



Drawing 24. **Topos/ alteration_ territory as volume**, drawing the vertical forces that shape coastal morphology

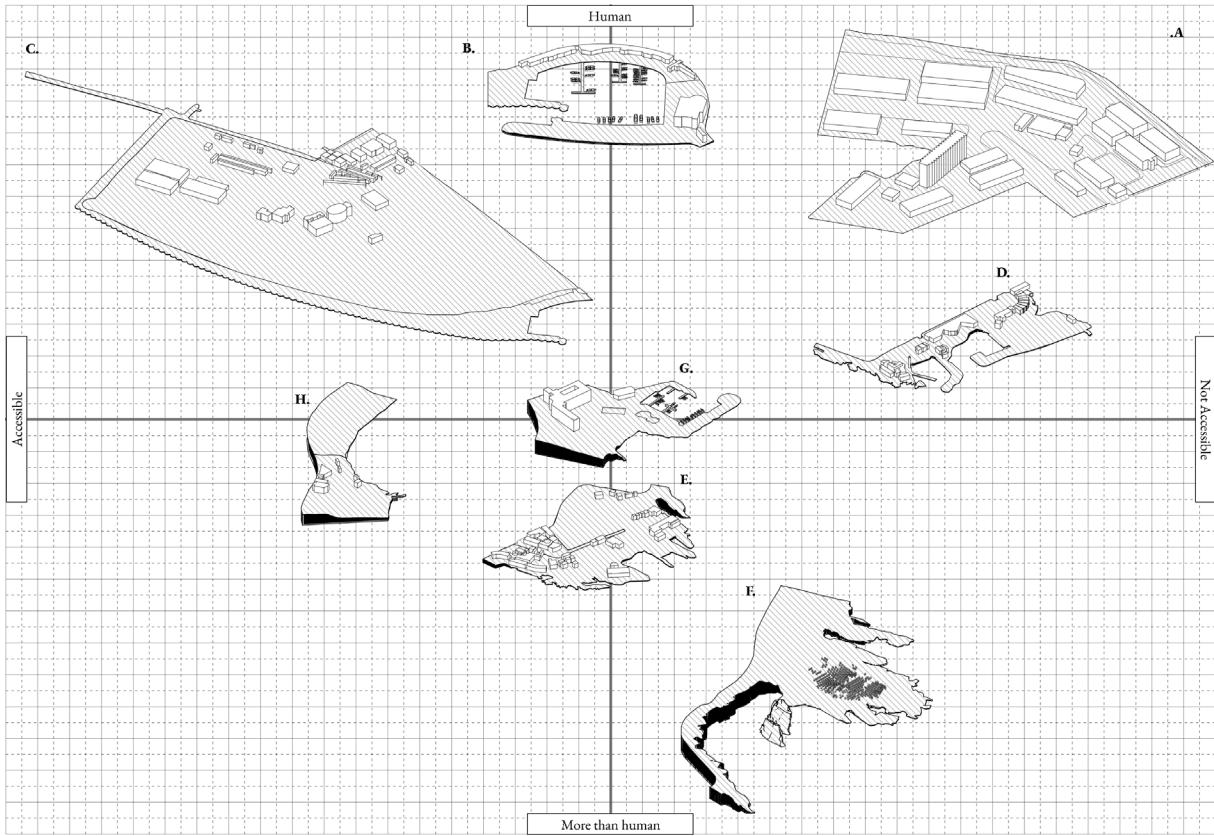
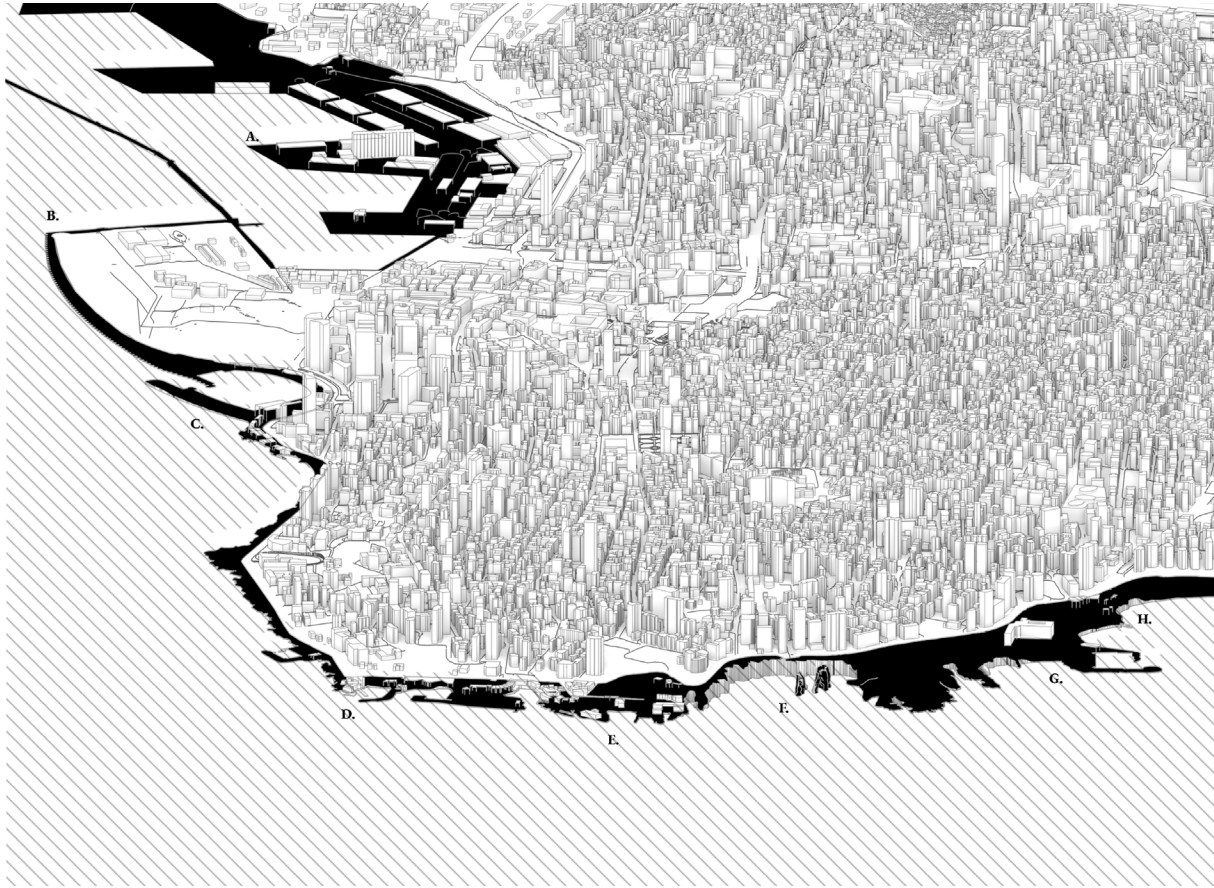
[C] Habitat

Habitat refers to the surroundings and conditions in which different forms of beings inhabit. Through this lens, I explored the parameters that dictate habitat, zooming in on my area of focus, Beirut. These investigations represent the fragmentation, illegal privatization, and occupation of the capital’s coastline, displaying shoreline continuity, patterns of ownership, violations, functions, pollution, and shore type. The main conclusion extracted sheds light on the extent of violation of the Maritime Public Domain, where the illegal privatization of the coast has resulted in an obstruction to its free access. These private developments mostly involve artificial extensions to the coastline, resulting in the paradox of an increased amount of physical space with a decreased amount of access. The lack of accessible public spaces within the congested capital renders the coastline the city’s only available open space, yet it is rarely accessible. This builds on the urgency of the need to somehow reestablish spatial justice on the coastline.

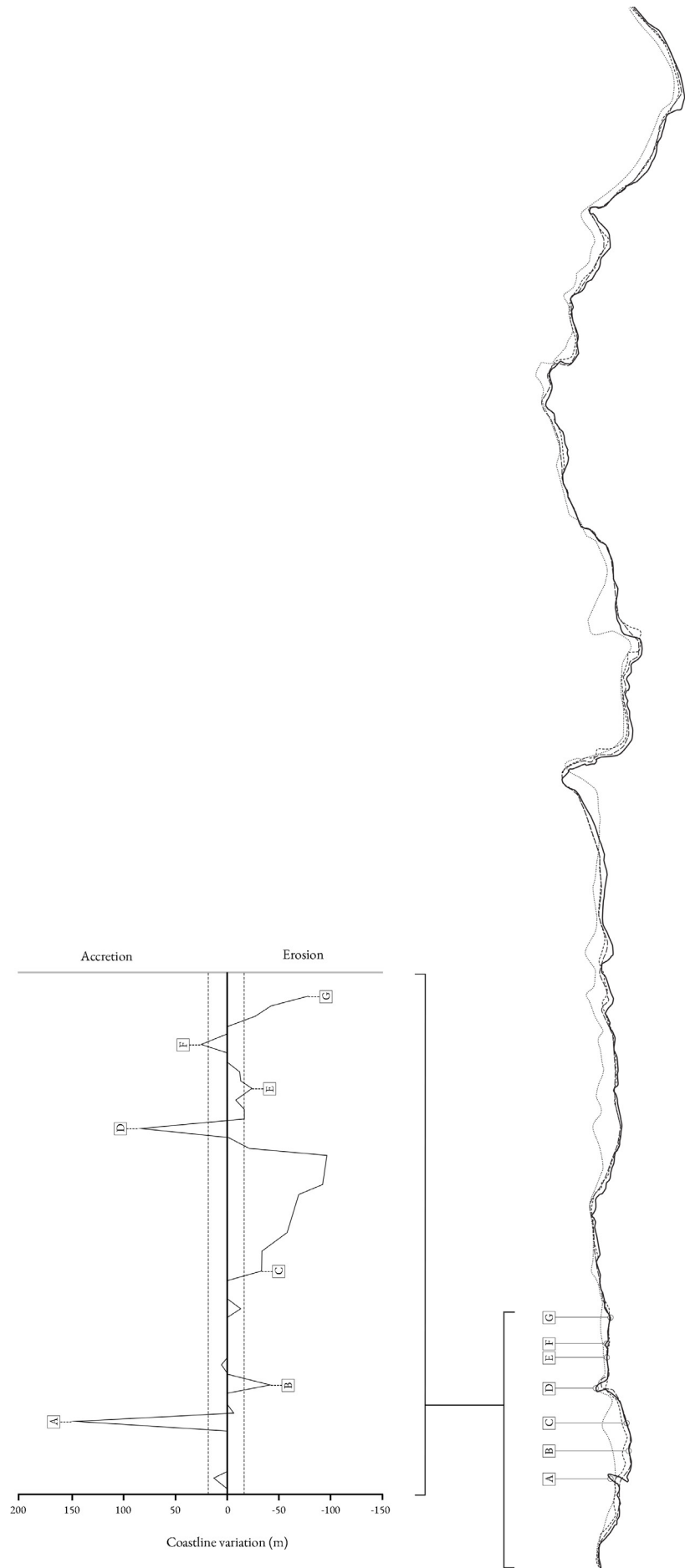
Finally, the limits of habitat are not only constrained by anthropocentric mutations but more so through the powerful forces of plate tectonics. Lebanon lies astride an active plate boundary, known as the Levant Fault System (where the eastern Arabian plate is sliding northward and clockwise relative to the Sinai plate located in the west) while simultaneously facing another significant plate boundary over Cyprus, known as the Cyprus Subduction Zone. Lebanon is situated amid these active zones, highly influenced by the relative motion of these plates, making the occurrence of earthquakes highly probable. Studies have revealed that such formations can generate the largest earthquakes (of magnitudes equal to or more than 8), consequently resulting in secondary coastal and inland hazards, such as tsunami waves and landslides. Such occurrences would completely obliterate habitats of the littoral zone and all its anthropogenic traces, as it is already subject to soil liquefaction due to the heavy construction on its alluvial plane



Drawing 25. **Habitat/ composition_** an exploration of the parameters that dictate habitat



Drawing 26. **Habitat/ alteration_** coastal fragments on a matrix

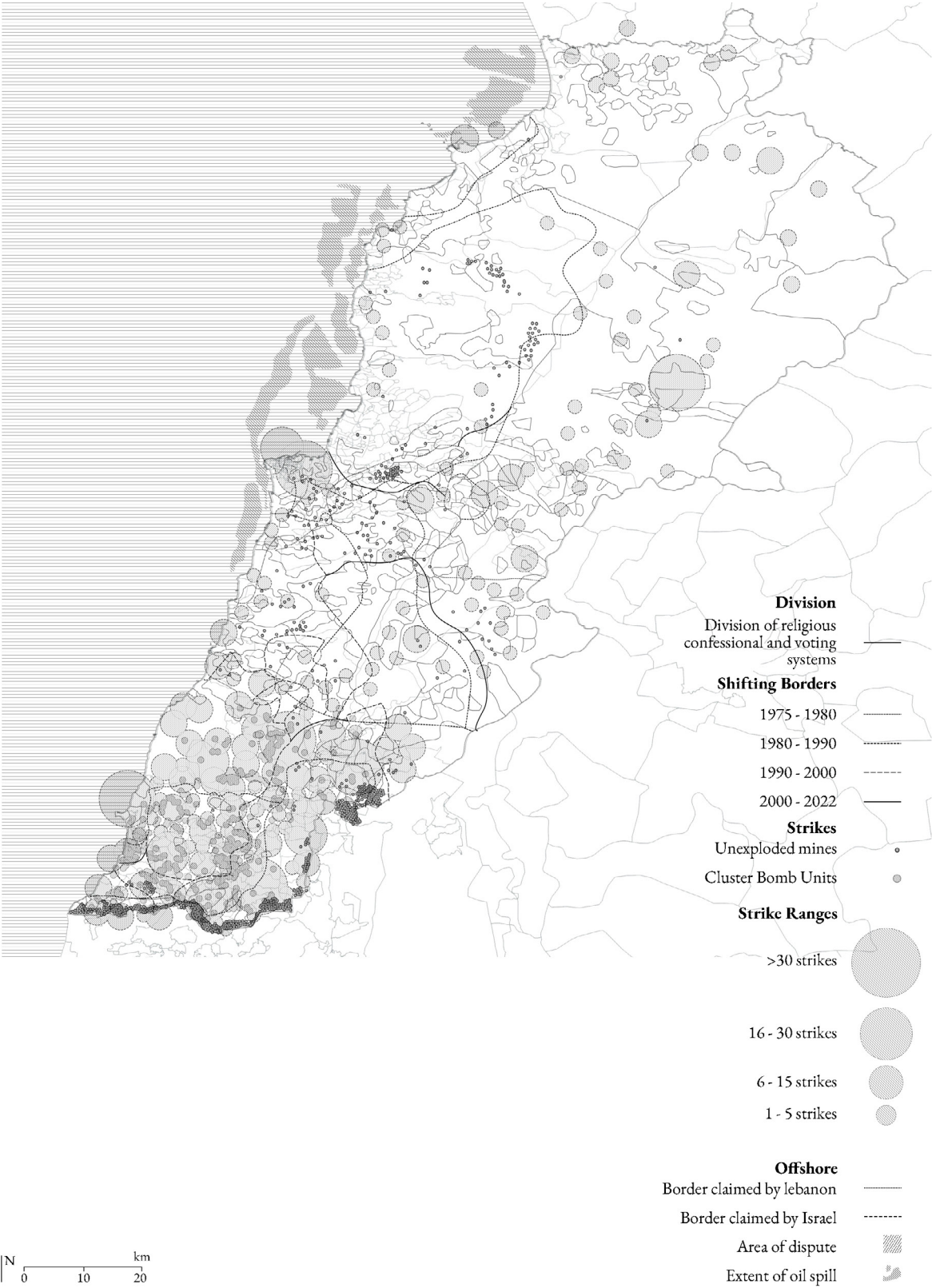


Drawing 27. **Topos/ limits_** the rate of fluctuation of the coastline throughout the years in relationship to the major developments that occurred along it (on the selected coastal city of Tyre, located in the south of Lebanon, previously a significant Phoenician capital city).

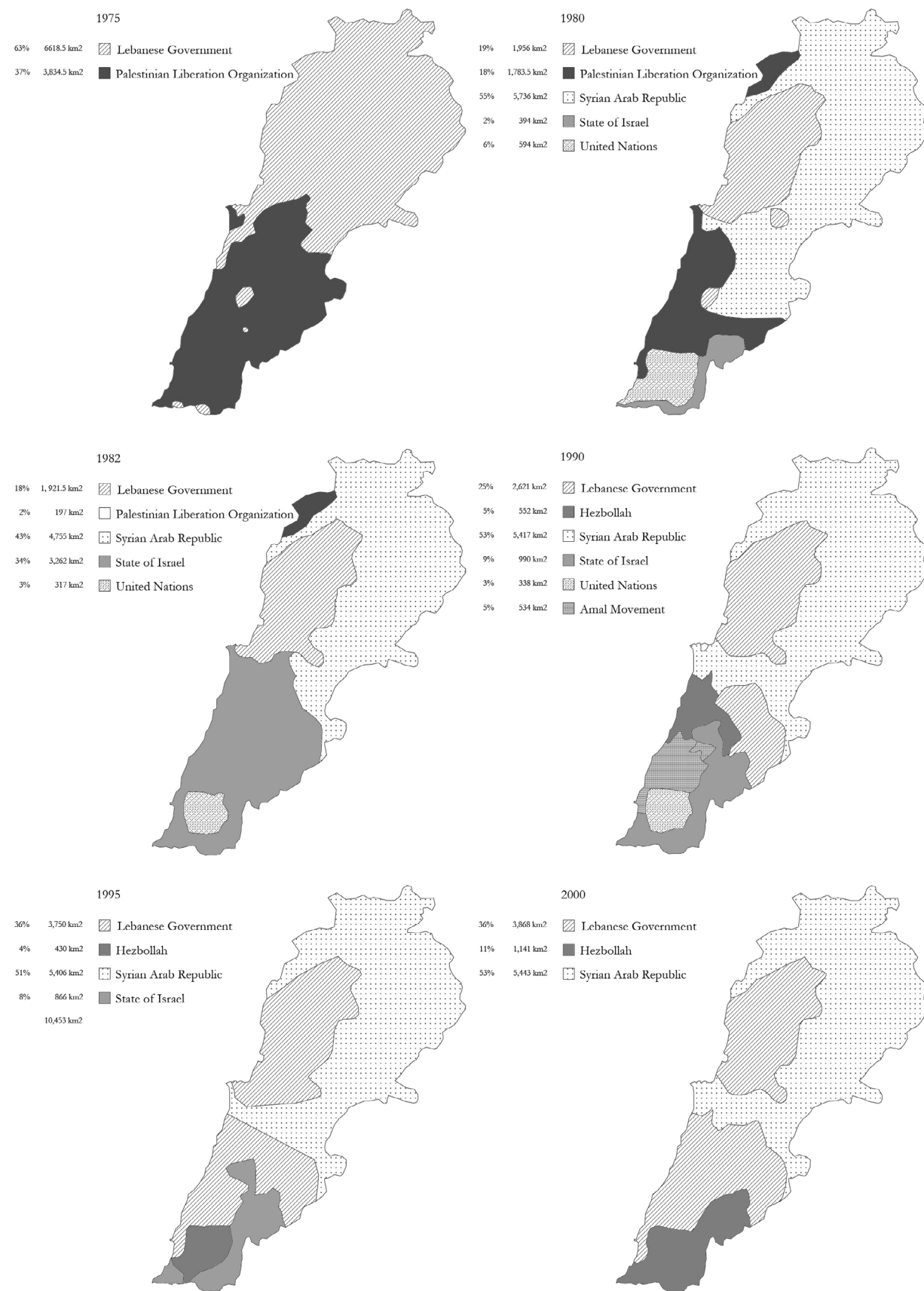
[D] Geopolitics

Lebanon is one of the most corrupt countries in the world, one of the reasons is that it is highly divided and sectarian in every aspect. There are 18 sects, all of which have inflicted war with one another at some point in time. Through the geopolitical lens, I endeavored to understand the spatial distribution of these political strongholds and their territorial occupation. Overlapping these two layers of information along with the physical damage caused throughout the conflicts, such as explosions, cluster air strikes, minefields, oil spill extents, and ongoing maritime border disputes, results in an overview and understanding of the extent of instability, where it is mainly occurring, and its temporal dimension.

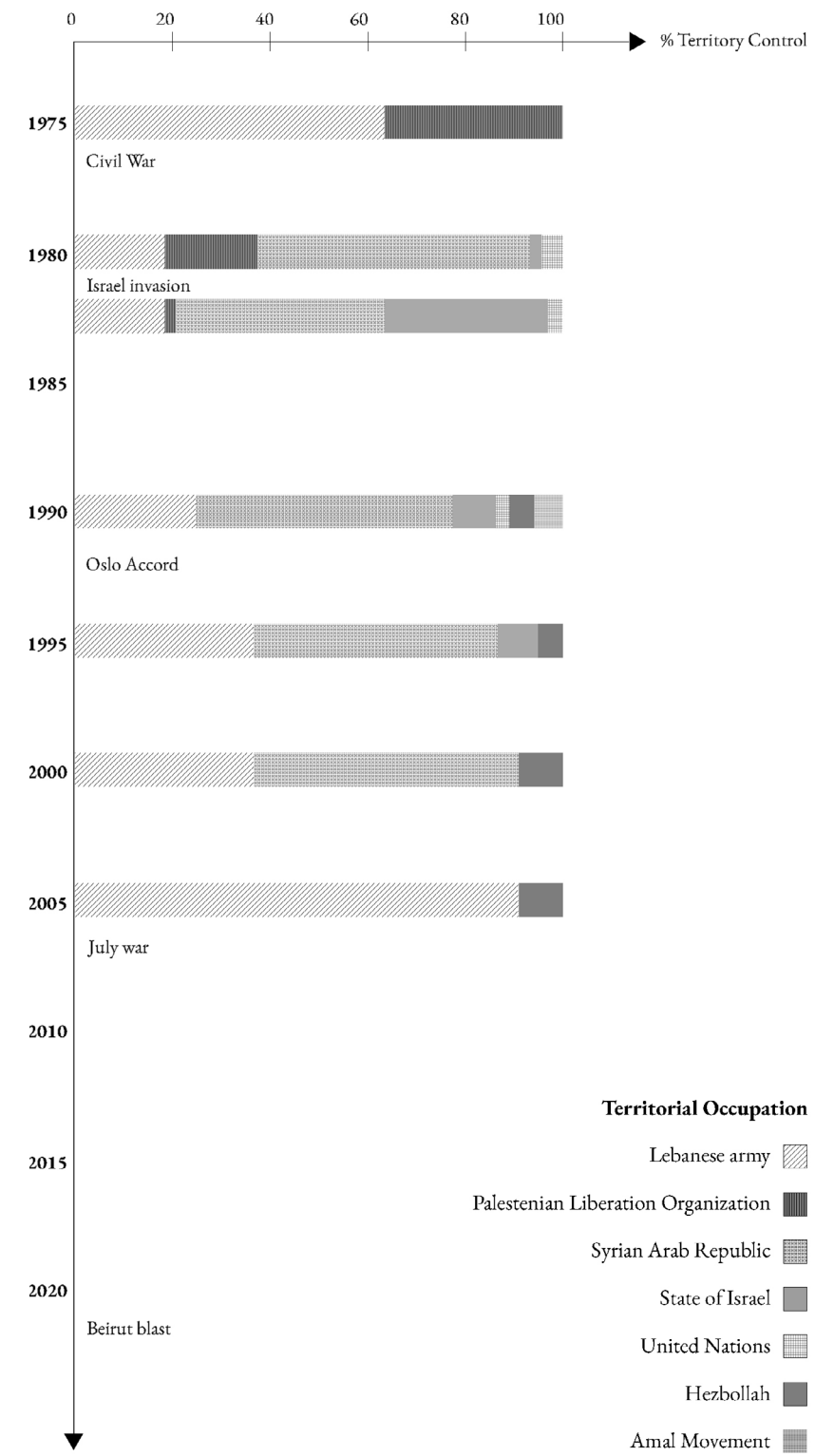
One of the many consequences of this volatility is haphazard migration forming slums, in particular, the coastal slum of Ouzai, one of the shorelines I am focusing on in this project. I explored the evolution of shore space adjacent to the major political crises, and what is left of that baseline shore space through high tide low tide, and storm surges, which is evidently inexistent today. This is illustrated in relation to the measure of the surface area of erosion and artificial accretion, resulting in an almost symmetrical formation [Drawing 27].



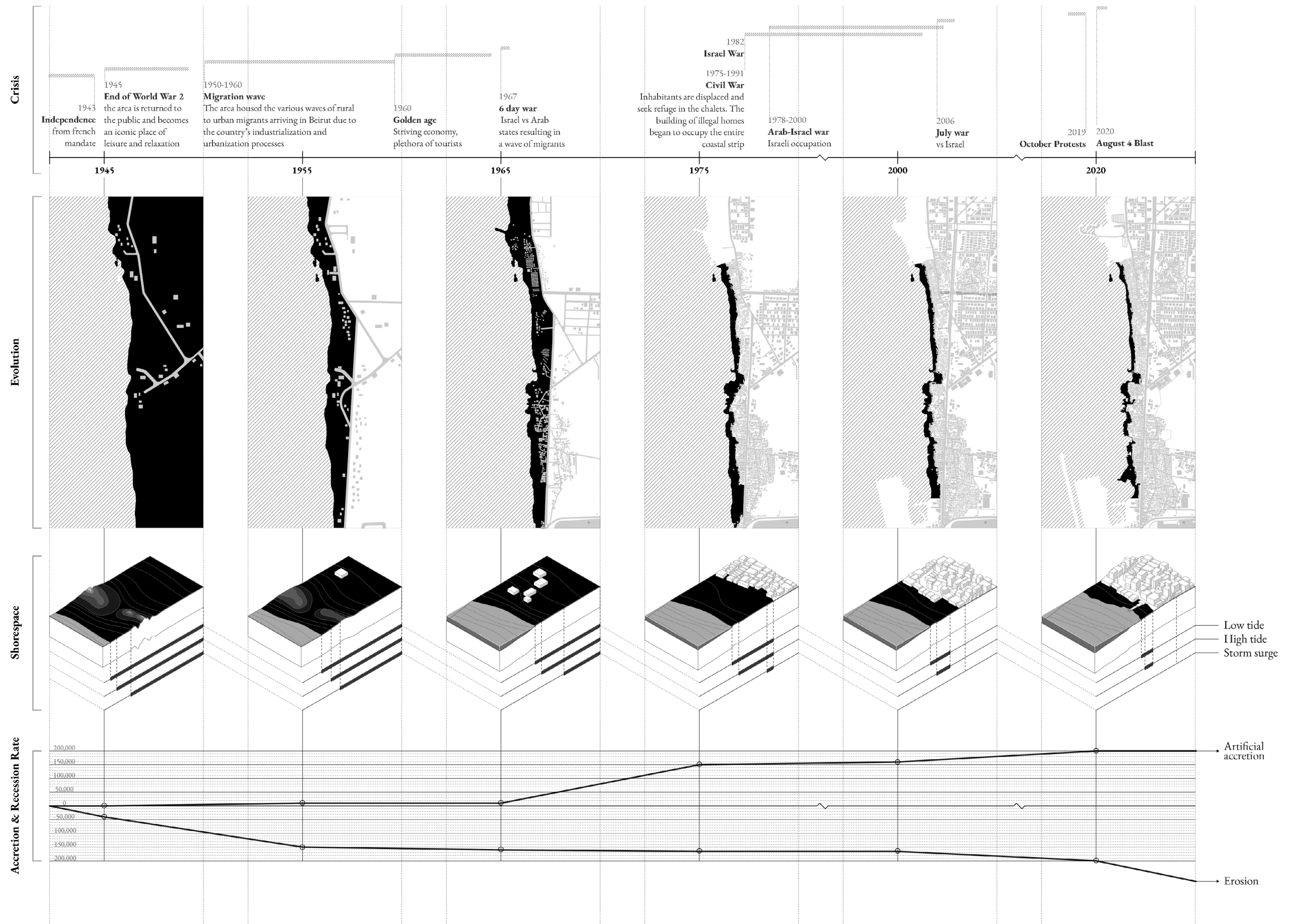
Drawing 28. Geopolitics/composition_ shifting territories and spatial implication of political conflict



Drawing 29. Geopolitics/ limits_ shifting territories



Drawing 29. Geopolitics/ limits_ shifting territories (continued)



Drawing 30. **Geopolitics/ alteration**_ spatial implication of geopolitics on the Ouzai coastal slum, the evolution of shore space adjacent to the major political crises, and what is left of that baseline shore space through high tide low tide, and storm surges (evidently inexistent today).

I.	Introduction
II.	Research question
III.	Methodology
IV.	Literature Review
V.	Assessment
VI.	Revised Progression
VII.	The Canvas
VIII.	Conclusion
IX.	Bibliography
X.	Appendix

VI. Revised Progression

I previously hypothesized that it is imperative to comprehend the morphology of the littoral landscape as dictated by a volume of permutations, and this understanding would result in the design of an approach which would attain an accessible autonomous coastline in this case of extremes. Through the culmination of research, assessments, and the site vision, my hypothesis developed an additional figure of thought.

i. Revised hypothesis

The littoral landscape perpetuates an embedded set of mechanisms which magnificently accommodate permutations of uncertainty. This is achieved simply through its innate characteristic as a threshold space of liminality. The coast is equipped with a programmed capacity to morph over varying spatiotemporal scales, possessing the purest and most powerful form of adaptation. This capacity has been entirely removed from the context in question, through the violent subjugation of the coastal space and its reduction to a series of fragments, plugged in to what was historically perceived as a coastline [Drawing 31]. This critical zone is now devoid of the essential transitional space which is necessary to exist in order for these two highly contrasting worlds of inland and seaward to coalesce harmoniously.

The objective of the project becomes simply about bringing back the beach.

I hypothesize that in these challenging circumstances of extreme conditions, the pathway to attaining this goal necessitates embracing an alternative perspective. Instead of solely focusing on identifying and addressing issues of deterioration, it calls for a lens that recognizes potentialities and actively leverages them. To accomplish this, an analytical approach combining cartographic and graphic interpretation is employed. It seeks to determine which of these fragments still retain the capacity for a transitional space of liminality to exist and to what degree. By doing so, it aims to maximize these opportunities rather than simply attempting to address the problems that possess them.



Drawing 31. Fragments plugged in to what was prehistorically a coastline

ii. Further research_ the ecological, cultural, and historical importance of the beach

Benthic life relies heavily on the transitional space where water starts to meet land. This zone serves as a critical interface between terrestrial and aquatic ecosystems. The shallow bathymetry allows for a uniquely diverse ecological niche due to the high percolation of light, amplifying nutrient cycling and filtration. Additionally, this space is essential for sediment stabilization in the endeavor to control erosion. This is applicable for all shore types, as rocky beaches reduce the impact of waves and storms while vegetated sandy shores are stabilized through extensive root systems (John et al., 2017; McLachlan & Defeo, 2017; Raffaelli & Hawkins, 1996).

In addition to its current cultural significance, it is imperative to note that the beach was an integral component in the identity, essence, and prosperity of Lebanon's historic and prehistoric civilizations [Drawing 32]. The Phoenicians, renowned as one of the most advanced civilizations, are characterized by their connection to the sea. They once ruled the Mediterranean sea, the core of their territory situated in what is known as Tyre, a city (once the capital) located in the south of Lebanon. This coastal region stands as a testament to the rich heritage and maritime legacy that characterizes Lebanon's past civilizations. Mark Woolmer, a leading researcher of Phoenician studies writes that this was the only recorded time in history where the land known as Lebanon today was not a political pawn and in fact, autonomous (Woolmer, 2017). He connects this with their strategic location on the eastern edge of the Mediterranean. Throughout the different eras of occupation, up to the Ottoman rule, the sea remained a defining characteristic of the civilizations that inhabited it, depicted through cartographies, writings, poetry, art, and historic events. Up until Lebanon came to existence in 1920, after the dissolution of the Ottoman empire at the end of World War I. The borders of Lebanon were drawn (almost randomly) through the Sykes-Picot treaty in 1916 dictating how the Levant region will be divided. The borders of Lebanon were delineated in a way which reflected political and economic interests, rather than the cultural, linguistic, and historical ties of the people living in the region. These divisions multiplied exponentially throughout Lebanon's modern history as a product of regional and local disputes.

The beach vanished when such lines started to arbitrarily appear on the map driven by political interests and tactical decisions, leading to the state that the coast holds today.

Prior to the imposition of these divisions, which tragically transformed into catalysts for mass violence, the waterfront's edge was not perceived as a solid line, but rather as a nuanced threshold. It embodied a formidable presence, not to be trifled with, and its influence often permeated into the city, asserting a temporal occupancy of the space that rightfully belonged to it.

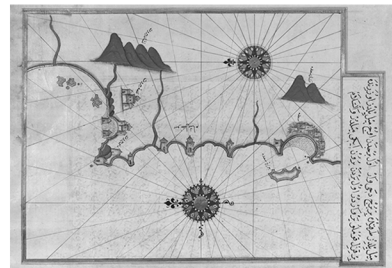
Today, similar to the era of the Phoenicians, the profound connection between the nation's identity and the sea endures, with one notable distinction: the almost complete loss of access to the sea. Despite this, the connection remains apparent through the presence of fishing ports which have persisted amidst severe pollution, the tenacity of recreational beach activities amid heaps of garbage and sewage flows, and the resourceful utilization of the scarce spaces that still manage to interact with the water.



5,000-3,500 B.C.
Neolithic & Chalcolithic



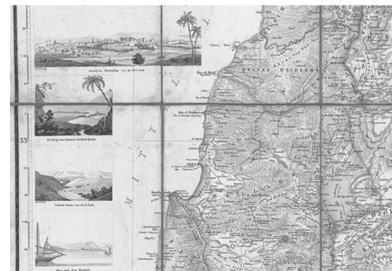
3,500-344 B.C.
Phoenicians



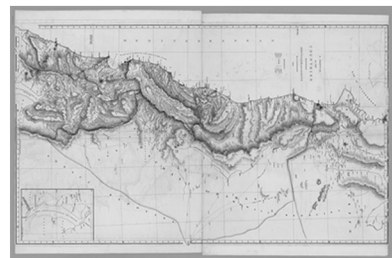
333-64 B.C.
Greek rule



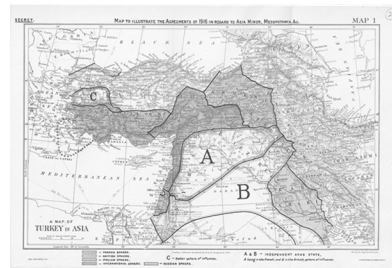
660-1258 A.D.
Byzantines



1099-1291 A.D.
Crusaders



1250-1516 A.D.
Mamlukes



1516-1914 A.D.
Ottomans

1920
Sykes-Picot Agreement

1944
Independence

iii. Definition of the beach as a space of liminality

Despite the subjective nature of its perception, whether feared or sought, the beach is inarguably a space of divinity. It exists as a physical space, characterized by the perpetual metamorphosis of its shoreline, molded by the ceaseless ebb and flow of tides. A boundless horizon stretches beyond, concealing depths of enigmatic topographies beneath it, and the immeasurable life that this volume hosts. It is a zone where the driving forces of the atmosphere, surface, and subsurface collide and are almost visibly revealed, simultaneously unveiling and further amplifying its mysteries. It is a space that is neither sea nor land, constantly transforming across all the different perceptions of time and scales, never identical to the state it was in the milliseconds, minutes, years, and millennia preceding each single unique moment in time. Unequivocally, the beach as a space of liminality has been a subject of discourse and representation, bringing forward thought provoking insights on its conception. Mihaly Csikszentmihalyi describes the sensation of being present on a shore as one of his definitions of his coined term “flow”, where he describes this experience as “a unified flowing from one moment to the next, in which we feel in control of our actions, and in which there is little distinction between self and environment; between stimulus and response; or between past, present and future.” (1974)

In Preson-Whyte’s essay The beach as a liminal space, the core essence of Csikszentmihalyi’s description can be found in the lack of a clear differentiation between oneself and the surrounding environment. This sentiment resonates with the prevailing perspectives regarding the division between human and nonhuman “actors” of Callon (1986), Latour (1987), and Law (1994). He further elaborates on this space’s ability to obscure spatial and theoretical boundaries of culture and nature and politics and freedom.

Drawing 32. Significance of the beach through time

iv. Further assessment and entry point

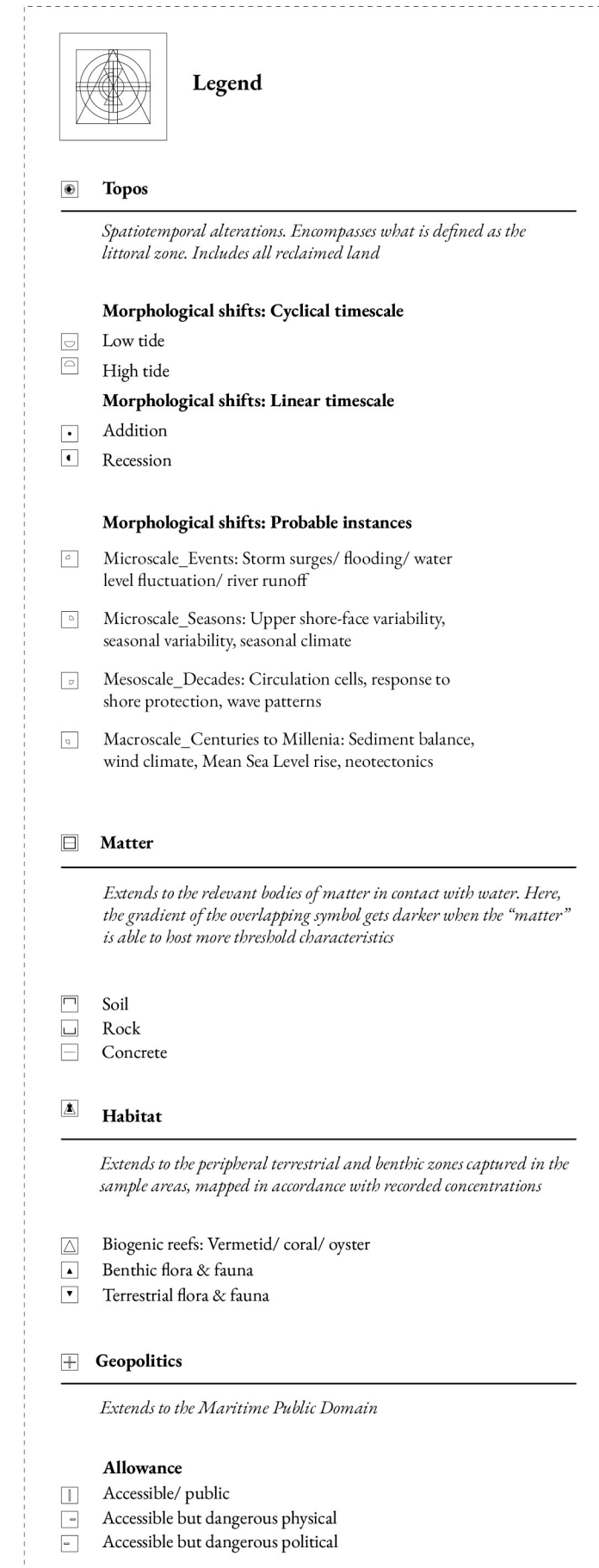
Through the adopted lens of identifying potentialities, I was curious to understand which of these fragments still allowed for a threshold space of liminality to exist, and to what extent. This resulted in an assessment centered around graphical cartography which would quantify and qualify the extent of threshold characteristics that each coastal fragment retains [Drawings 33 to 45]. The cartographies represented an assessment of parameters which indicate the tangible and intangible elements which host such characteristics. This was realized through the production of a basic basemap drawing for each fragment, followed by its reduction to a pixel grid, which enabled a more systematic, quantifiable, and comparative approach to mapping. The mapped parameters were derived from the four thematic lines of inquiry previously explored in the Transitional Territories studio. The data represented was retrieved from a combination of thorough contextual research, analysis of satellite imagery and drone footage, site visit observations, and interviews with relevant experts.

“Topos” represented the physical spatiotemporal alterations on the space defined as the littoral zone, mapping the main morphological shifts across cyclical (tides) and linear (recession and accretion) timescales, as well as shape-shifting probable instances in the micro, meso, and macro scales. “Matter” addresses the materiality, or nature of the relevant bodies of matter in contact with water. “Habitat” examined the peripheral terrestrial and benthic zones captured in the sample area, mapping the concentrations of critical habitats of potentiality. Finally, “Geopolitics” assessed the extent of access within the Maritime Public Domain.

The logic of this mapping method lies in the deliberate selection of symbols for each parameter. As a result, each pixel portrays a composite layer of information while maintaining the visibility of individual layers. As a final composition, darker areas of the grid resulting from a multitude of symbols overlapping indicate a higher value of threshold capacity. This tool additionally provides a detailed level of information encapsulated within each pixel which would be used to inform design, deeply taking into consideration the existing condition in all its complexity to figure out how can the proposed beach condition coexist with these fragments.

This method of representation blurs the boundary between water and land, challenging the notion that the coast is perceived as line, rather than a space. The coastline is no longer confined to its delineation as an abrupt border between land and water. It becomes blurred, layered, malleable, temporal, and interpretative. This liminality is defined by the permutation of components which dictate littoral landscapes, even the ill perceived. “Man made” elements such as concrete are re imagined and represented in a way which recognizes their potential to act as a shore. This contributes as part of shifting the narrative.

I argue that adopting this view is the entry point for a hopeless case of extremes.

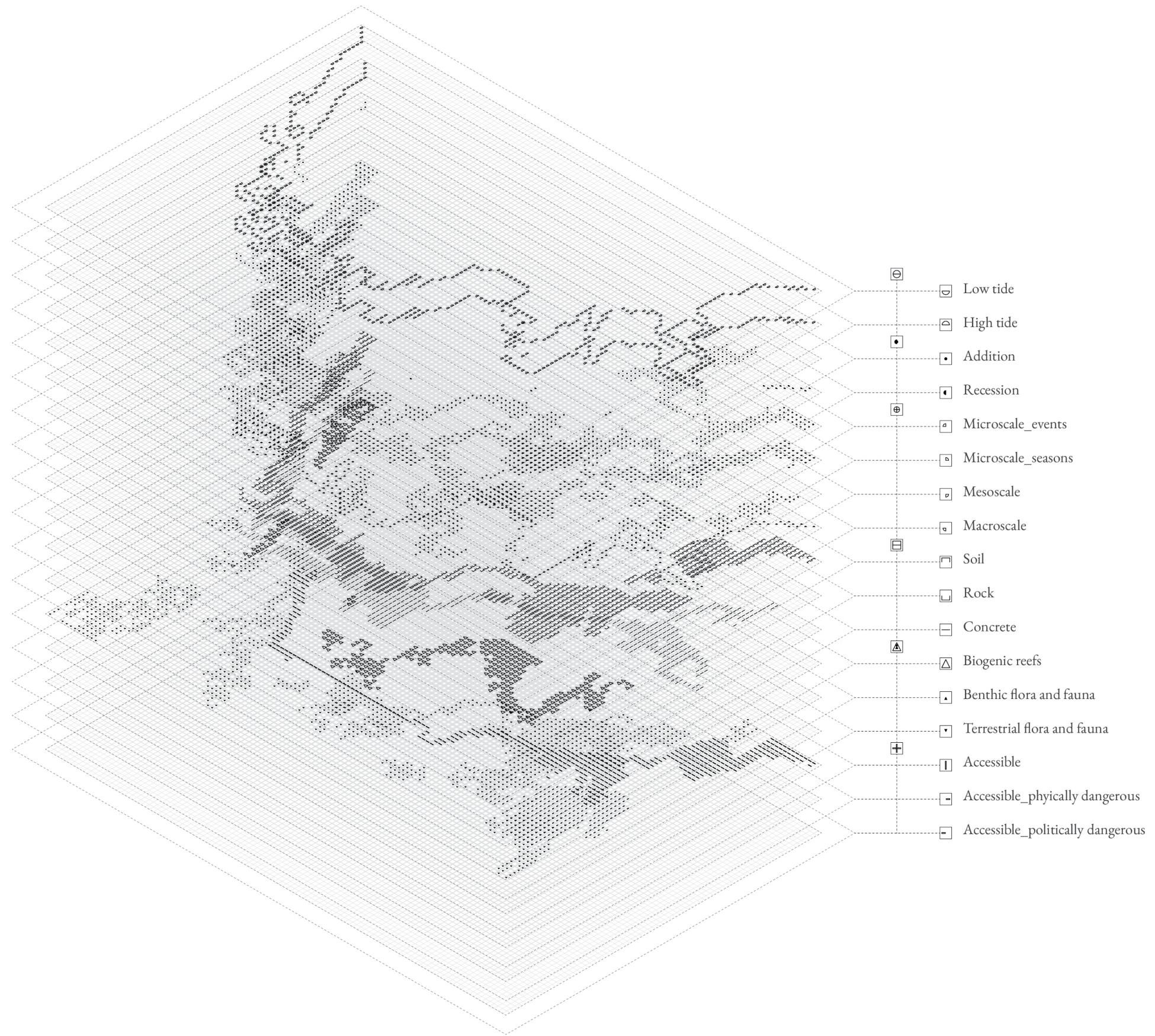


Drawing 33. Threshold capacity assessment legend



Drawing 34 & 35. Fragment A: The Dalieh rock formation

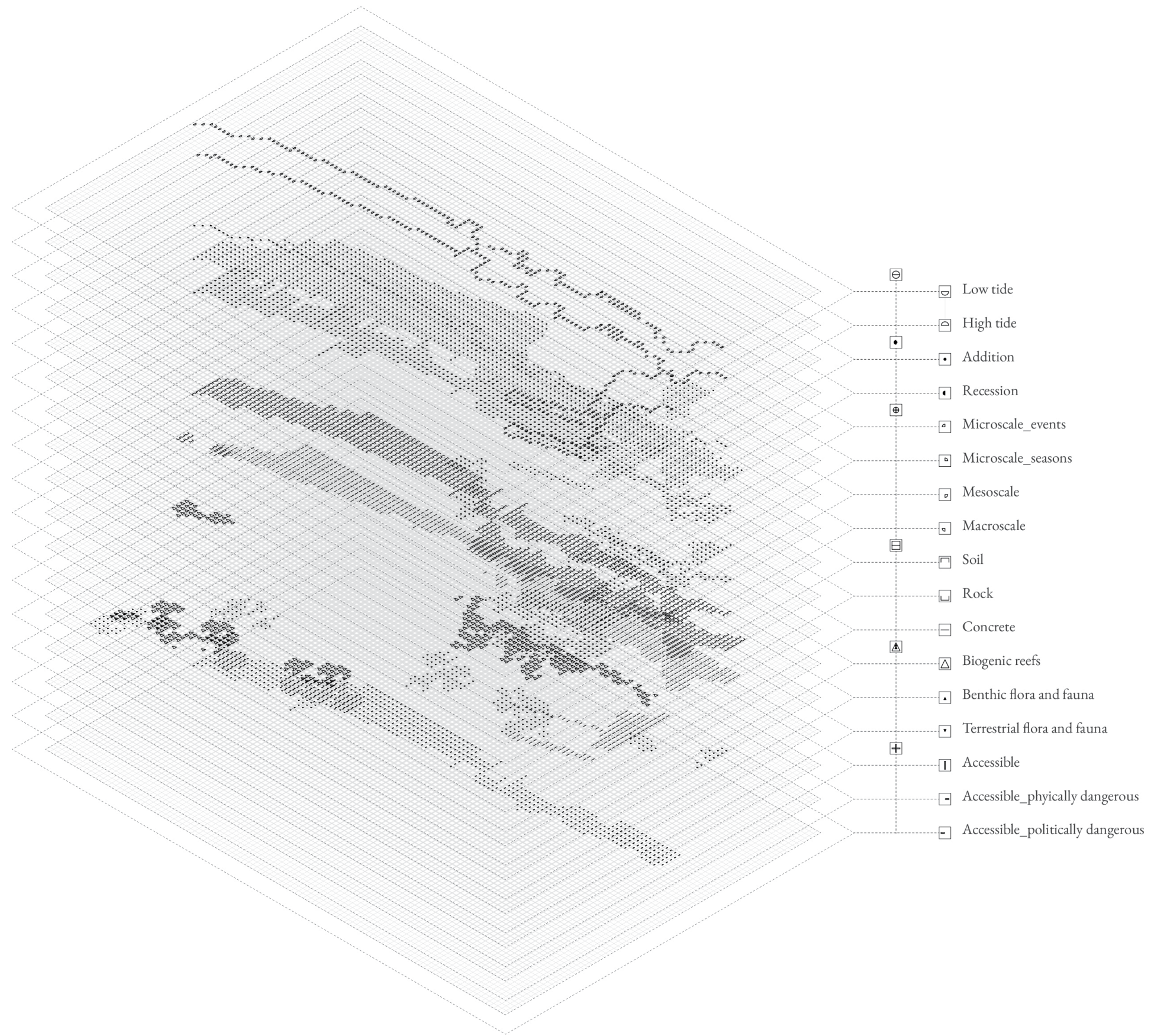






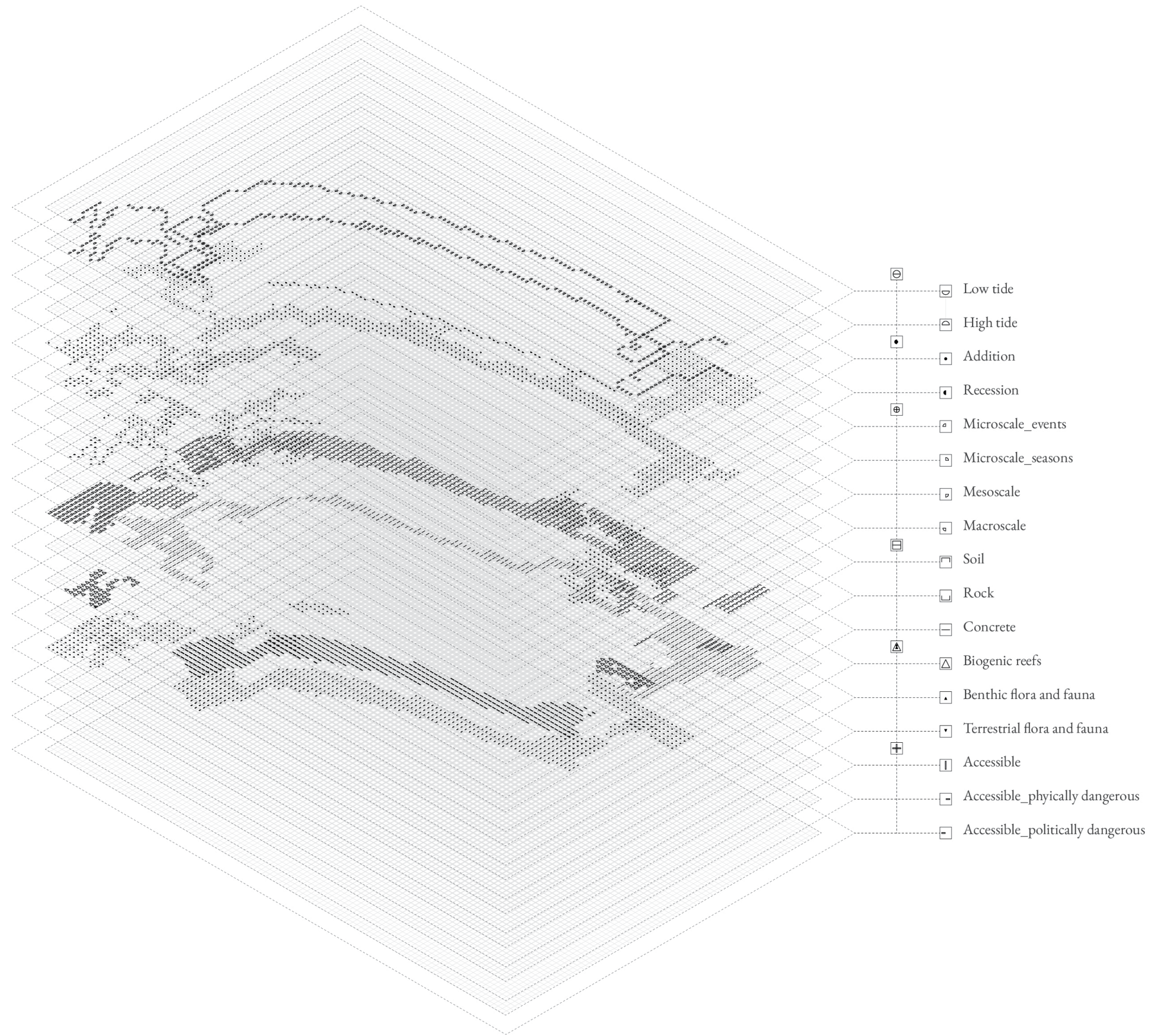
Drawing 36 & 37. Fragments B: The sandy shores of the Ouzaï slum





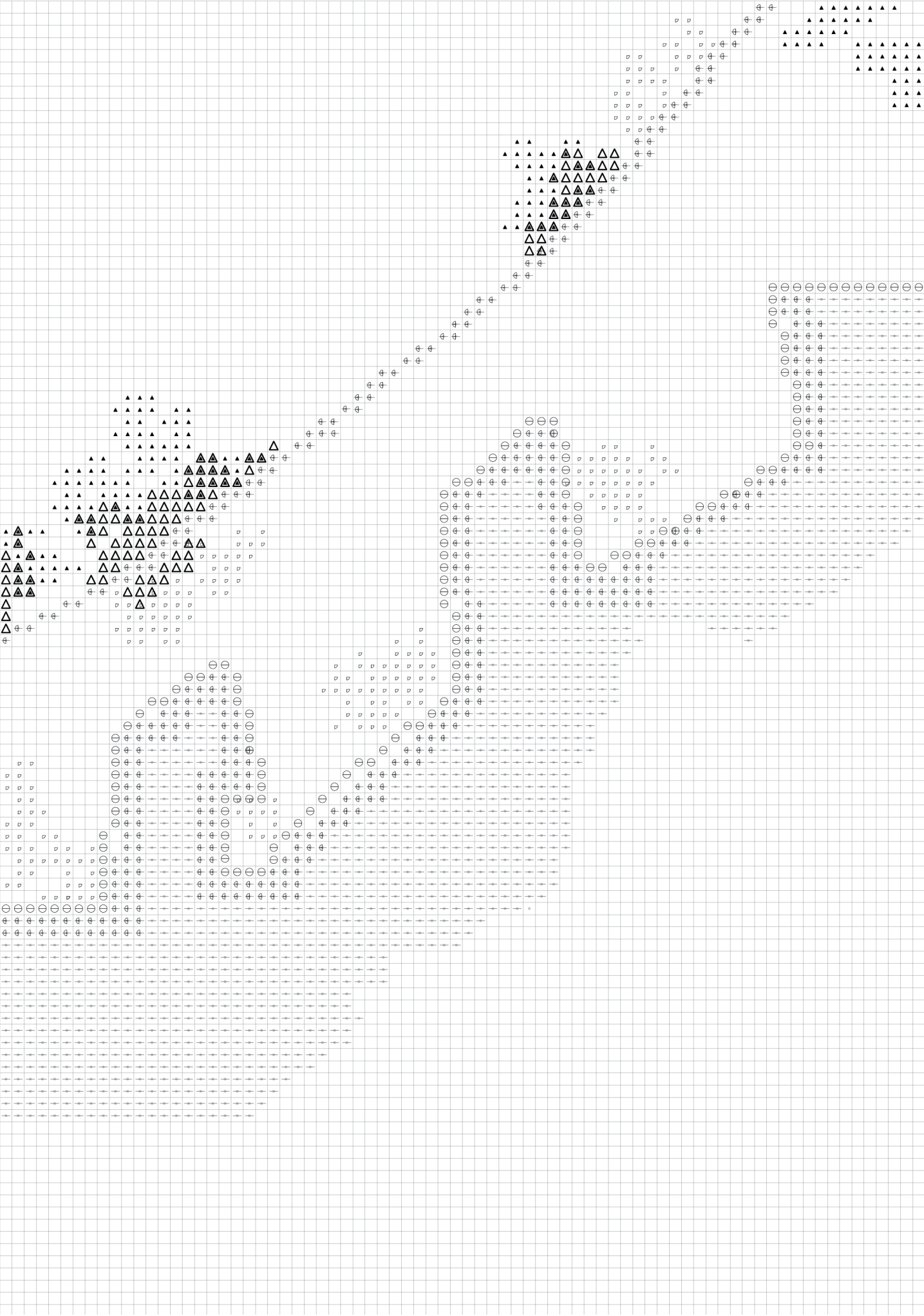


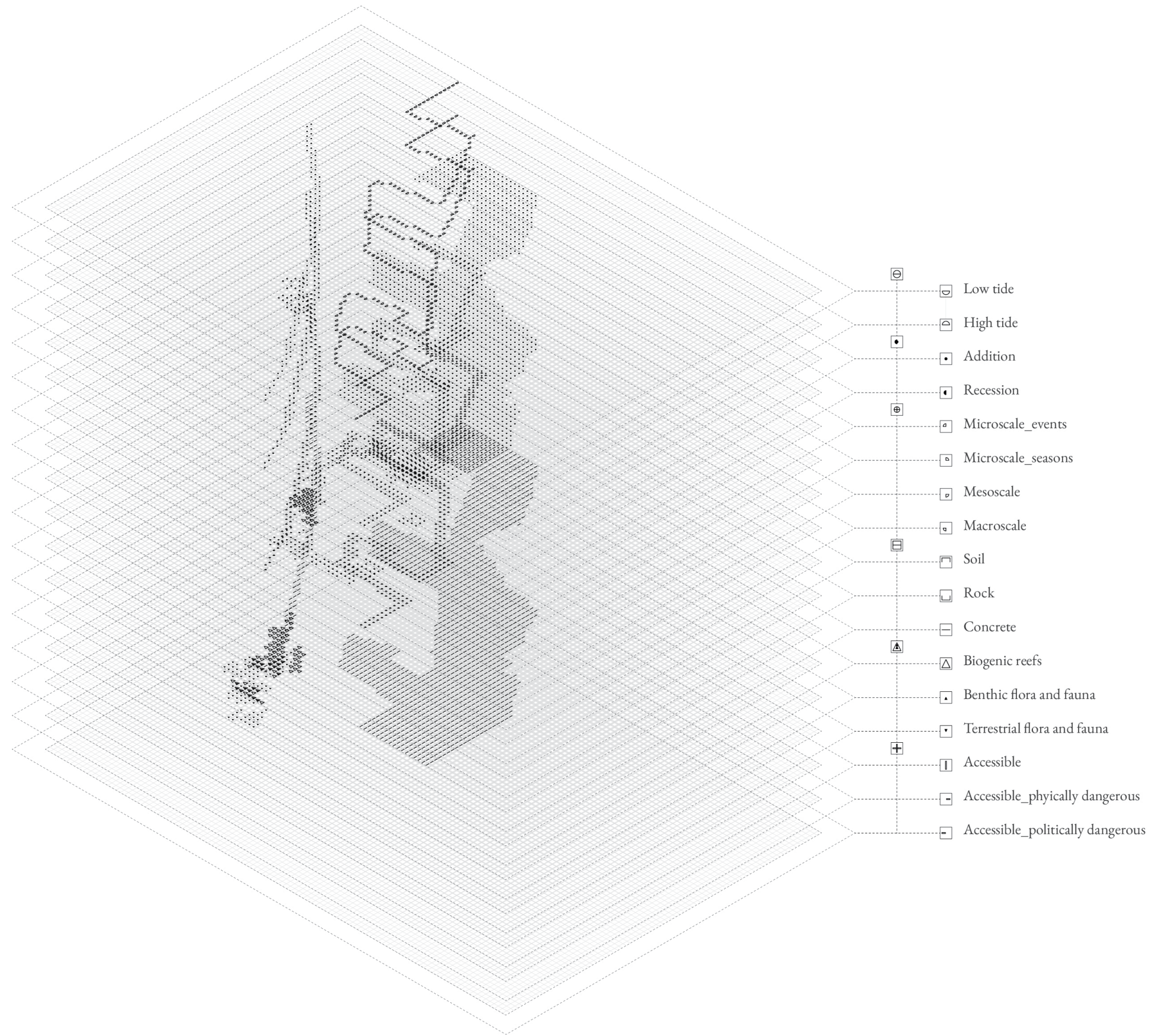
Drawing 38 & 39. Fragment C: The sandy shores of Ramlet al Baida public beach





Drawing 40 & 41. Fragment D: The port of Beirut

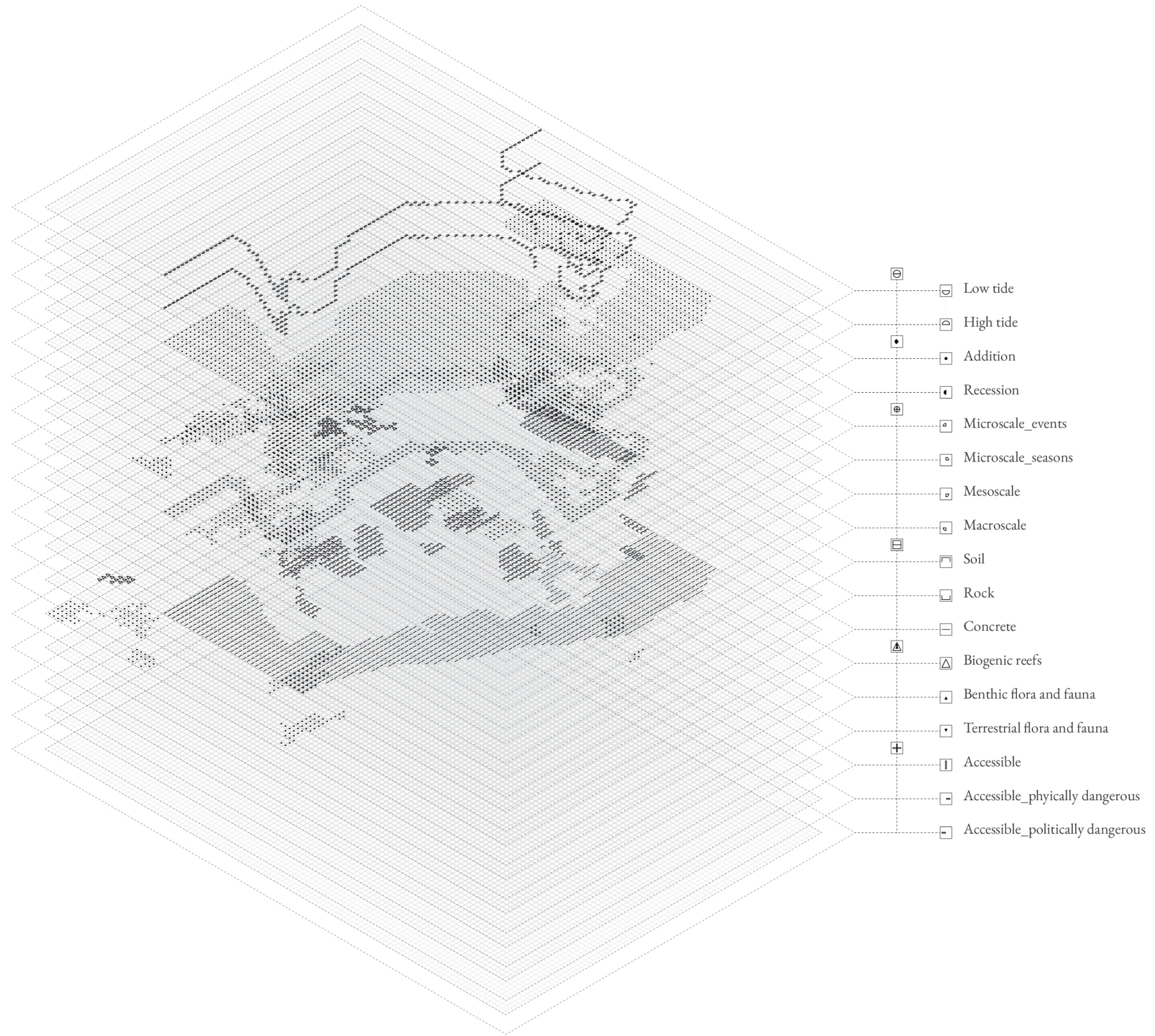






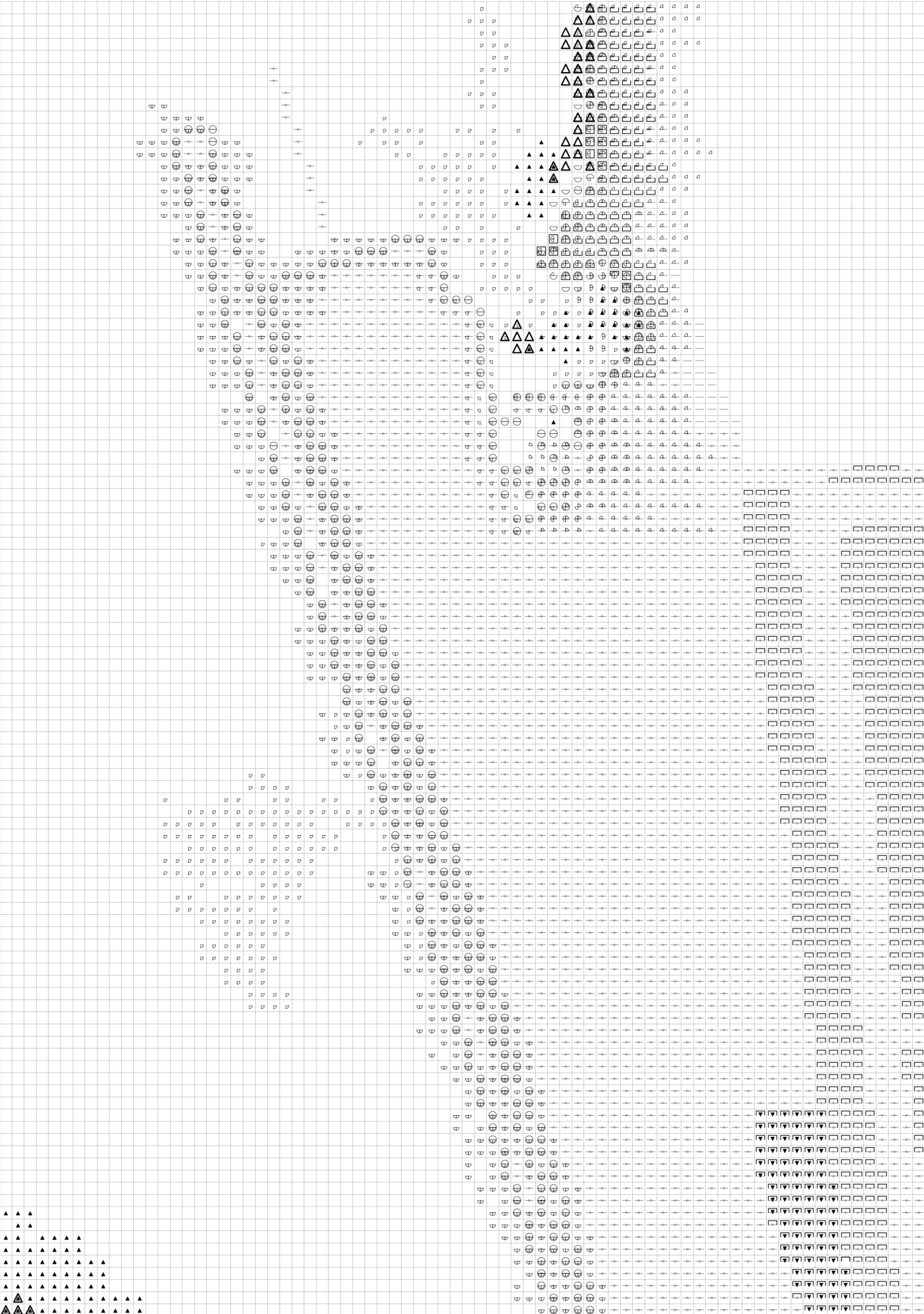
Drawing 42 & 43. Fragment E: The Bourj Hammoud Landfill

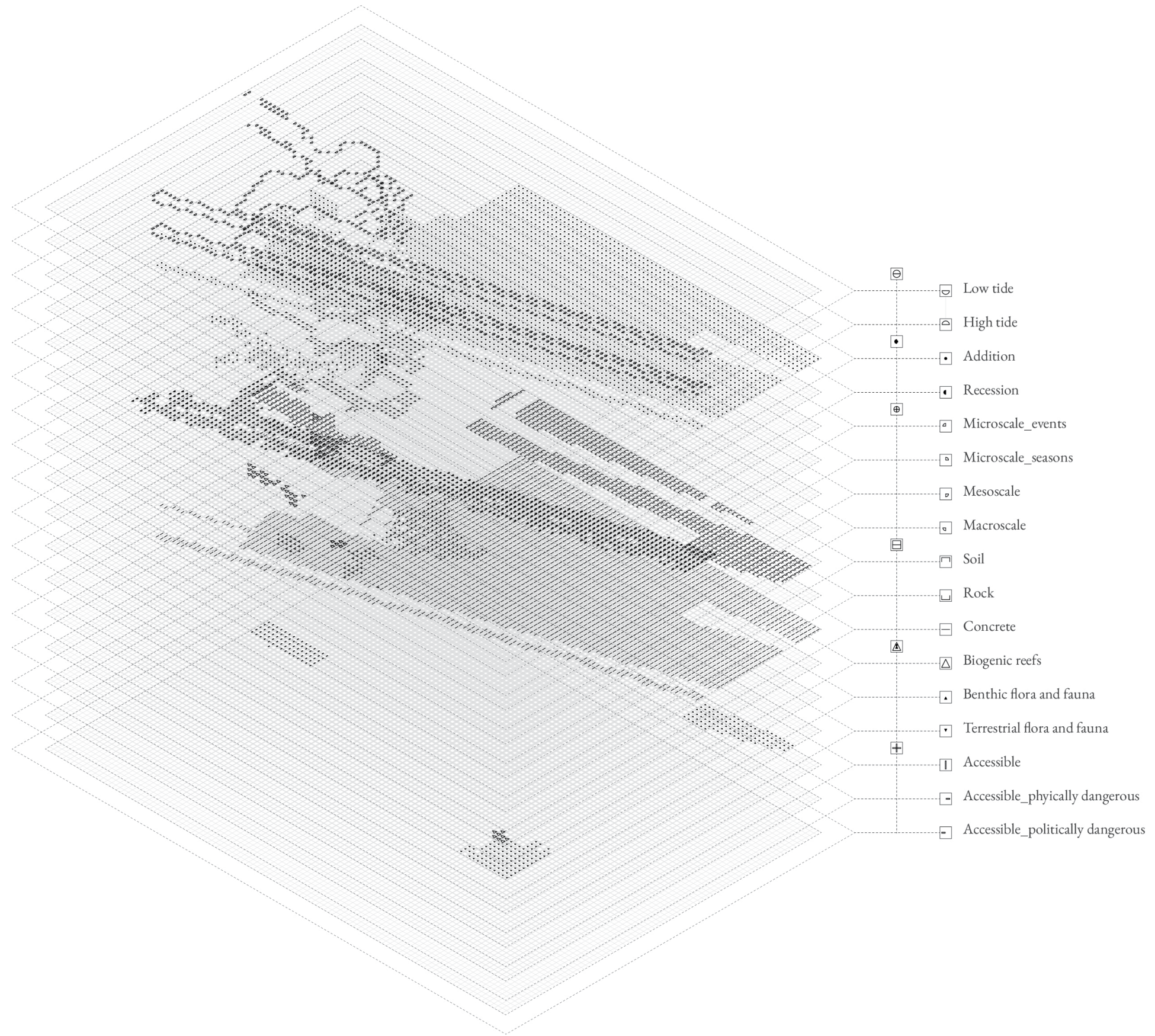






Drawing 44 & 45. Fragment F: The Beirut Rafic Hariri Airport





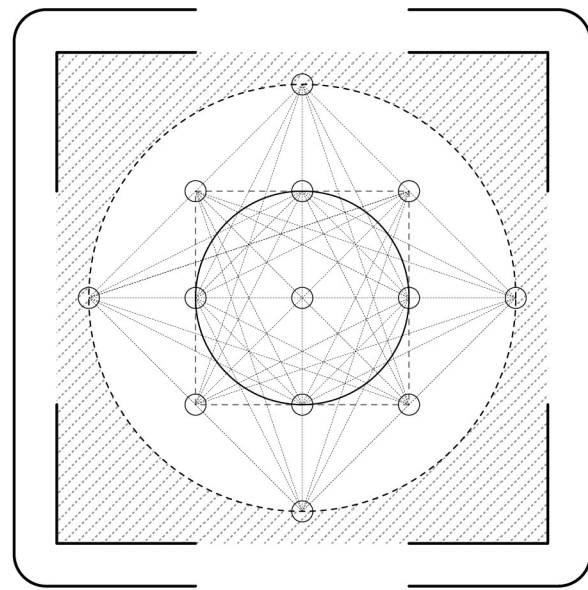
I.	Introduction
II.	Research question
III.	Methodology
IV.	Literature Review
V.	Assessment
VI.	Revised Progression
VII.	The Canvas
VIII.	Conclusion
IX.	Bibliography
X.	Appendix

VII. Framing of the project: the Canvas

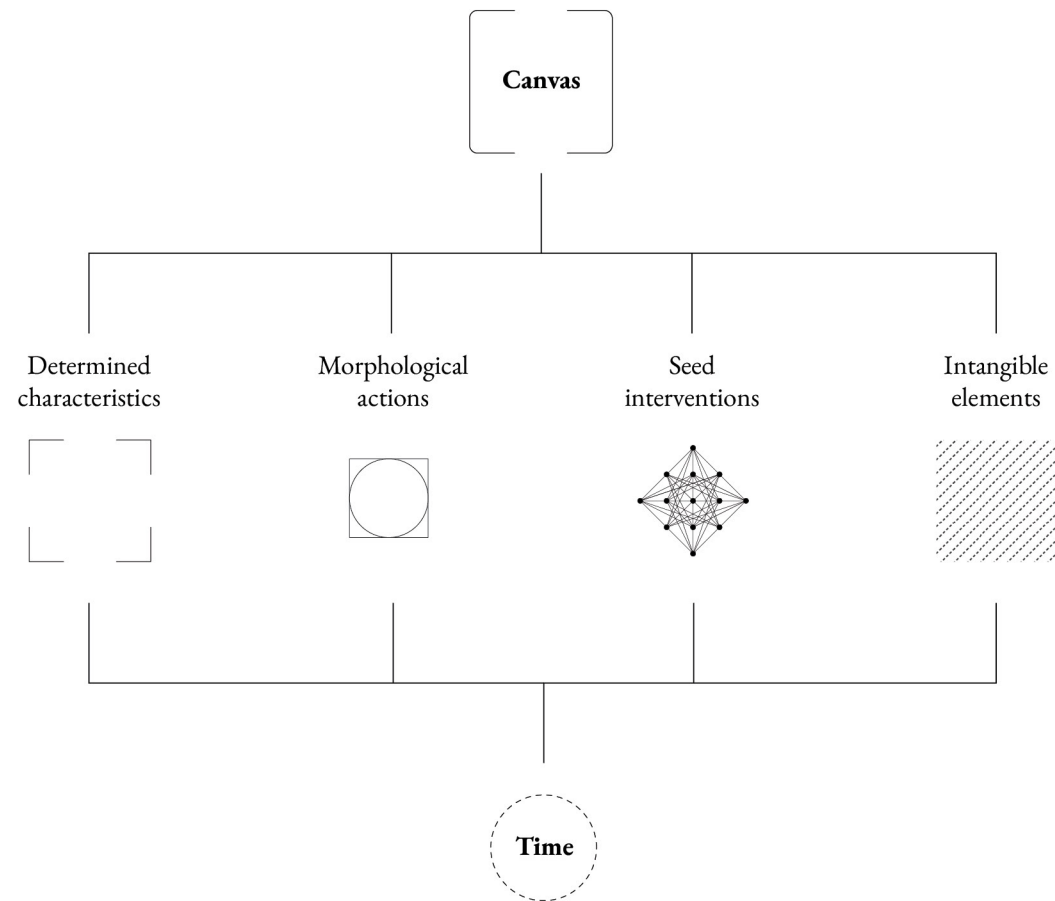
The question now revolves around the methods through which a beach condition could coexist with the imposed fragments of violations. The project centers on the creation of a framework that fosters the emergence of this newly introduced beach condition amidst extreme circumstances. This framework, referred to as the “canvas,” encompasses four key levels of attributes essential for the beach’s existence. Firstly, it [A] establishes a clear definition of the beach, [B] followed by a series of crucial morphological actions along the coastline that contribute to its realization. [C] Next, strategically placed seed interventions set the foundation for subsequent transformations. Finally, [D] the canvas considers the consequential intangible shifts which will unfold encompassing culture, identity, economy, and society [Drawing 46].

The project dialogues with the recognition that this is but one frame in time within an ongoing process of iterations and evolution. It navigates the intricate interplay of unfolding temporalities, each contingent upon the existence of the preceding one. At times, it designs with a speculative approach, exploring alternative possibilities had the proposed approach been adopted in the past. This serves as a tool to display the potential effectiveness of the proposed approach. Additionally, the project ventures into the realm of the future, acknowledging that certain elements can only be implemented once others have come to fruition. It anticipates transformations, acknowledges the limitations of predictability, and recognizes that morphologies can only be forecasted to a certain extent. While the final morphology of the landscape holds importance, its adaptability and resilience are the ultimate considerations.

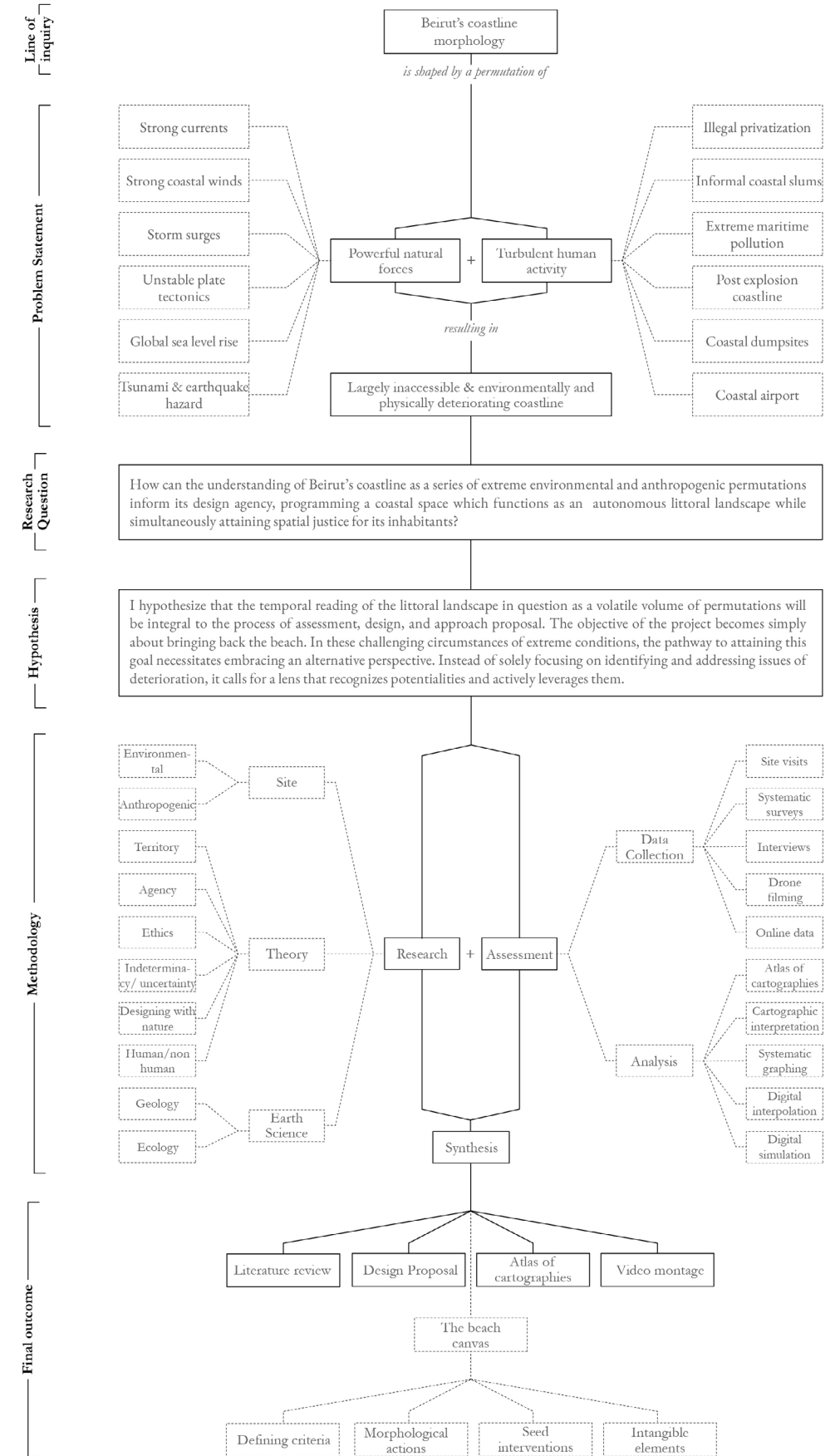
In this project, time is a site of intervention.



Drawing 46. Framing of the Canvas



Project Framework Summary



Drawing 47. Revised project framework summary

i. Defining criteria

The act of defining the beach becomes a strategic approach in attaining its realization, identifying the characteristics that persist within the current condition and recognizing those that have vanished but can be recreated. The idea is to adopt the nuance of the subtleties inherent in being on a shore and seamlessly integrating them into the present condition. This will entail different beach conditions in different locations, dynamically responding to the meticulously analyzed existing conditions. They will be referred to as fragments of beach conditions as a diffused state of being.

This is the process of elevating a physical description of the beach to a conceptual notion and subsequently bringing that notion into fruition into an almost negotiated physical form. This will allow the existence of a beach in places where a beach could never exist. The characteristics and parameters are defined as follows:

[A] Seamless integration

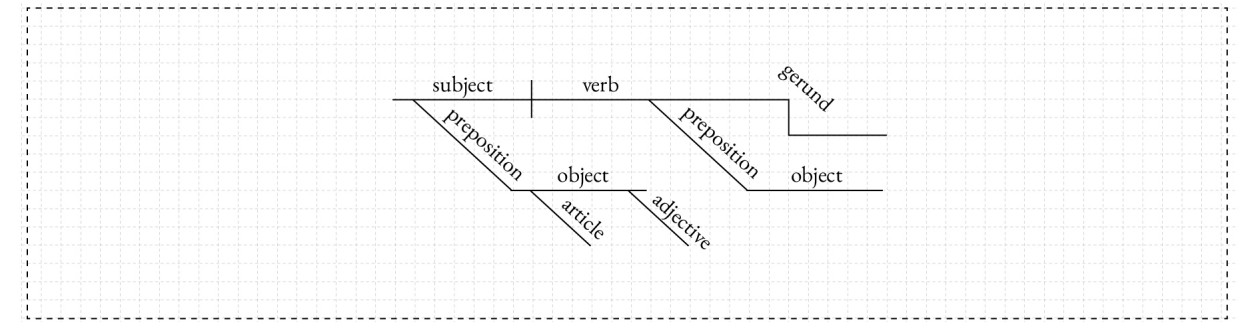
The beach will retain the fundamental functionalities of the fragments, ensuring, and sometimes maximizing, their continued efficiency. This implies that the port must retain its complete operational capacity, while finding a way to seamlessly integrate the beach into its infrastructure. The same principle applies to the airport. The challenge lies in balancing the maintenance of their functionality while simultaneously ameliorating their repercussions.

[B] The beach tackles pollution

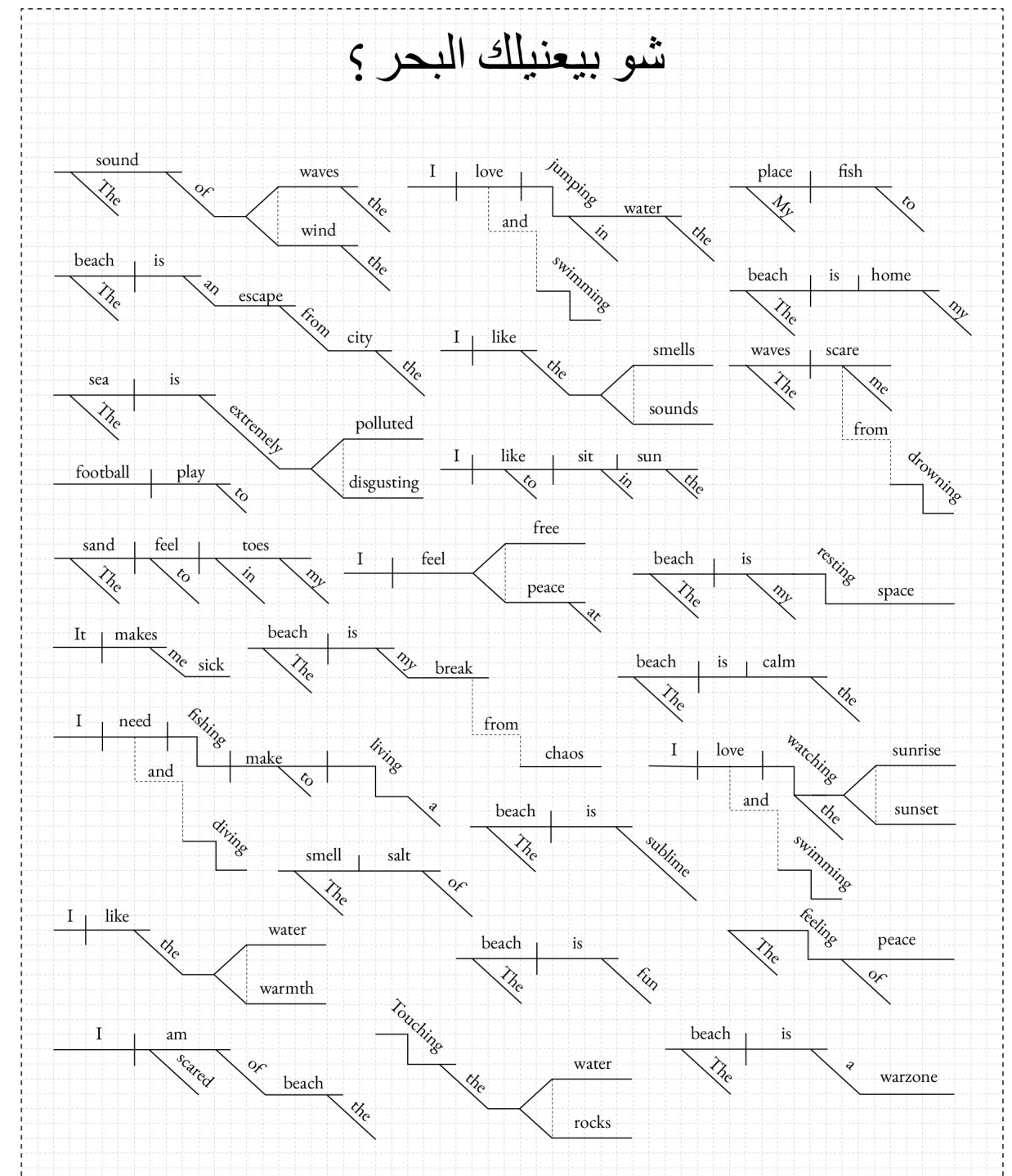
It has been well established that in the context of the Lebanese coastline, the sea is treated almost like a backyard, serving as a receptacle for various forms of accumulating waste (both literal and metaphoric) generated by the city. The beach much digest pollution of all forms.

[C] *A collective horizon space*

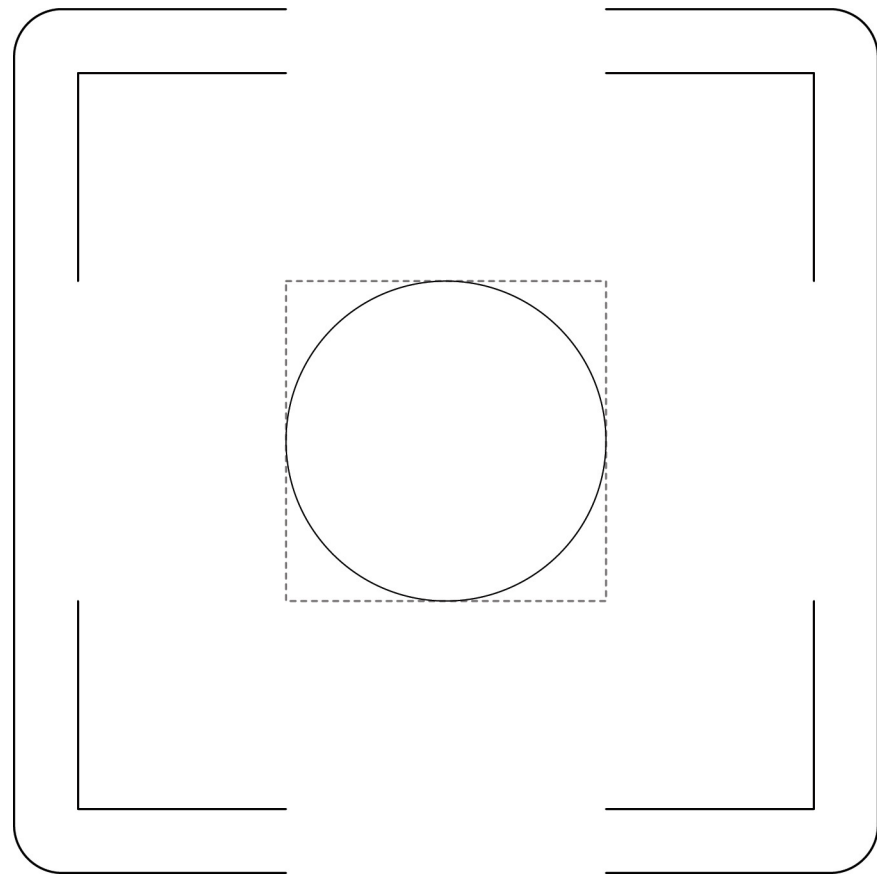
The nuance of a beach is determined through the questioning of the inhabitants in the form of conducted interviews, comprised of one sentence: what does it mean for you to be at the beach? The responses are collected and visualized through sentence diagramming, which is a method used to analyze and understand the grammatical structure and syntax of a sentence [Drawing 48]. It entails dissecting a sentence into its component pieces (such as subjects, verbs, objects, modifiers, etc.), and then using a diagram to visualize the relationships between these components. The diagram typically comprises of vertical lines connecting these pieces to demonstrate their syntactic links and horizontal lines denoting the grammatical functions or parts of speech. This method aids in visualizing a sentence's grammatical structure and the relationships between its many parts. Hence, this approach is employed to dissect the testimonies of the inhabitants as a method of capturing their collective perception of a beach and ensuring that this perception is inclusively incorporated into the proposal [Drawing 49].



Drawing 48. Sentence diagramming legend



Drawing 49. Testimonies



ii. Morphological actions

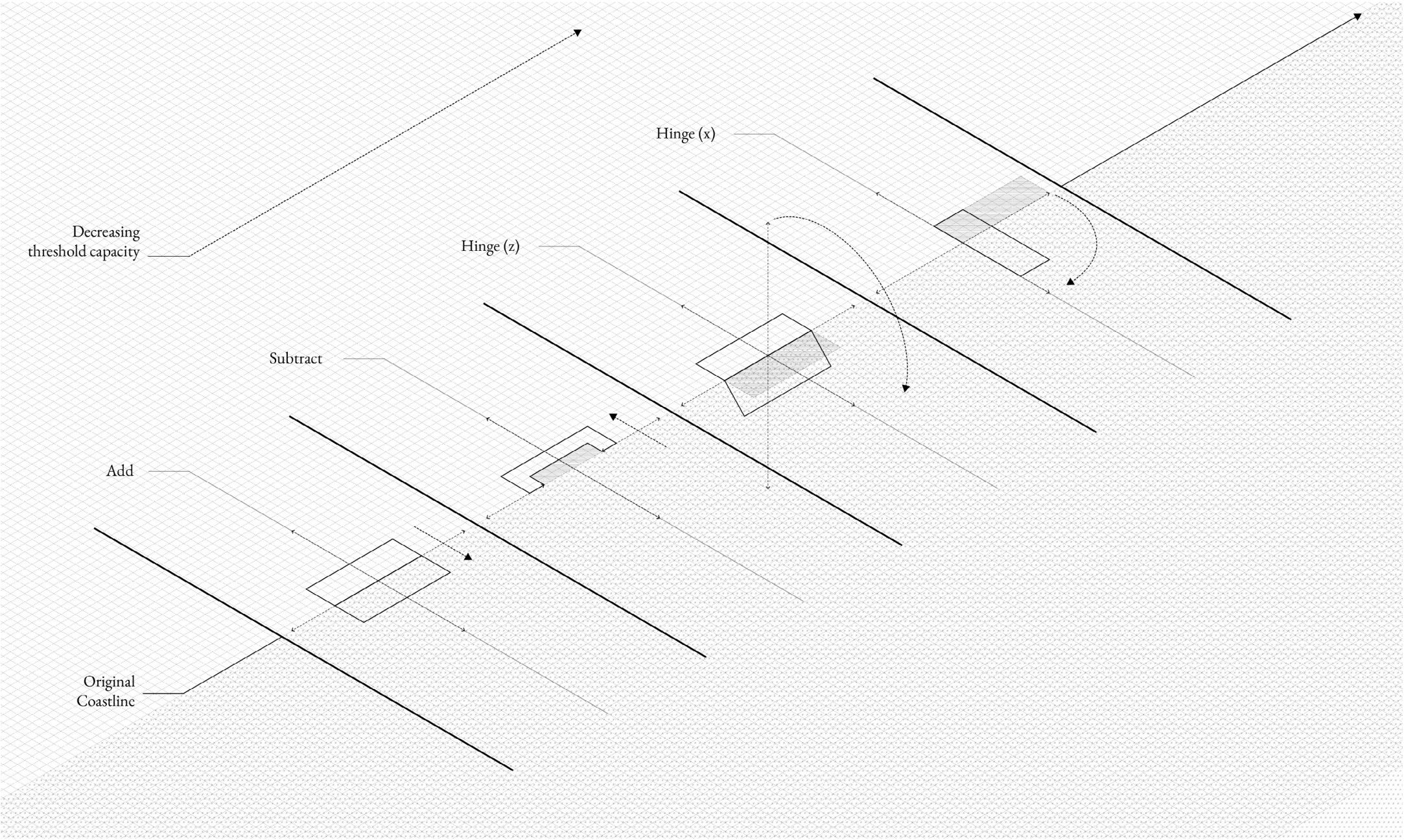
As this thesis assesses coastal morphology and influential forces shaping in, in pursuit of the objective of establishing the beach, it becomes an integral component of the strategy to actively engage with the morphology of the coastline. This entails implementing deliberate actions altering the existing morphologies of the fragments. The proposed morphological mutations synergistically interact with the aeolian, celestial, and oceanic circulation patterns, working in harmony to accomplish the specific goals of each location. Additionally, the extent of access is determined, where some beach fragments would be purely functional, others would be fully or partially public, and others would purposefully remain inaccessible and left to heal on their own.

The morphological actions were based on a series of experimentation of single-minded movements uniformly applied to all the fragments [Drawing 50]. Then, the most appropriate action was selected based on the threshold capacity analysis. The intervention and extent of alteration on each fragment's morphology is determined by considering the fragment's capacity to retain threshold characteristics in addition to the specific details gleaned from the findings. The type and extent of intervention directly respond to these factors.

The nature of these terraforming actions includes the very basic manipulations applicable to space. They include movements such as rotation, displacements, addition, and subtraction, generating morphologies based on shape grammar, or the coding of actions, their afterlife, and the cessation of their existence [Drawing 51].



Drawing 50. Morphological explorations



Drawing 51. The morphological actions

Morphologies

1		Existing coastline
2		Proposed coastline
3		Accumulation_sediments
4		Accumulation_reefs
5		Carving
6		Bathymetry

Seed Interventions

A		Fish quadrats
B		Seagrass plantation
C		Biogenic reefs
D		Sand fences
E		Breakwaters
F		Intertidal tiles
G		Perforated paths

Legend for drawings 53 to 64

[A] Morph 1: Hinging through time _ Terminal 16/34

The act of hinging is the dominant movement undertaken in this deliberate alteration of morphology. This movement represents a pivotal point around which a fragment will transform (rotate), allowing for its realization in both its past and present states. This point on a fixed axis is considered the point through which a fragment intersects with the coastline. The most extreme form of hinging occurs on the fragments which have been assessed to contain the least amount of threshold holding capacity. These are the fragments quantitatively and qualitatively assessed and display the most extreme repercussions on the coastline, in terms of the nature of their existence, their lack of access, and the extent of their environmental deterioration.

The Beirut Rafic Hariri airport can be described as an anomaly in the coastal landscape, with its extensions both towards the sea and inland magnifying its impacts in all directions. Runway 16/34 pierces the coastline at an angle seeking to align itself parallel to the shore. Constructed in the final phases of the development of the airport, its purpose was to alleviate landing traffic and commotion from the adjacent neighborhoods. The airport is the fragment assessed to have the highest level of repercussions; therefore, the design action required resided in the implementation of a drastic morphological action.

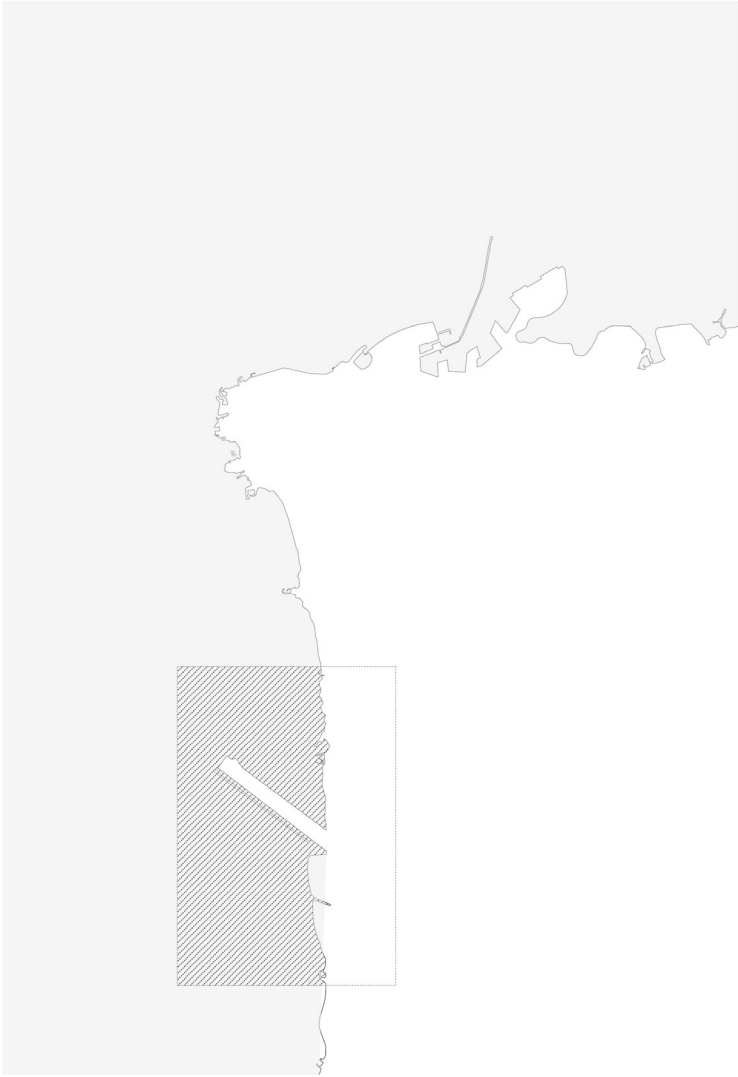
This runway was constructed after several bombardments of the airport through various events and wars. In fact, it is evident in construction and analytical documents that initially, other angles were considered, and the current one was selected haphazardly (Mokalled, 2016). The decision to build this runway was established under exceptional and pressing circumstances following post war reconstruction efforts rendering many decisions essential to its conception and planning, and messing, arbitrary. This runway configuration was one of many unconsidered possible layout iterations. Here, it is possible to imagine what could have been if another version had been implemented in the first place.

Engaging in this line of inquiry has resulted in the proposal to design in the past throughout this project, treating time as a site of intervention. The act of reimagining what the littoral landscape would resemble if an alternate configuration was implemented becomes a key method in framing the canvas. Designing in the past and building on such proposed speculations possesses the power to adequately portray an argument of “what could have been”. Here, thinking backwards to think forward is used as a tool.

As a consequence, in this project, runway 16/34 hinges 45 degrees southwest from its original position, in the past, making it double as a massive infrastructural breakwater protecting the vulnerable coastal settlements to its north. The runway’s rotation would not impede the functionality of the airport, as its length is maintained. As a result of this rotation, numerous ecological, spatial, and social transformations unfold, yielding a range of constructive outcomes. Its precise positioning intercepts the dominant longshore current, wind, and waves, resulting in significantly calmer waters and stable benthic floor on its leeward side. The establishment of this newfound stability unlocks possibilities for various offshore activities that were previously constrained by limited space and turbulent waters caused by exposure. Offshore fish farms emerge as an economic resurgence for a declining profession, located adjacent to the now revived fishing port of Beirut, north of the airport.

Extensive research has revealed a distinct thriving of vermetid reefs in this region (Oceana et al., 2018). Their proliferation is further amplified through this established protection in addition to the introduction of submerged biogenic reefs. The Ouzai coastal slum north of the airport, previously under the constant demise of flash flooding and an exponentially receding coastline now has a reinforced protection from the waves. Through this strategic rotation, accretion occurs on the windward side of the terminal, accumulating sediments as a method of remediating the Costa Brava dump site south of the airport. It is left alone to remediate with minimal human intervention and restricted access.

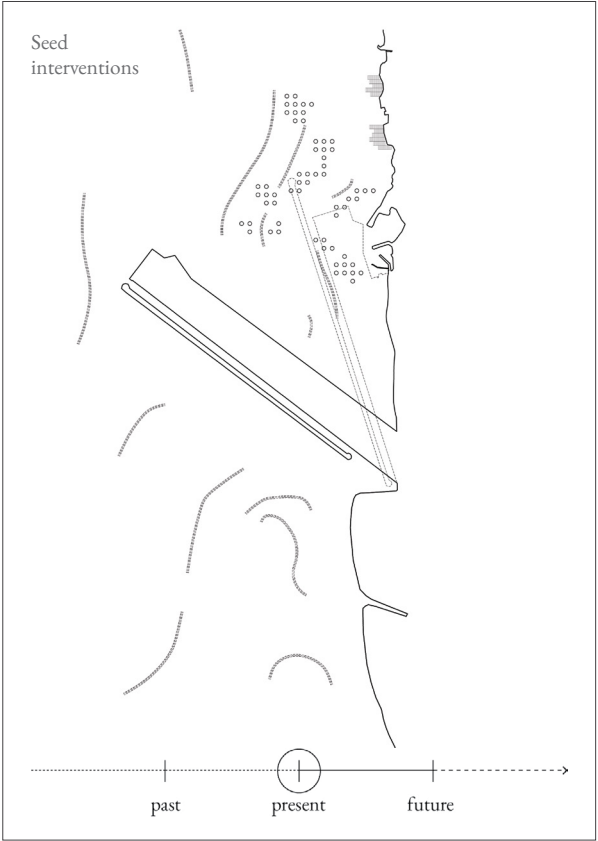
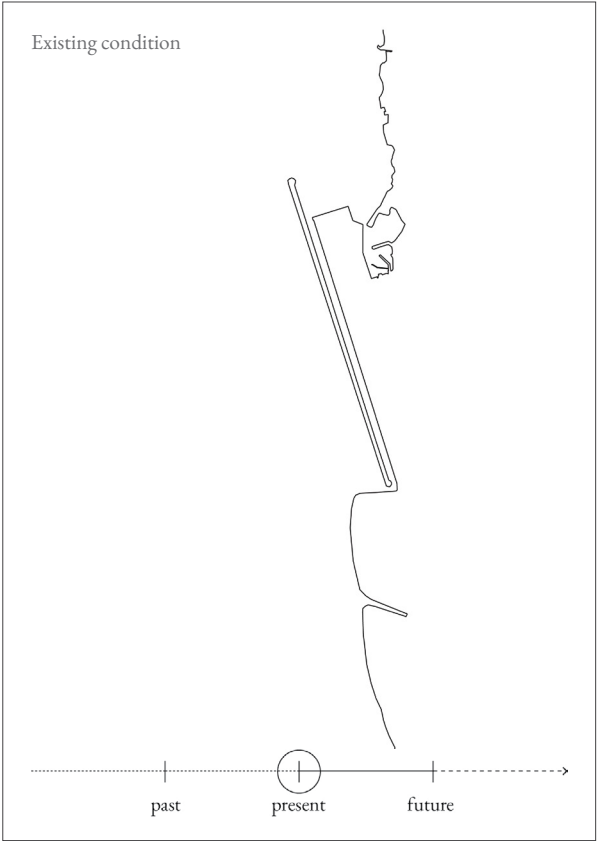
Through the 45-degree rotation, the airport terminal is still an imposition on the coastline, but it is an imposition with the capacity to orchestrate autonomy to the fragile littoral landscape surrounding it. It is an example of how permutations are considered as a pivotal design force and are thus integrated within the proposal itself. It is a display of how a simple rotation would have such substantial effects, achieved through adopting the lens that this project argues is optimal for such contexts of extremes.



Drawing 52. Terminal 16/34 key plan



Drawing 53. Terminal 16/34 in the past, present, and future



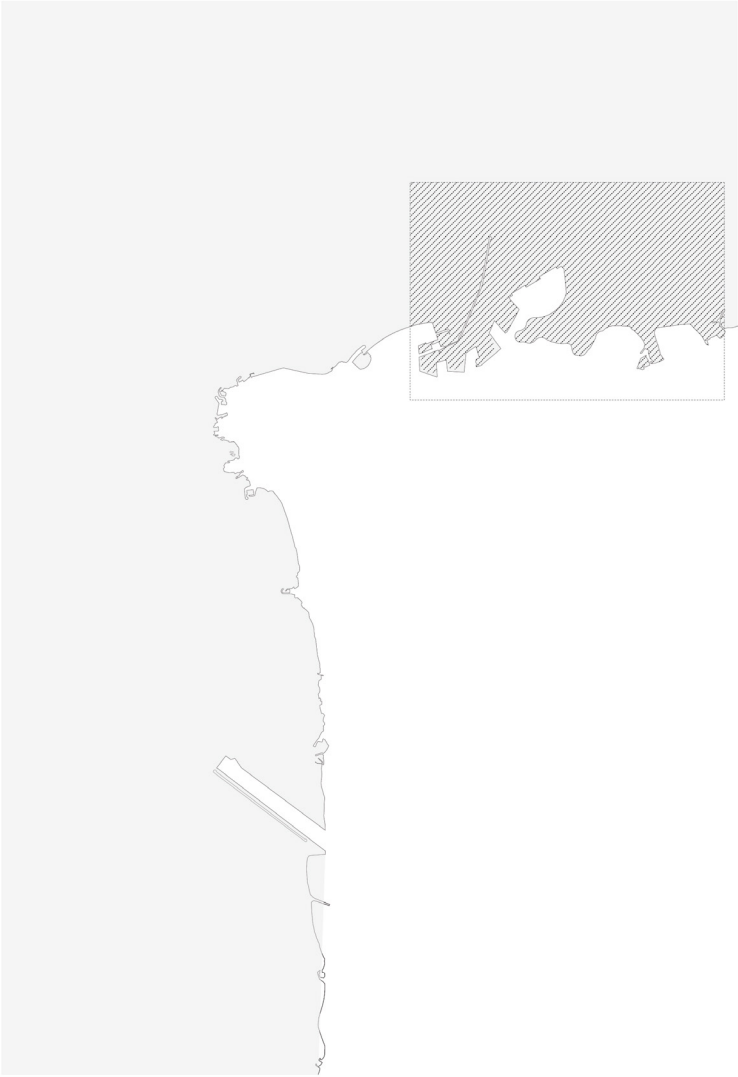
[B] Morph 2: Hinging through time _Port of Beirut

Similar to the airport, the port of Beirut stands as a conspicuous fragment with limited capacity for integration within its context. It acts as a prominent obstruction, completely separating the city from the sea, the water from the shore, and aquatic life from terrestrial ecosystems. Hinging is the course of action adopted here as well as a reaction to its extremity. First and foremost, hinging results in the freeing up of the coastline, bringing in the water back in contact with a space which isn’t purely reserved for functionality. The port is divided into two areas, the portion which contains the silos and most heavily impacted by the explosion remains intact. The functional portion of the port is the one that rotates. This maintains the memory of the silos embedded within the landscape. After the explosion, this portion of the port has been rendered obsolete, while the port returned to its full functionality. Through this occurrence, I propose to create this distinction between those two spaces and maintain the silos platform as a fully accessible public space. The rotation of the second portion of the port introduces a new edge which enables the docking of ships optimizing its efficient functionality, further enabling the opportunity to maintain the first platform as a public space and establishing a fully accessible waterfront. This rotation additionally creates conditions of beach enclaves and landforms which enhance the capture and accumulation of sediments. Ecologically, such enclaves serve as optimal environments for aquatic and terrestrial organisms.

The edge of platform one is hinged on the vertical access, through the terracing and perforation of the hard concrete edge and introduction of intertidal tiles (explained below). These perforations attract sediments and allow for the accumulation of vermetids, resulting in the concrete edge’s future transformation into a vermetid reef edge. Such intertidal zones are crucial for aquatic habitats and erosion control.

[C] Morph 3: Subtraction_ Bourj Hammoud landfill

The Bourj Hammoud dumpsite lies east of the Beirut Port will be sealed as an alternative dumpsite with less detrimental effects is proposed in land. The landfills will then be carved to let water in a way to create a beach enclave condition between the two mounds, a beach condition with optimal tranquil water suitable for the existing fishing port to further be established in that location. Cleaning will occur through the secured sealing of the landfill along with the filtration that will occur through the aquatic and terrestrial remediating flora, as well as the biogenic reefs. This carving brings water further in to closer proximity with the Bourj Hammoud neighborhood.

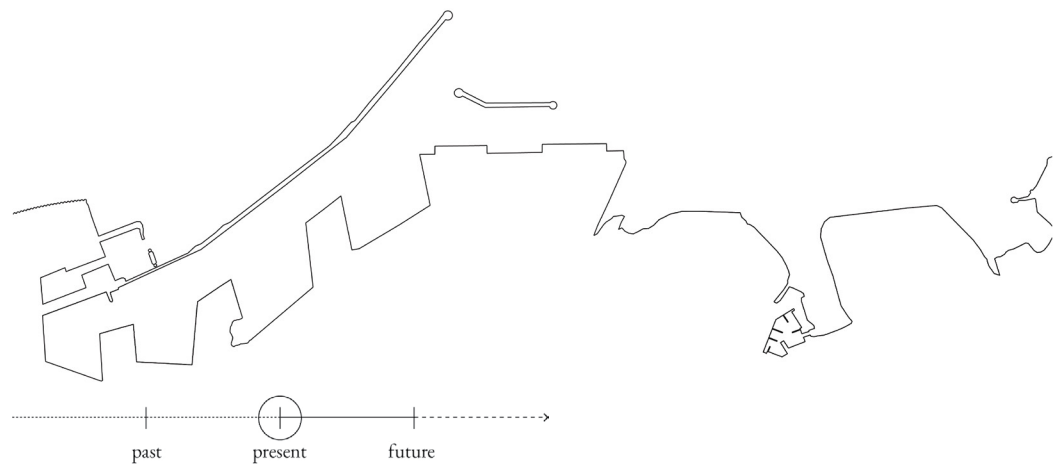


Drawing 54. Port of beirut and Bourj Hammoud landfill key plan

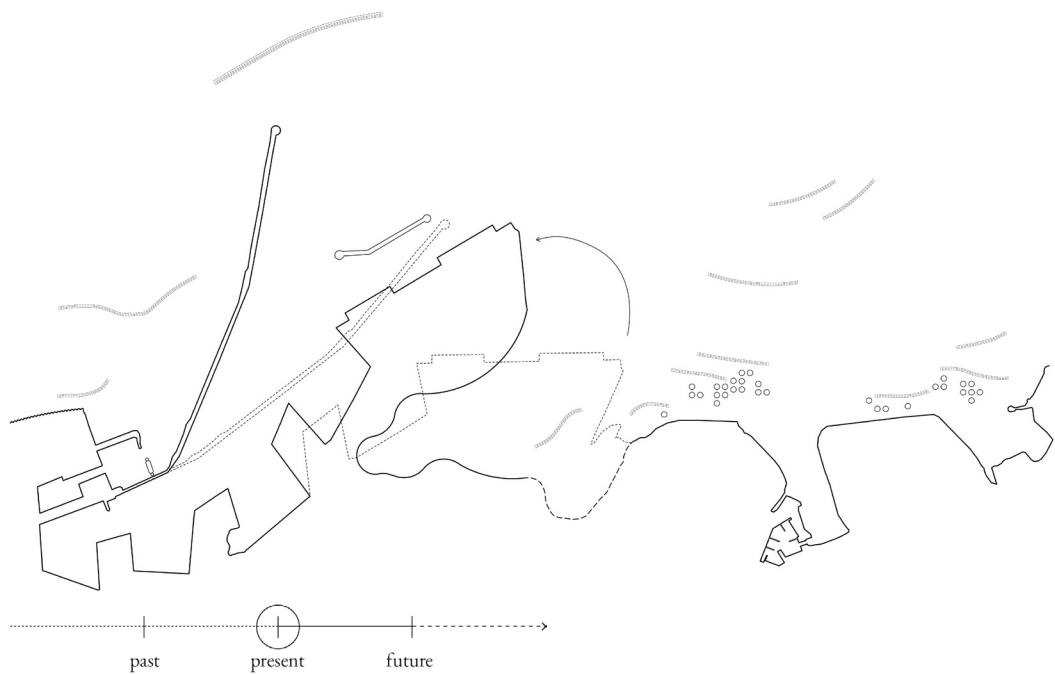


Drawing 55. The port of Beirut in the past, present, and future

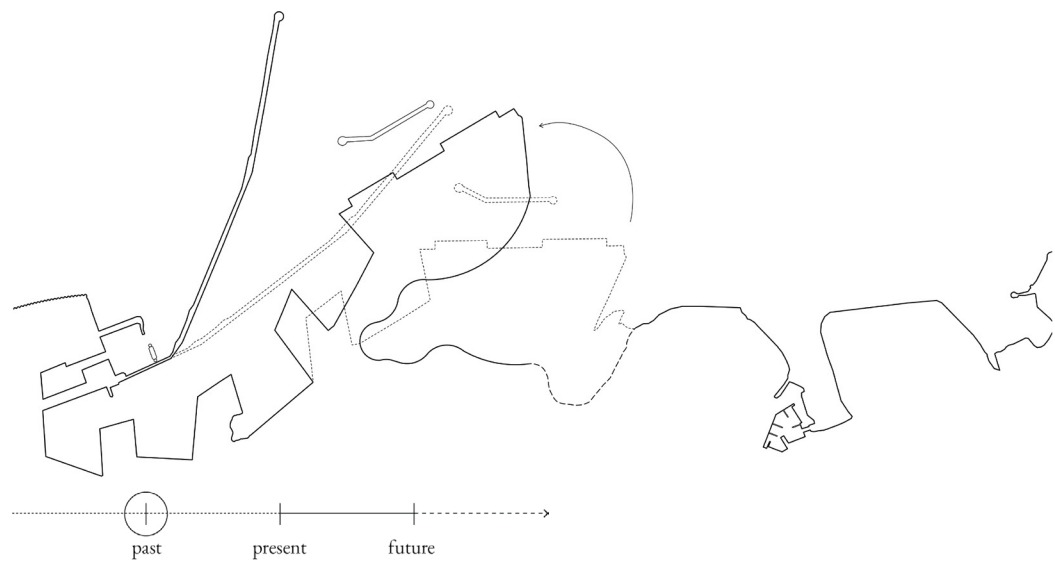
Existing condition



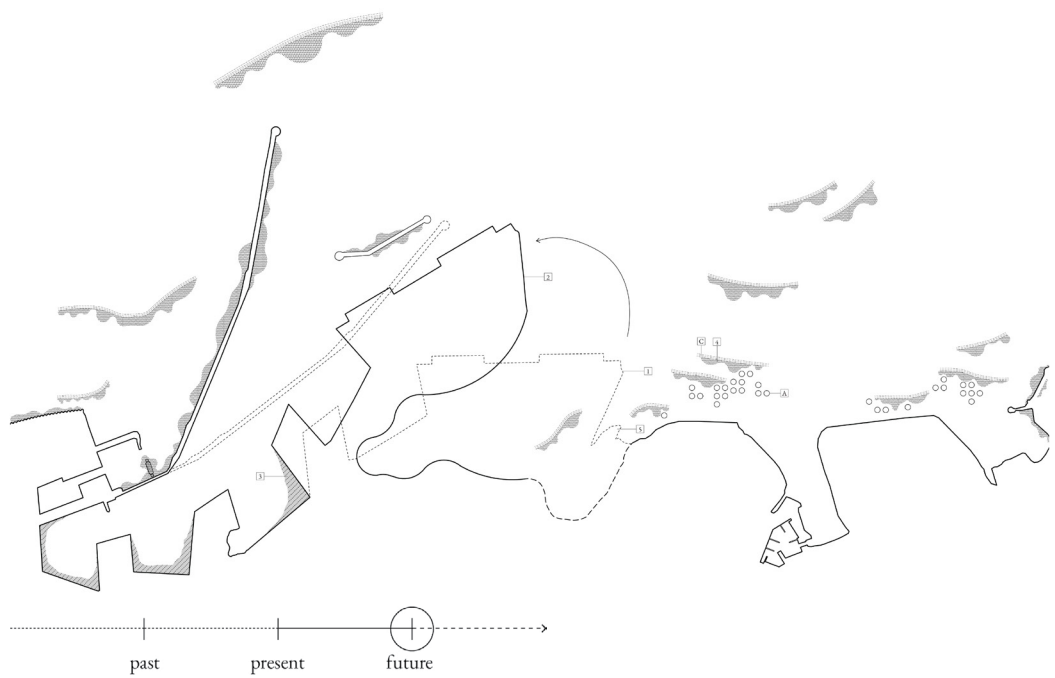
Seed interventions



Hinging (x) in the past



Future transformations





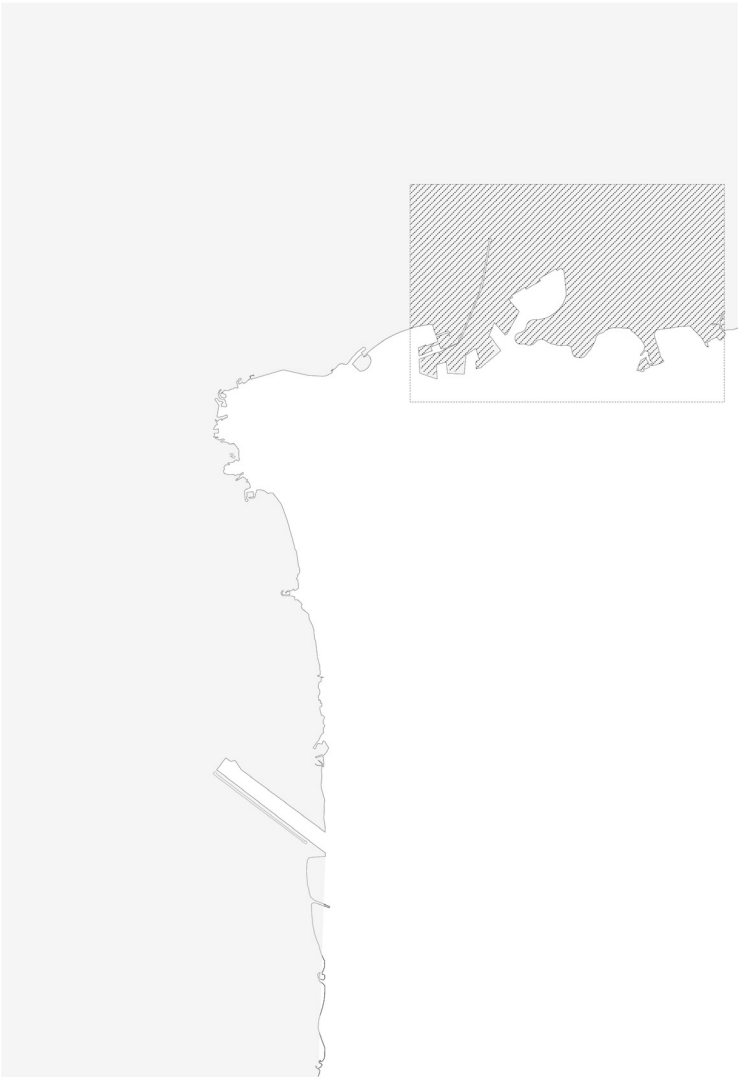
Drawing 56. The port of Beirut rotated in the past

[D] Morph 4: Hinging through time _Biel Waterfront

The sealed landfill, known as Biel Waterfront, is a large concrete slab extruding from the city’s periphery. Its edge functions as a seaside promenade, while its center comprises of expansive but often vacant parking lots and private developments. The edge terraces into the water through the gradation of three platforms 4 meters high, connected with stairs. The lowest platform sits 4m above the water, with the edge abruptly ending as a curved sea wall. The edge of Biel descends through three platforms, each rising four meters above the water, connected to one another with staircases. This further exacerbates the disconnection between the slab and the sea. The lowest platform abruptly terminates with a lackluster curved sea wall, further emphasizing the absence of harmony.

The morphological action here is the hinging of Biel’s edge along the vertical axis, further terracing and softening the hard disconnection between the slab and the water. Intertidal tiles are introduced at the platform closest to the water, leading to its eventual morphosis into an extensive vermetid reef. This is achieved through the perforations of the intertidal tiles, allowing biogenic reefs to proliferate within them. Together with the offshore submerged reefs, they work in symbiosis to simultaneously attenuate wave action and increase sedimentations. This terracing enables a more efficient form of fishing, an activity that already persists there but is hindered by the imposed railing and height of the platforms. Contact with water is more intimate, and the space is in constant transition. The physical state of the platforms is dependent on the tides and the seasons. Moreover, the protruding nature of this platform is leveraged to create a horizon space, offering a captivating view of the city’s silhouette towards the west and Lebanon’s mountain range towards the east. It serves as a true escape from the bustling urban environment that dominates the inner part of the city.

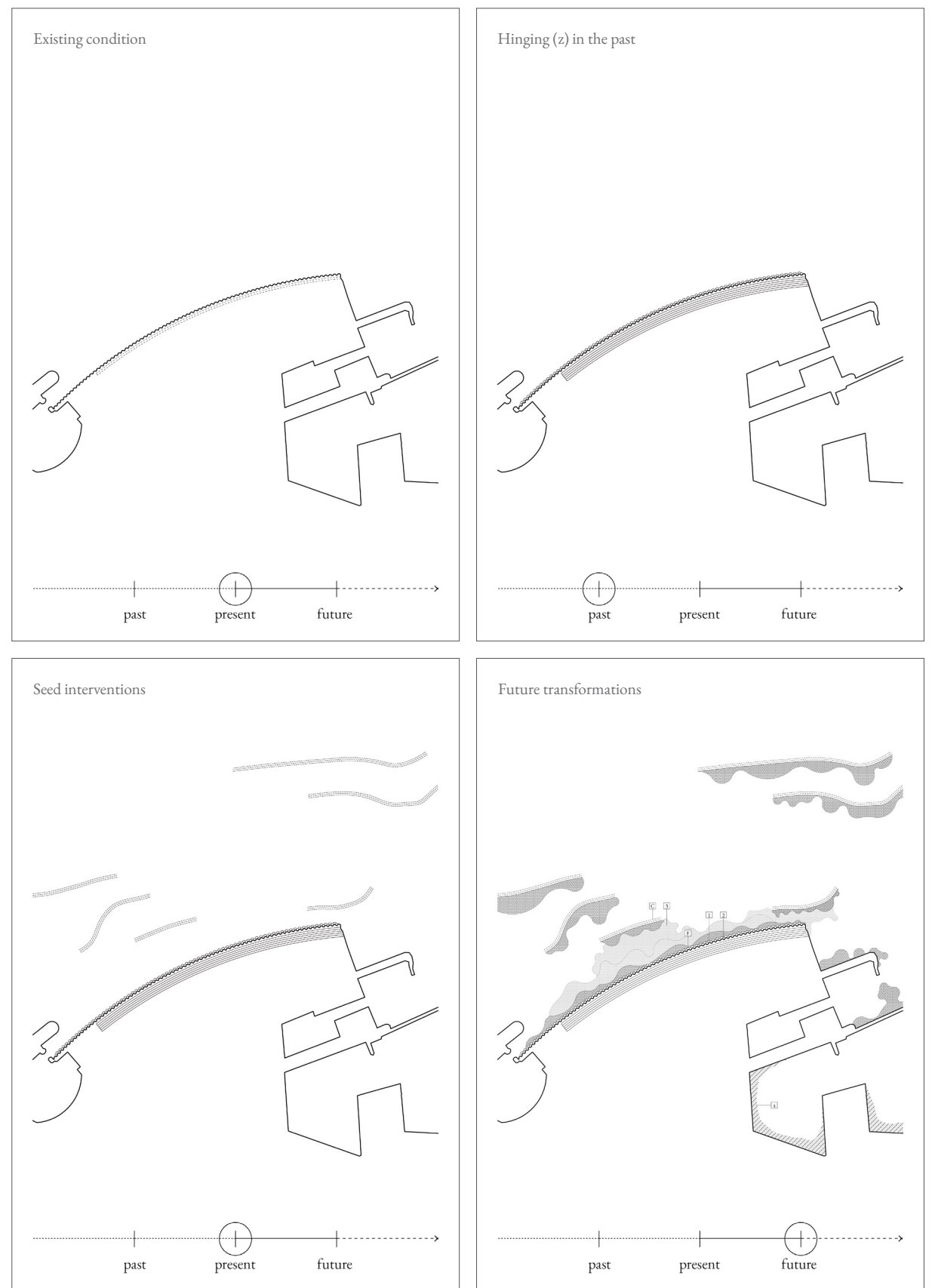
The vertical hinge of this fragment also occurs in the past, in the timeframe when the decision to implement this landfill was undertaken. As this project is a form of negotiation, it has been carefully considered to encompass the following aspects, striking a balance between an identical concrete consumption and the desired form.

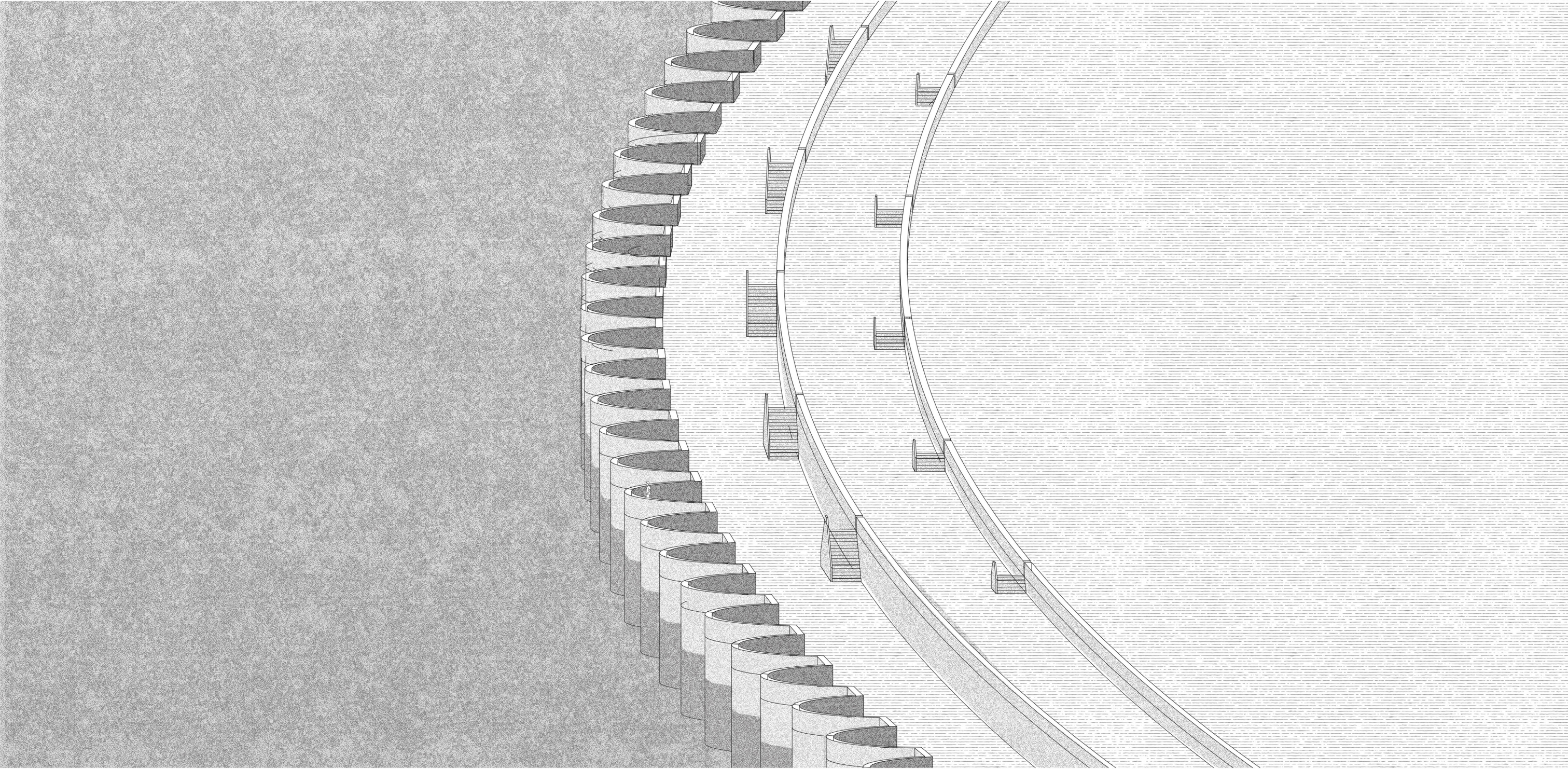


Drawing 57. Biel waterfront key plan

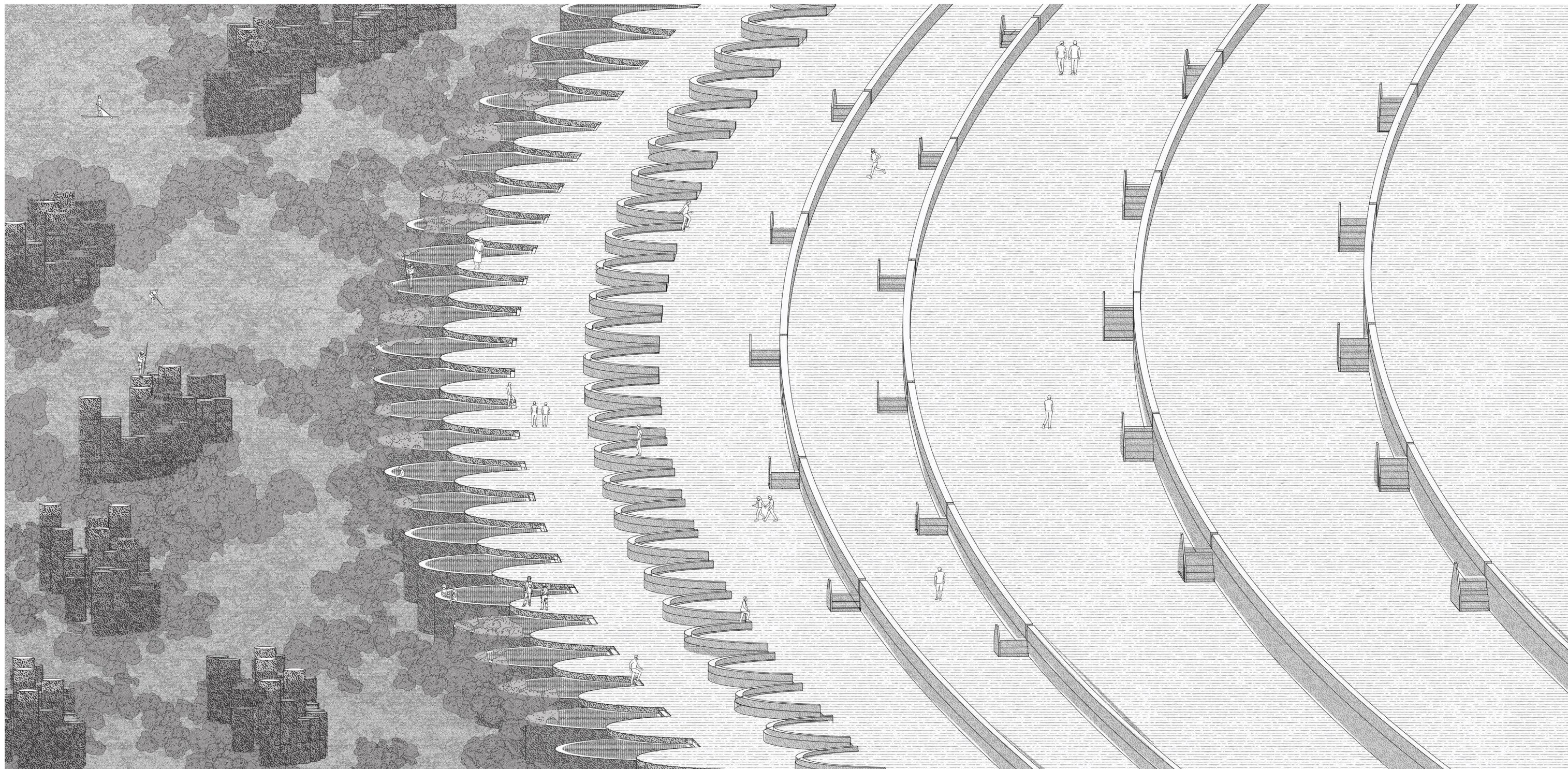


Drawing 58. Biel waterfront in the past, present, and future





Drawing 59. Biel Landfill, existing condition

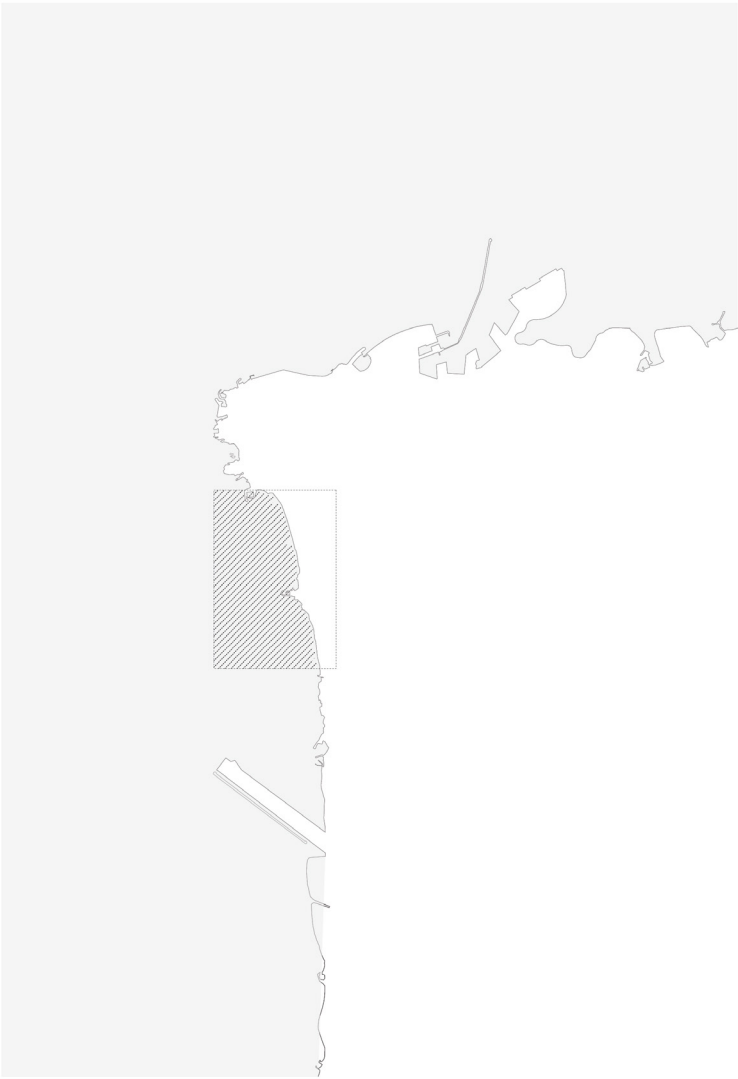


Drawing 59. Biel Landfill, as a biogenic edge

[E] Morph 5: Addition _Sandy shores of Ramlet al Bayda public beach and Ouzai slum

Some fragments are receding at an exponential rate, making them especially vulnerable to high tides, storm surges, and the impending rise of sea levels. This is namely present in the ouzai coastal slum. The morphological action here is to increase the shore space through the synergistic action of onshore and offshore structures, manipulating shore space increase through sedimentation dynamics.

The Ouzai coastal slum will be surrounded by accessible offshore breakwaters, which serve as platforms for fishermen while strategically positioned to generate eventual tombolos and salients. The Ain mraisseh rocky promenade’s abrupt edge is mediated with the proliferation of its already existing vermetid reefs through the symbiotic interaction of introduced groins at strategic angles with submerged reefs. Similar to Ouzai, Ramlet al Bayda public beach benefits from an increased shoreline through the interplay between the offshore breakwaters and the onshore sediment capturing fences. The sewage infested waters get cleaned up by mussel reefs, as a single muscle can filter 50 gallons of water per day (Inoue et al., 2021).

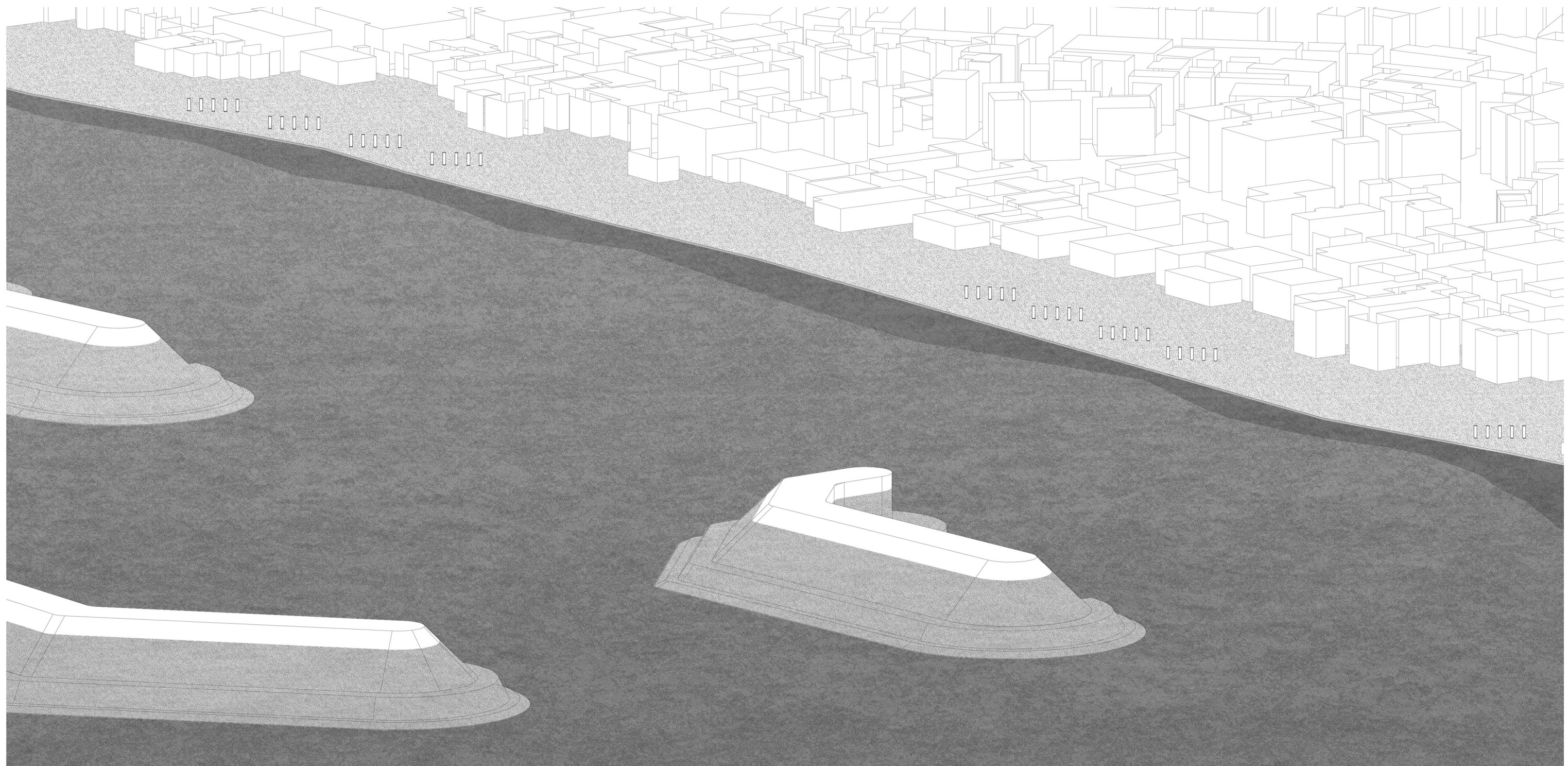


Drawing 60. Ramlet al Bayda and Ouzai Key plan



Drawing 61. Ramlet al Bayda and Ouzai in the past, present, and future





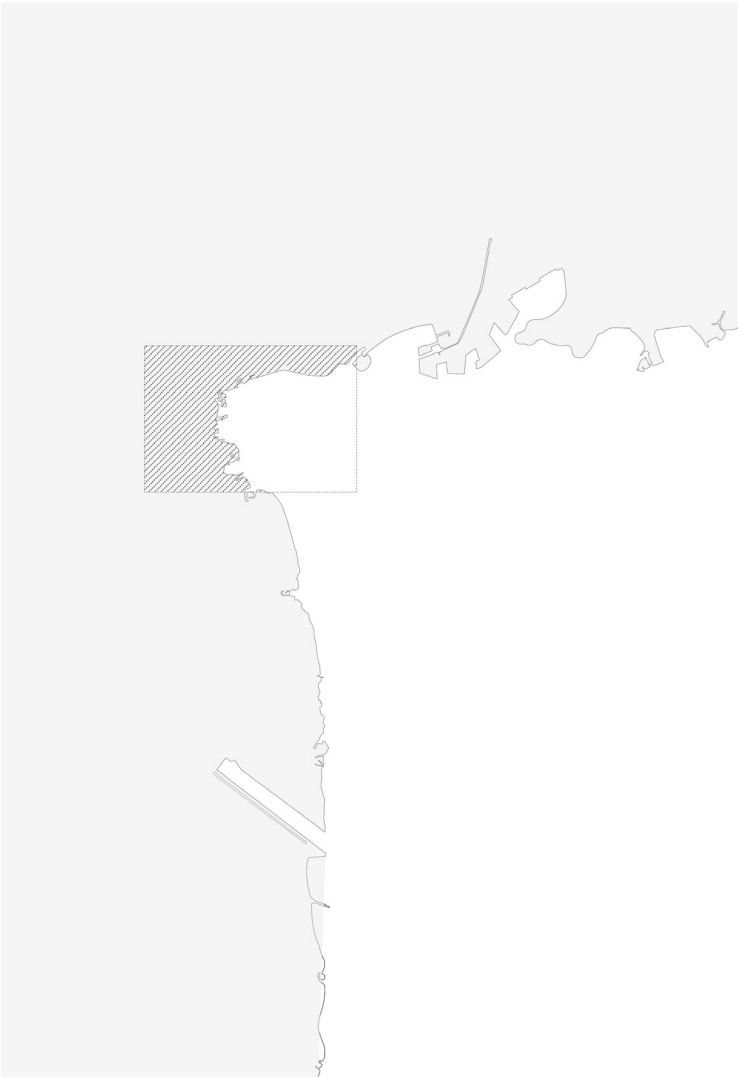
Drawing 62. Breakwaters



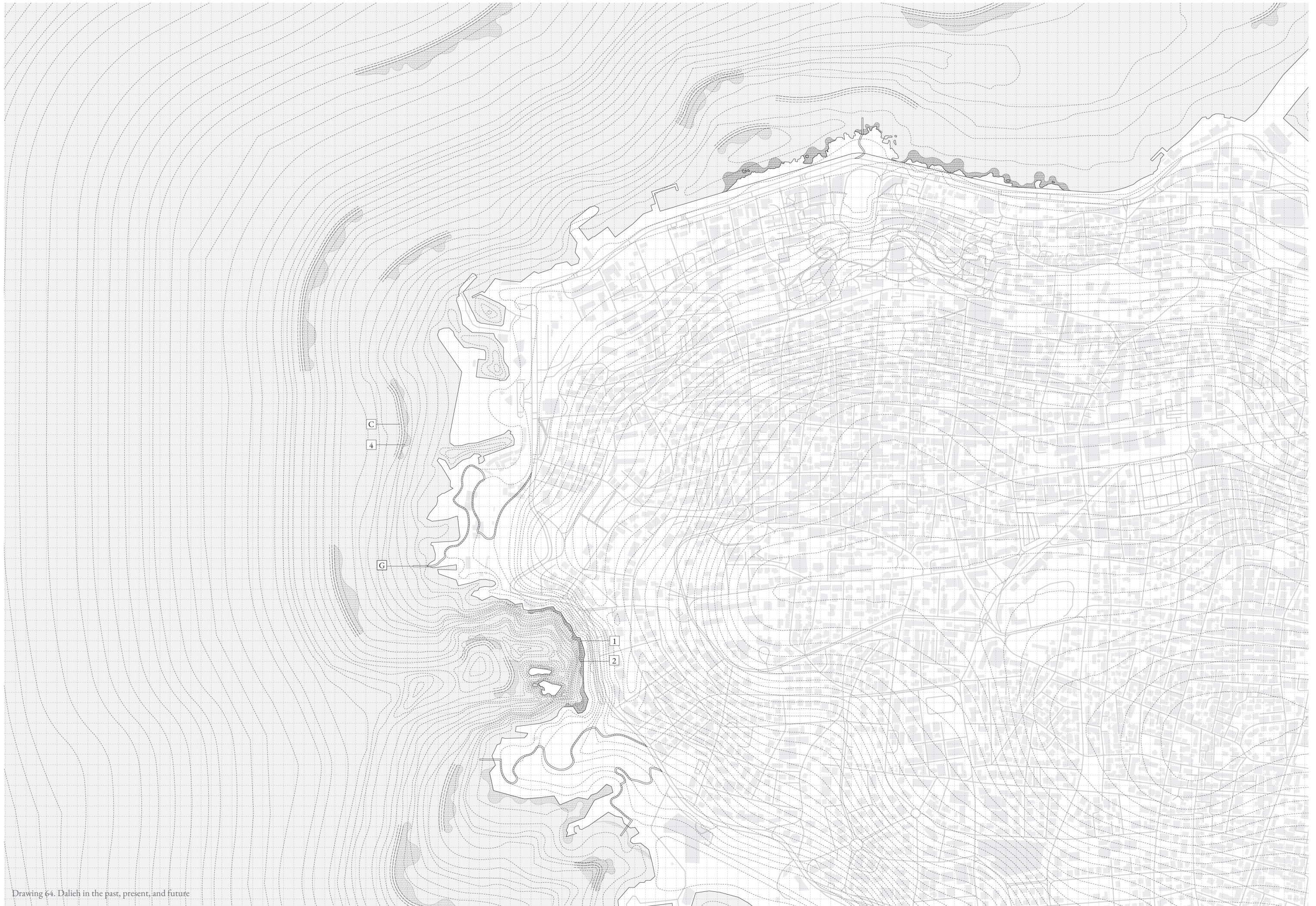
Drawing 62. Established threshold zone

[F] Morph 6: Addition_Dalieh rock formation

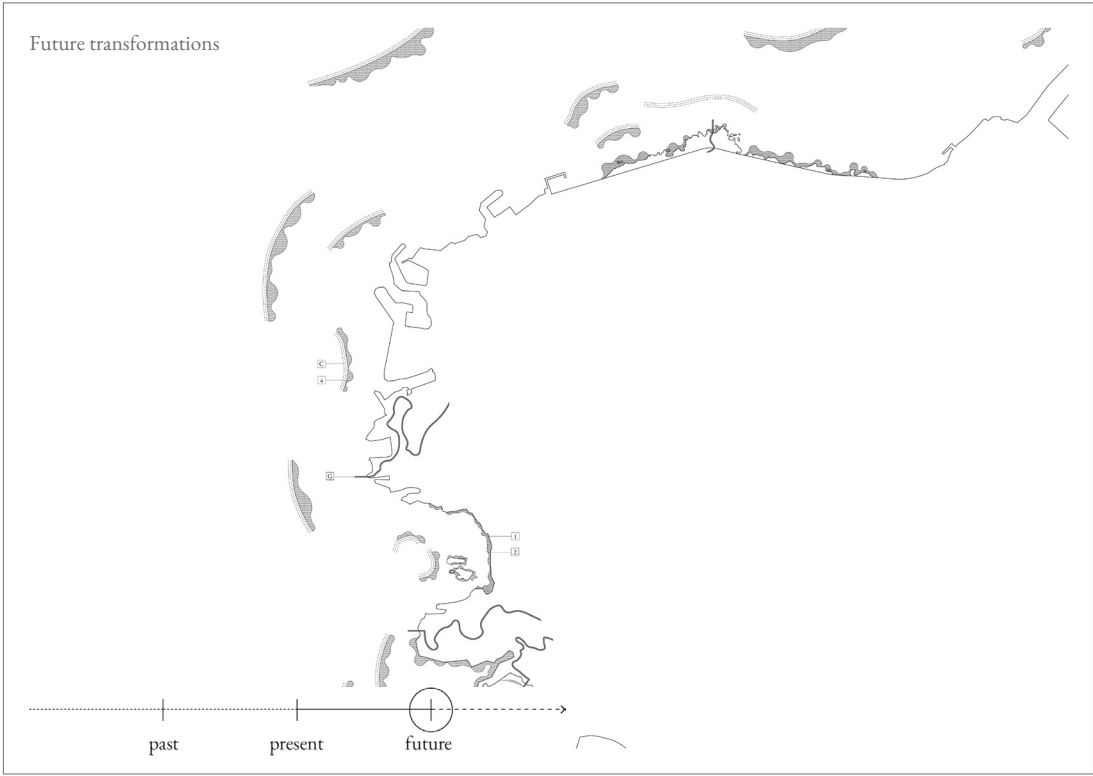
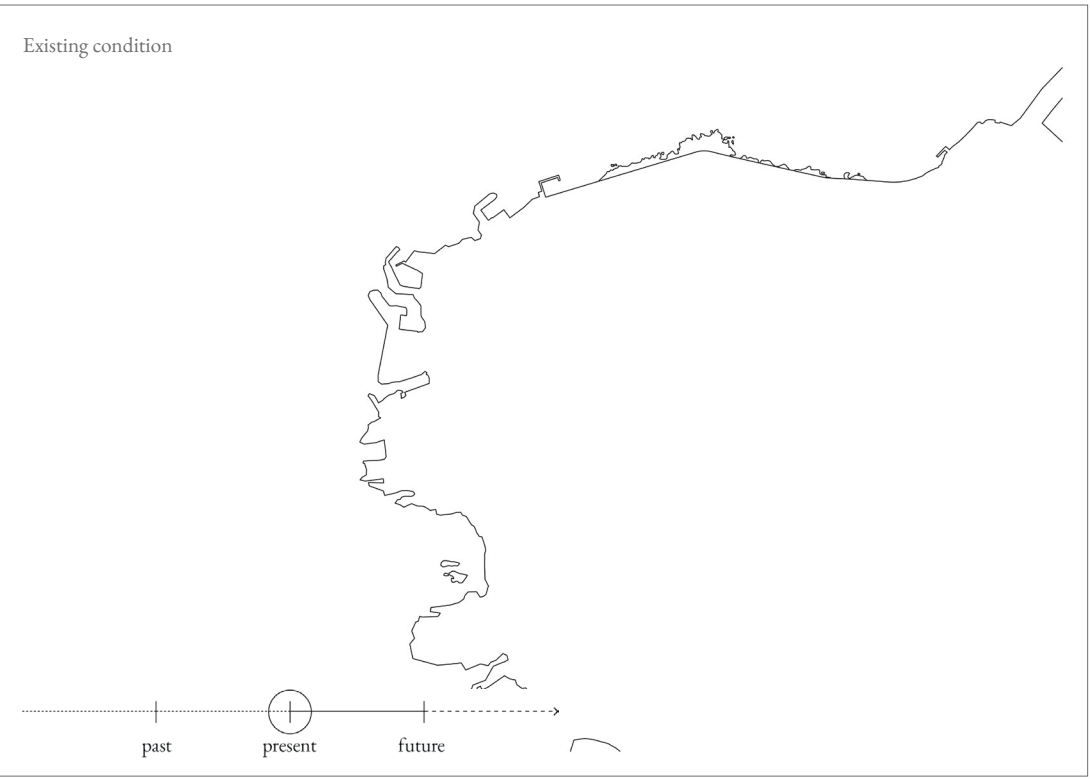
The Dalieh rock formation suffers from habitat deterioration and erosion. Its steep topography makes it difficult to access, but any attempts to do so cause severe abrasions on its surface, impeding the growth and vitality of the live vermetid reefs it harbors. Offshore biogenic reefs aid in its continuous growth while sensitively placed perforated paths enable safe access to the rock, mitigating the rough topography, without harming the rock itself. Perforations allow light rays to percolate, essential to the growth of the microhabitats beneath it.

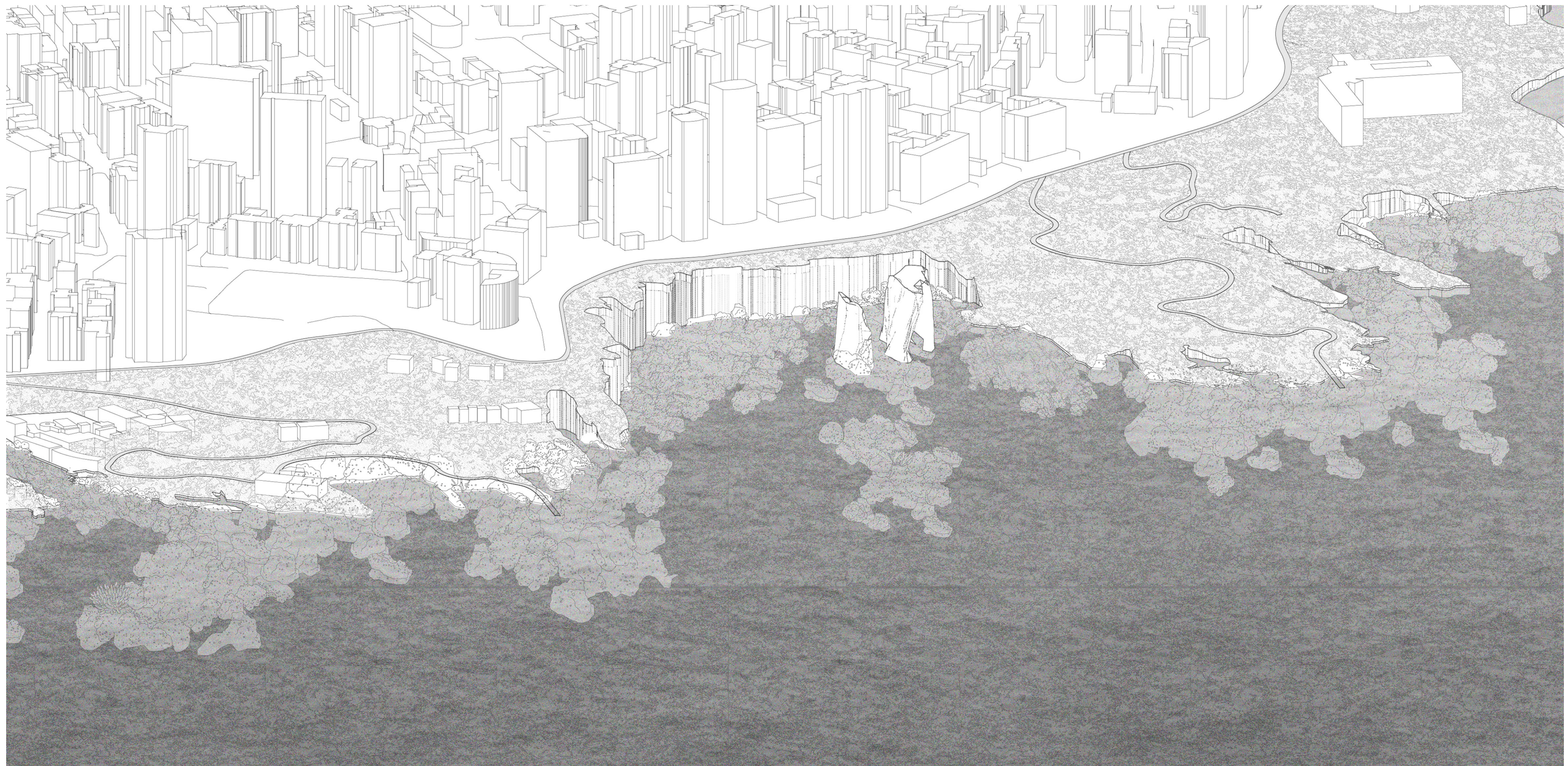


Drawing 63. Dalieh Key plan

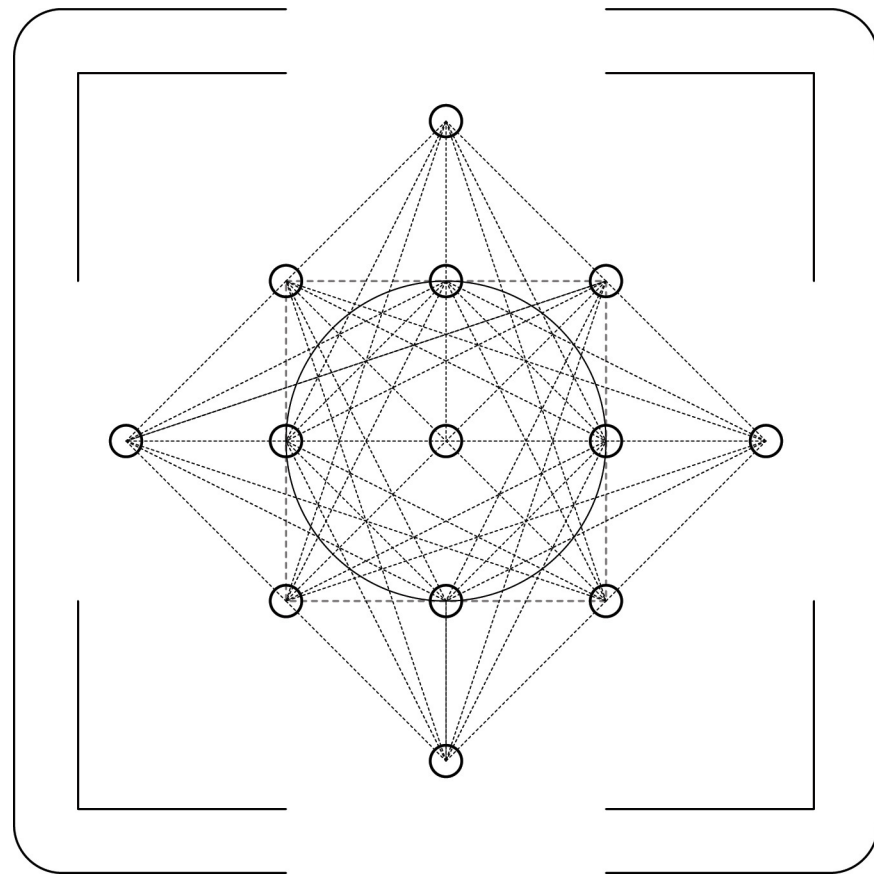


Drawing 64. Dalieh in the past, present, and future





Drawing 65. Accessible vermetids



iii. Seed interventions

Seed interventions are designed and strategically distributed to work in concert with the morphological shifts, with a focus on the interplay between progradational and retrogradational deposits. While each intervention addresses the site-specific challenges in close proximity to its installation, they also interact with one another in various permutations to collectively pursue the goal of establishing the beach. Similar to the morphological shifts, they transform synergistically with natural forces ultimately harmoniously integrating into the fabric of the littoral landscape. The seed interventions exhibit a shared foundation, where their base is comprised of fundamental engineered structures and mechanisms. However, their “design” encompasses two key aspects: firstly, the calculated customization in their operational functionality, and secondly, their strategic placement in relation to one another, other seed interventions, and the coastline. This design approach emphasizes the consequential landscapes that emerge over varying time frames and scales as a result of these interventions.

[A] Breakwaters

[Drawings 66 - 70]

Breakwaters are engineered structures placed offshore to dissipate wave energy and protect the coastline from flooding and erosion (Ligteringen, 1987). Along sandy coasts, in addition to their protective capacities, breakwaters possess the capacity to morph the coastline through sedimentation dynamics and the subsequent formation of a salient, where sediments are deposited and accumulated at the lee side of the breakwater, or a tombolo, formed through the extended accumulation of sediments attached to the structure (Frihy et al., 2004). The resulting morphologies are determined by several aspects of the design of the breakwater and its placement. These parameters include the length(B) and height (H) of the breakwater, distance from the shoreline (X), and distance from adjacent breakwaters (G) (Tsai et al., 2023).

These breakwaters of this project maximize this mechanism through their strategic placement along the coastline to obtain a determined morphology. The basic strategies for designing a breakwater are adopted, but they are further customized by allowing a shelf on the lee side of the structure to enable docking, and the base of the breakwater includes perforations to enable the proliferation of biogenic reefs, eventually leading to the complete disappearance of the breakwater and its transformation to a reef itself. This is done without compromising the functionality of the breakwater itself.

The placement of these interventions along Beirut’s coastline was determined by conducting a concise literature review that examined the diverse impacts of sedimentation in relation to the aforementioned parameters. The findings of this review are summarized in the table below. Accordingly, different forms are explored and placed on a matrix based on their extent of access in relation to sedimentation accumulation ratio.

[B] Biogenic reefs

[Drawings 71 - 74]

The Levantine basin hosts diverse shellfish species, mostly native to their origin (Oceana et al., 2018). This research effort is once again aimed at shifting the narrative towards highlighting the inherent potentialities and maximizing their benefits. Recognizing the importance of exploring this, extensive research has been undertaken to identify their current distribution and assess their potential for further proliferation. The Levantine Mussel (*Mytilus galilaeus*), native to the Lebanese coast, plays a critical role as a keystone species, offering a multitude of benefits. Similar to other bivalve mollusks, the Mediterranean mussel is a filter feeder. As they feed, they extract suspended particles, phytoplankton, and organic matter from the water. As filter feeders, they are essential components of the nitrogen and phosphorus cycles, assimilating these nutrients into their tissues and cells. They also sequester carbon. Additionally, their presence significantly enhances habitats as they form aggregations on the sea floor through their attachment to hard substances. They establish complex habitats by providing shelter, clean water, and feeding ground for other organisms. Once transformed into a reef, mussel beds stabilize sediments and dissipate wave energy through the dense network of byssal threads (the filaments they use to attach themselves to surfaces). They have the potential to play a significant role in local economies as they have a high growth rate (Inoue et al., 2021).

This seed intervention aims at serving as hard surface to amplify the spawning and development of *Mytilus galilaeus* and other shellfish native to the Levantine basin. The intervention is simply composed of a hollow structure with perforations, typical of an optimally constructed reef foundation. They are designed in a way such that the vortex motion established within not only dissipates wave action but serves as an optimal habitat for benthic fauna. Two types of vortex motions are established through the creation of varying diameter perforations. This maximizes the dissipation of wave energy and attracts a higher diversity of benthic organisms. It also serves as a host for reef proliferation. They are placed strategically in areas which are more protected from harsh waves, and in such a way to accelerate and reinforce reef growth.

After the adult mussels release their eggs and sperm, the fertilized eggs develop into larvae known as veligers, which spend several weeks drifting in the water column, aided by ocean currents. Once they undergo metamorphosis, they transform into juvenile mussels (spat), which then settle onto the strategically placed pods, and all other hard benthic surfaces in between. This settlement process helps establish new mussel populations and can contribute to the connectivity between different mussel habitats. The aggregated pods eventually disintegrate and transform completely into shellfish reefs.

For this to be made possible, it would involve the community's continuous effort of maintaining and transporting mussels to and from the reefs. This engaging task not only promotes stewardship but also holds particular significance in coastal areas inhabited by fishermen, who have a vested interest in the health and productivity of the marine ecosystem.

[C] Fish quadrats

[Drawings 74 - 79]

Fishing in Lebanon holds a rich cultural heritage as it has played an important role in coastal communities for centuries. It has been an integral part of the economy and serves as a primary source of livelihood for a large part of the population. The practice of fishing has been significantly hindered by environmental degradation and rapid occupation and imposition of the coastal fragments, leading to a substantial decrease in available viable onshore fishing locations. Fishing ports are neglected and pushed to the edge, often adjacent to sites of mass violation, such as landfills, sewage outflows, or coastal slums.

Fish quadrats, designed with an accessible floating path, provide a controlled and monitored environment for the reintroduction of fish species in proximity to filtered water, thereby enhancing their biodiversity. The nets provide protection from predator species allowing threatened fish species to thrive, restoring ecological balance, and reinforcing the overall health of the aquatic ecosystem. While a portion of the fish is harvested, a specific number is designated to be returned to the sea, ensuring sustainable fishing practices, and maintaining a robust fishing economy, which is a crucial foundation for fishermen (Karathanasi et al., 2022).

In addition to its conventional design, a floating path surrounding the net is integrated to enable ease of access for the fishermen. Additionally, lines are extended from the floating path which serves as spawning grounds for mussels. They surround the quadrat net, filtering the water, dissipating the waves, and providing a rich microenvironment. The nets are designed such that the shellfish take over in the future and they are converted into reefs.

[D] Seagrass beds

[Drawings 80 - 81]

This seed intervention encompasses the growth of Neptune grass (*Posidonia oceanica*) and its eventual transplantation into seagrass beds. Neptune grass, a native species of sea-grass to Lebanon (Abboud-Abi Saab, 2012; Oceana et al., 2018), is the primary habitat and nursery ground for the majority of the local benthic fauna. It forms dense intertwined submerged meadows offering shelter for invertebrates, feeding grounds for fish species, and nutrient control for microorganisms (Unsworth et al., 2014). Their extensive root system stabilizes sediments as their dense canopy increases friction, reducing wave and current velocity. Through their active photosynthesis, they significantly contribute to the oxygenation and carbon sequestration of the water column (Vanderklift et al., 2016). This helps prevent eutrophication, and attracts endangered benthic species, primarily the Loggerhead sea turtle (*Caretta caretta*) (Bigagli, 2018).

This installation simply involves the placement of wooden stakes 1.5m high, 0.5m apart, connected by a monofilament of a maximum of 4 meters. The ease of this setup would enable a participatory approach, allowing the community to actively contribute to the design and establishment of its layout. Additionally, it would involve the participation of divers in the transplantation of sea-grass beds, facilitating their transformation into thriving meadows.

[E] Sand fences

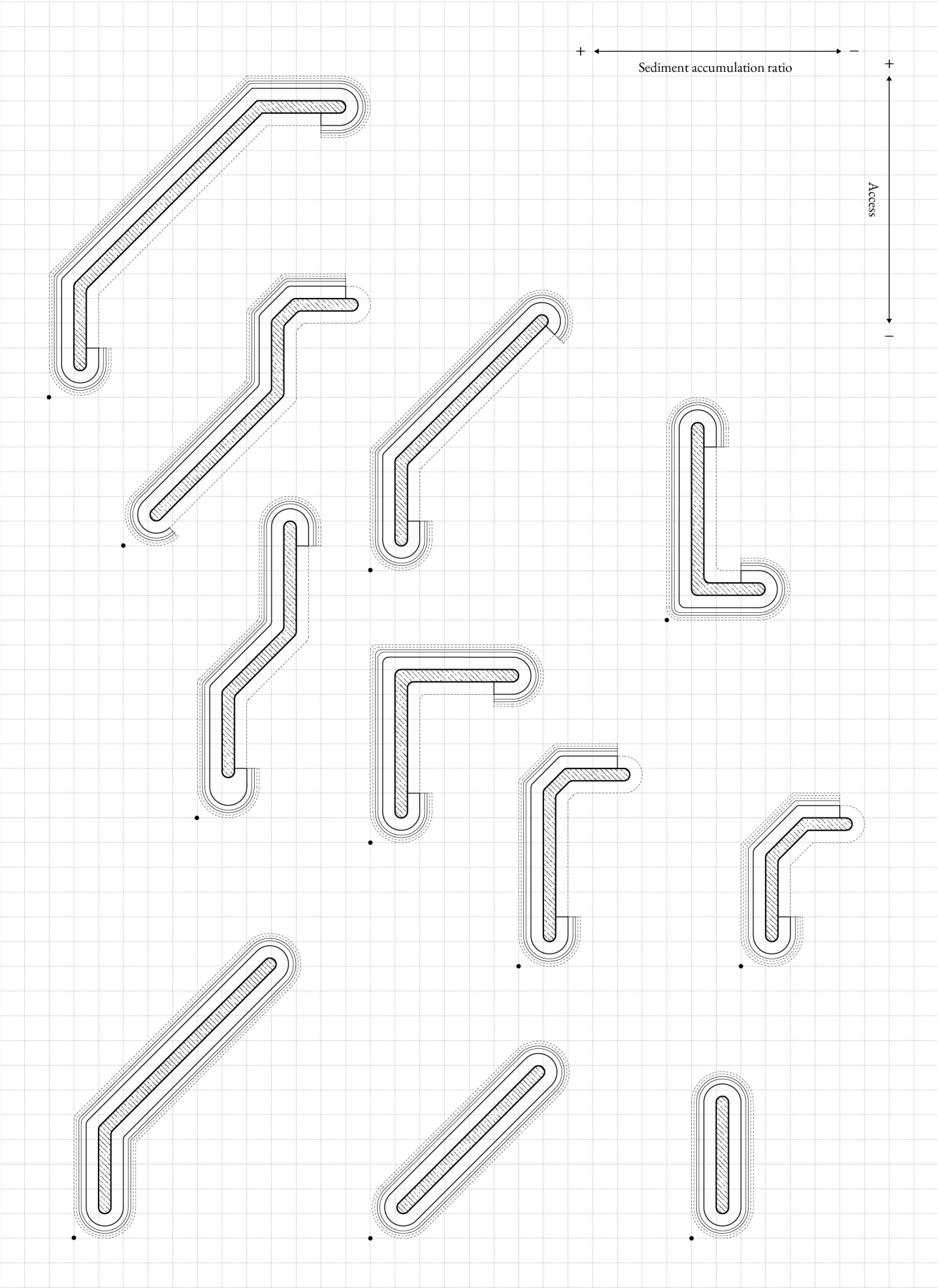
With the aim of capturing and accumulating sand particles, this intervention works symbiotically with offshore structures to further stabilize the shore. The poles, stacked equidistantly 0.5 meters apart, angled perpendicular to the dominant wind direction, decrease the velocity of the wind and the sand particles it carries, resulting in the deposit of said particles at the base of the fence. This leads to sand dune formation, and together with the further planting of stabilizing dune grasses, the shoreline is reinforced and slowly increases over time, further resisting the threat of sea level rise.

[F] Intertidal tiles

Intertidal tiles are perforated tile units composed of concrete which could be retrofitted on hard concrete edges. They transform into reefs, softening the edge of these hard boundary lines between water and land, establishing the biogenic interface characteristic of the beach.

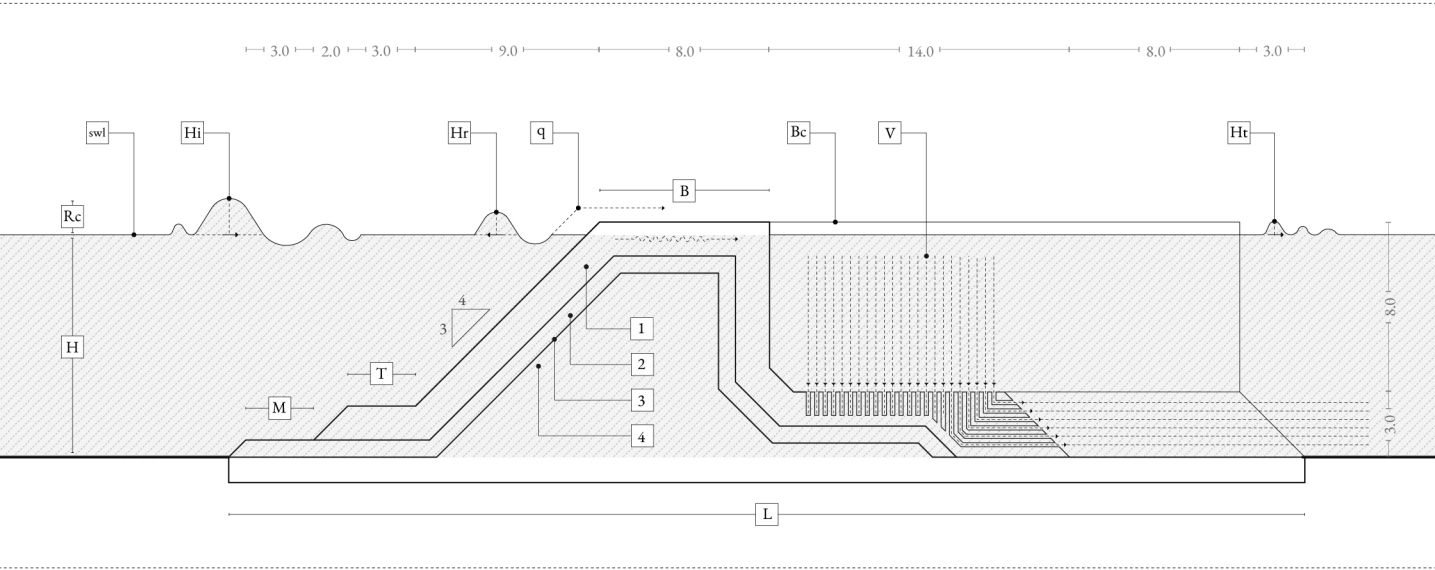
[G] Perforated paths

A path element is inserted to enable safe access to areas of harsh topography which also need protection. The slightly elevated path protects the rocks beneath and allows the percolation of sun through its perforations. The materiality blends with the rocky landscape maintaining an intimate experience with the natural landscape.



Drawing 66. Breakwater shape Grammar

Definitions for the altered rubber mound breakwater



Type of shoreline formation for the ratio L_s/x

Type of formation	Ratio	Type of structure	Reference
Tombolo	$L_s/x > 0.6$	Offshore reefs	(Black and Andrews, 2001)
	$L_s/x = 1.5$ to 2.0	Single breakwater	(Dally and Pope, 1986)
	$L_s/x > 1$	Multiple breakwaters	(Dally and Pope, 1986)
	$L_s/x = 1.5$	Multiple submerged breakwaters	(Suh and Dalrymple, 1987)
	$G \cdot X / L_s^2 = 0.5$	Multiple submerged breakwaters	(Suh and Dalrymple, 1987)
Salient	$L_s/x > 1.0$ to $1.5 / (1 - K_r)$	Multiple submerged breakwaters	(Pilarczyk, 2003)
	$L_s/x < 2.0$	Offshore reefs	(Black and Andrews, 2001)
	$L_s/x = 0.67$ to 1.5	Offshore reefs	(Dally and Pope, 1986)
	$L_s/x = 0.5$ to 1.0	Submerged breakwaters	(Shore Protection Manual, 1984)
	$L_s/x > 1.0 / (1 - K_r)$	Submerged breakwaters	(Pilarczyk, 2003)
Non-depositional conditions	$G \cdot X / L_s^2 = 0.5 \cdot 1 - K_r$	Multiple submerged breakwaters	(Pilarczyk, 2003)
	$L_s/x < 1.0$	Offshore reefs	(Black and Andrews, 2001)
	$L_s/x < 0.5$	Offshore reefs	(Nir, 1982)

Section legend

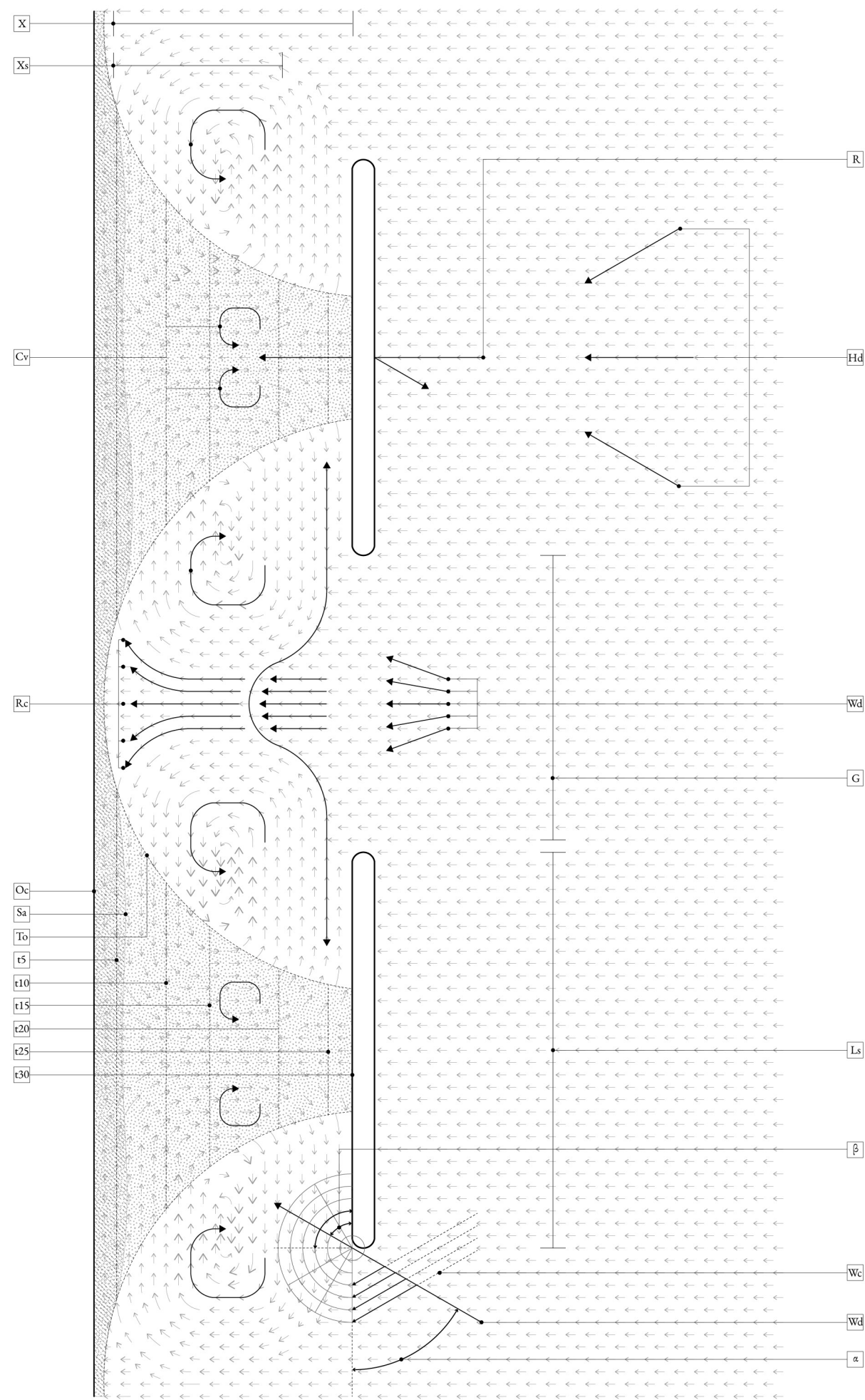
- B Crest width
- H Structure height
- Rc The crest free board
- M Scour width
- T Toe width
- swl Still water level
- Hi Incident wave height
- Hr Reflected wave
- Ht Transmitted wave height
- q Run-up and over-topping
- 2 Armour layer
- 3 Under layer
- 4 Geotextile membrane
- 5 Rubble core

Plan (continued on next page) legend

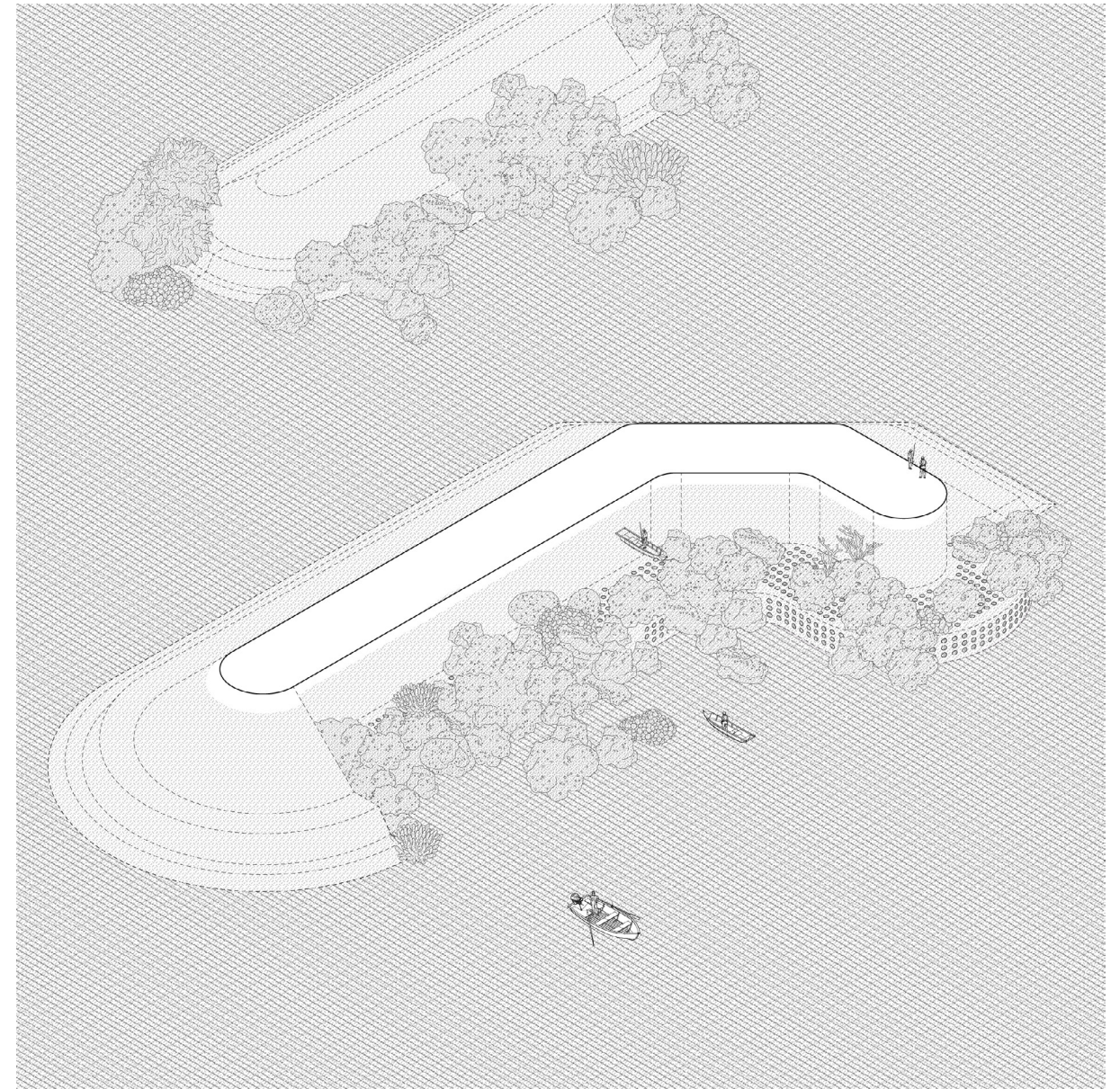
- La Length of breakwater
- G Distance gap between breakwaters
- X Distance offshore from the coastline
- Xs Distance from original coastline to accretion coastline
- Wc Wave crest
- Wx Wave direction
- Cv Convergent vortices
- Wd Wave diffraction
- Rc Rip current
- Hd Incident wave direction
- R Reflection
- a Incident wave direction from the breakwater
- B Angle between the breakwater and the radial, r
- Ic Initial coastline

- Sa Salient
- To Tombolo
- t5 Coastline evolution at 5 months [salient]
- t10 Coastline evolution at 10 months
- t15 Coastline evolution at 15 months
- t20 Coastline evolution at 20 months
- t25 Coastline evolution at 25 months
- t30 Coastline evolution at 30 months [complete tombolo]

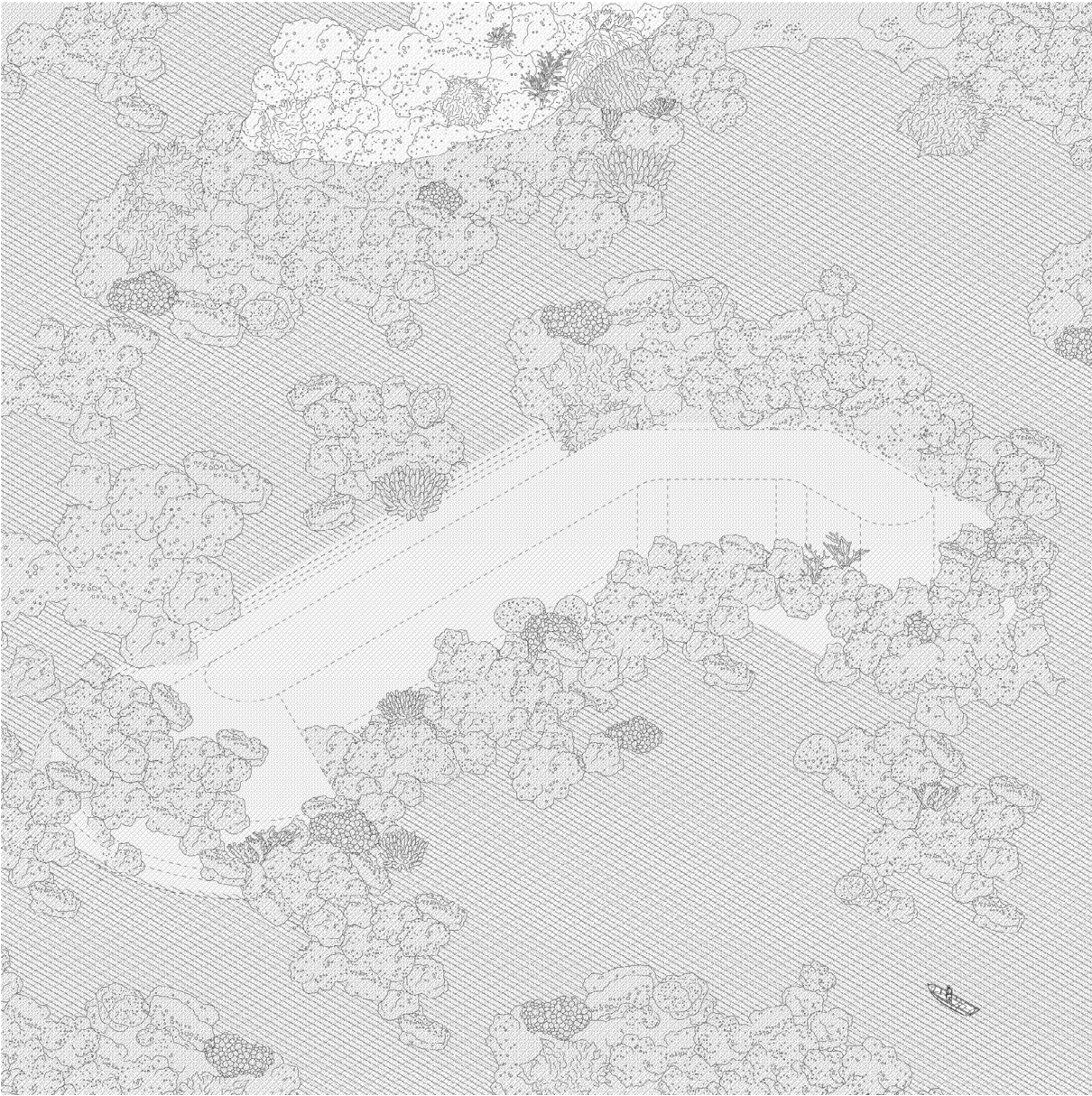
Drawing 67. Manipulating morphologies through the application of coastal engineering



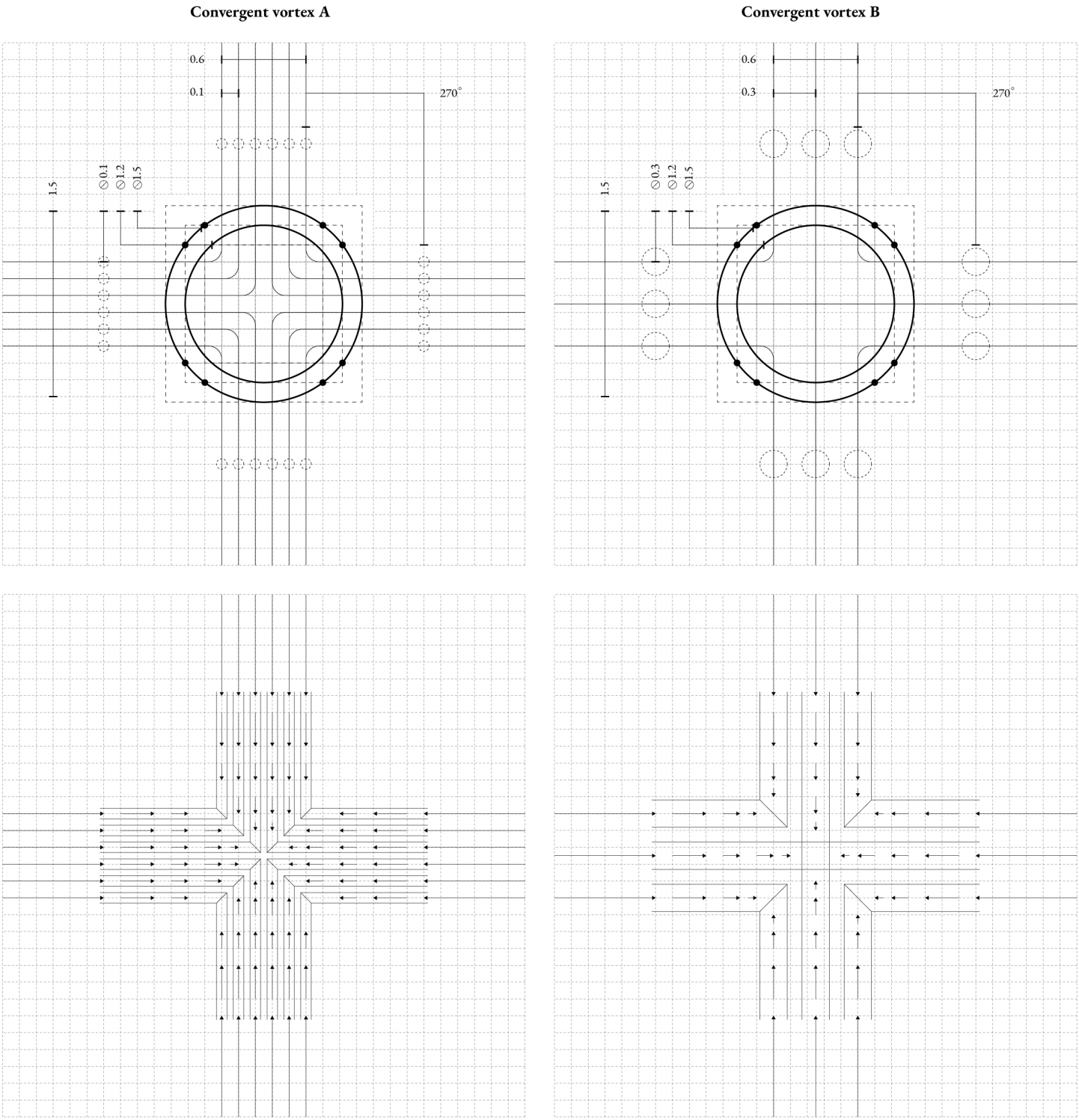
Drawing 68. Breakwater coastal morphodynamics: tombolo and salient formation



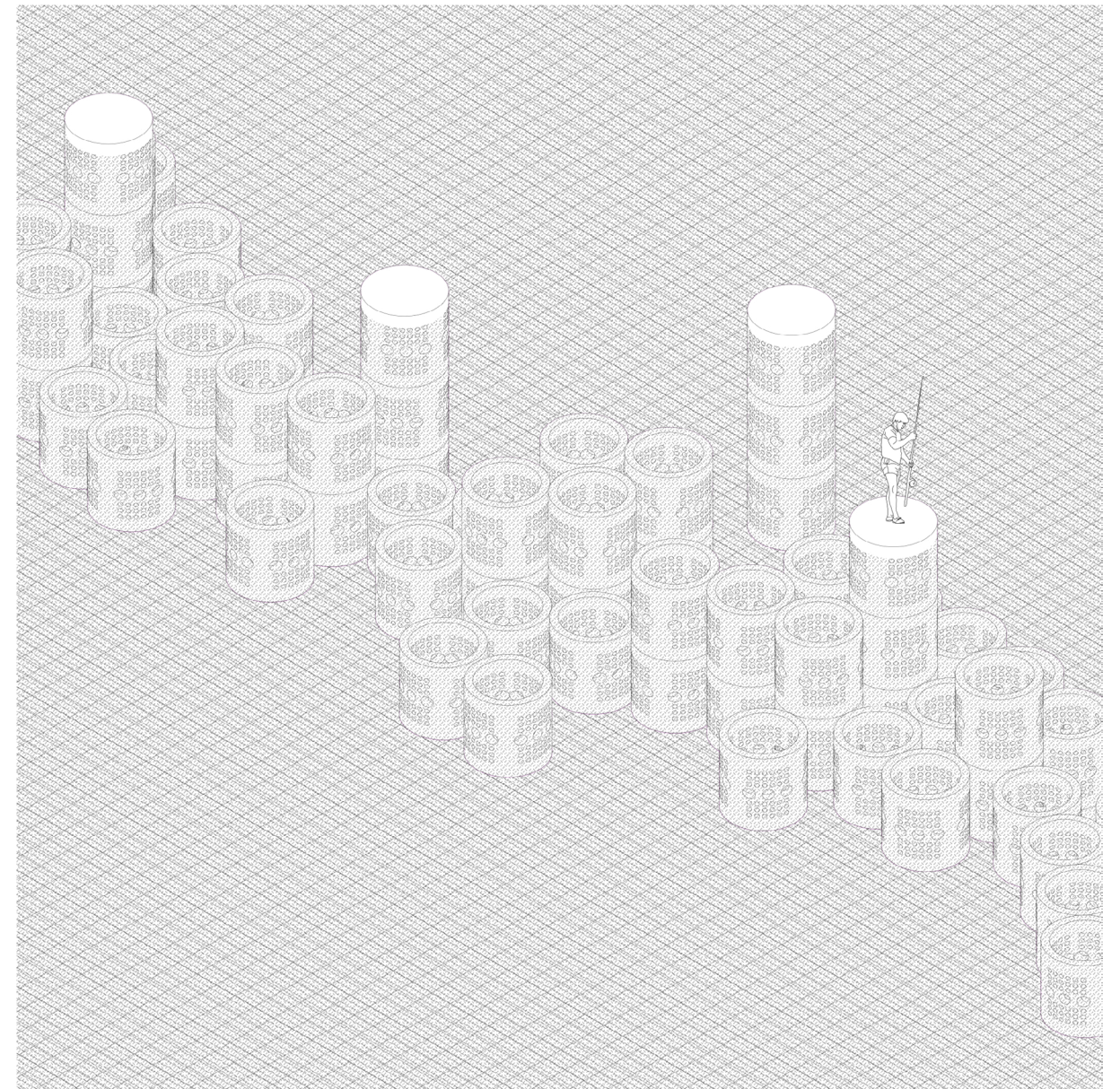
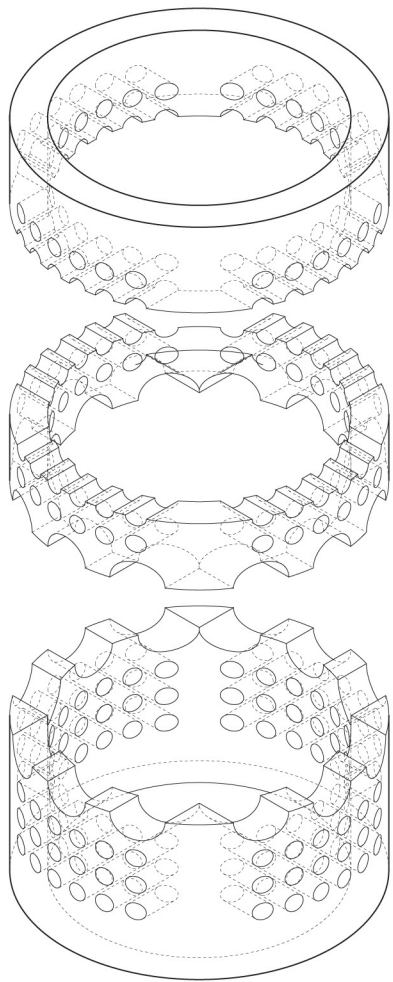
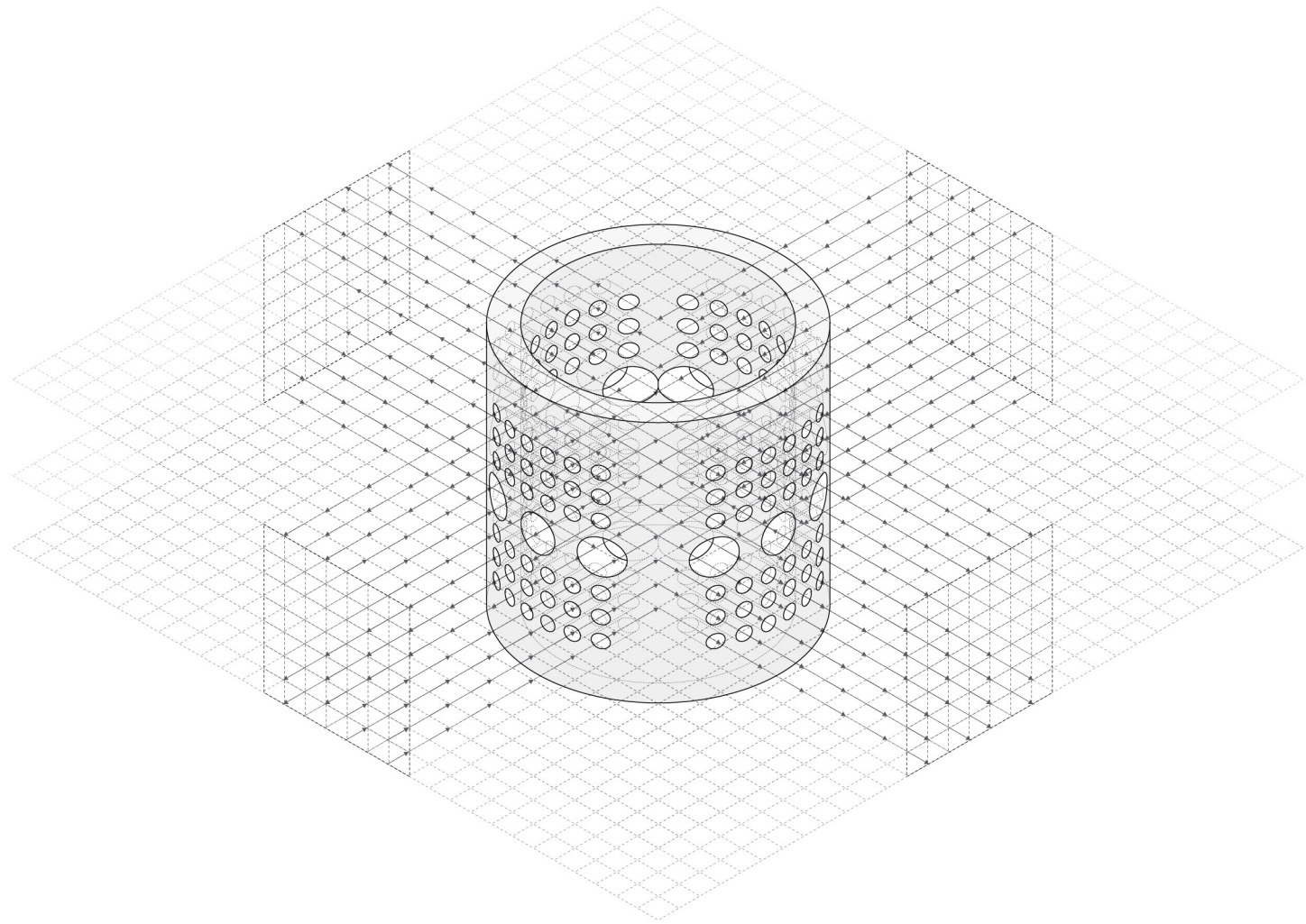
Drawing 69. Breakwaters as offshore platforms and biogenic reef base



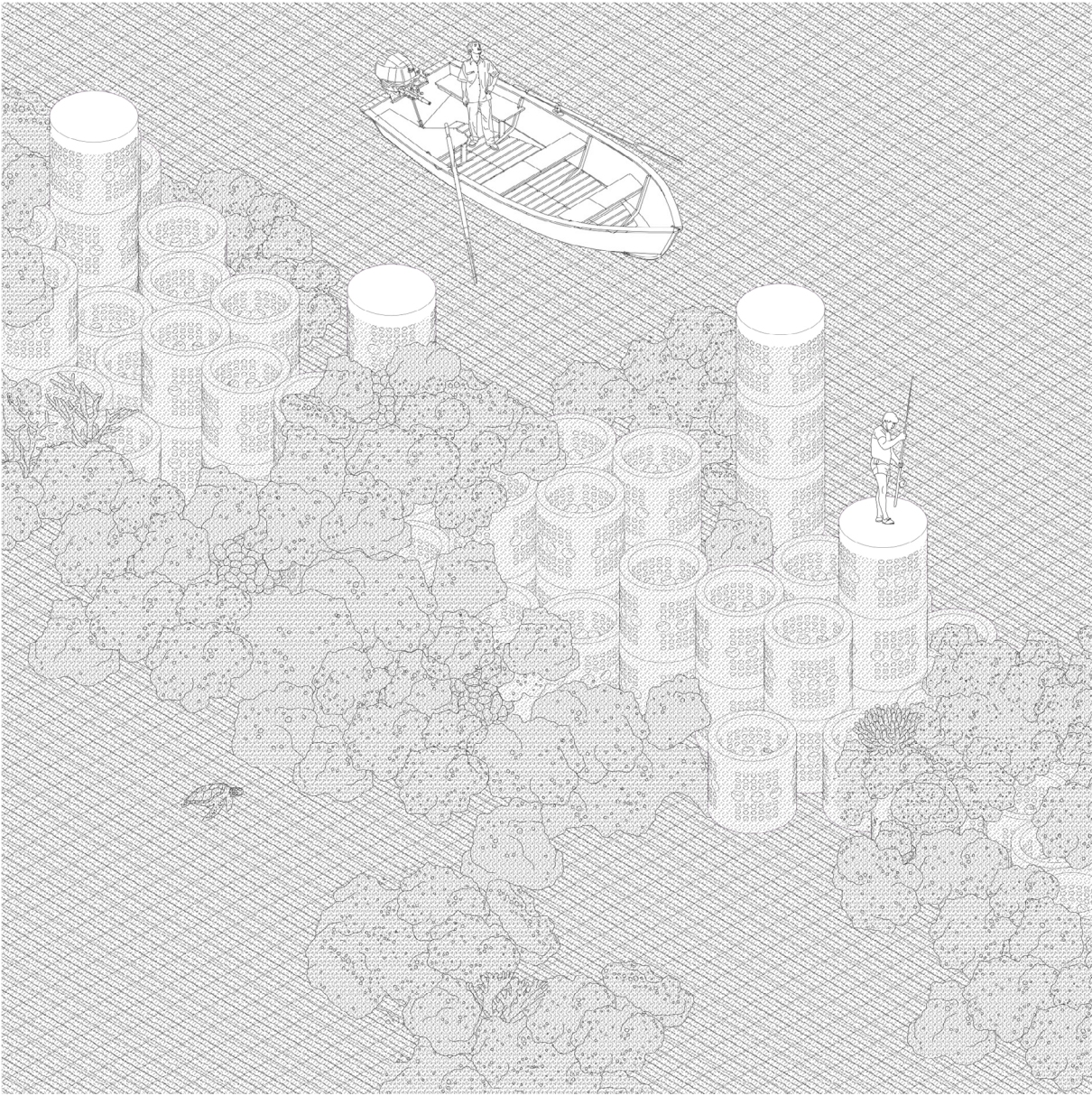
Drawing 70. Breakwaters transform into reefs



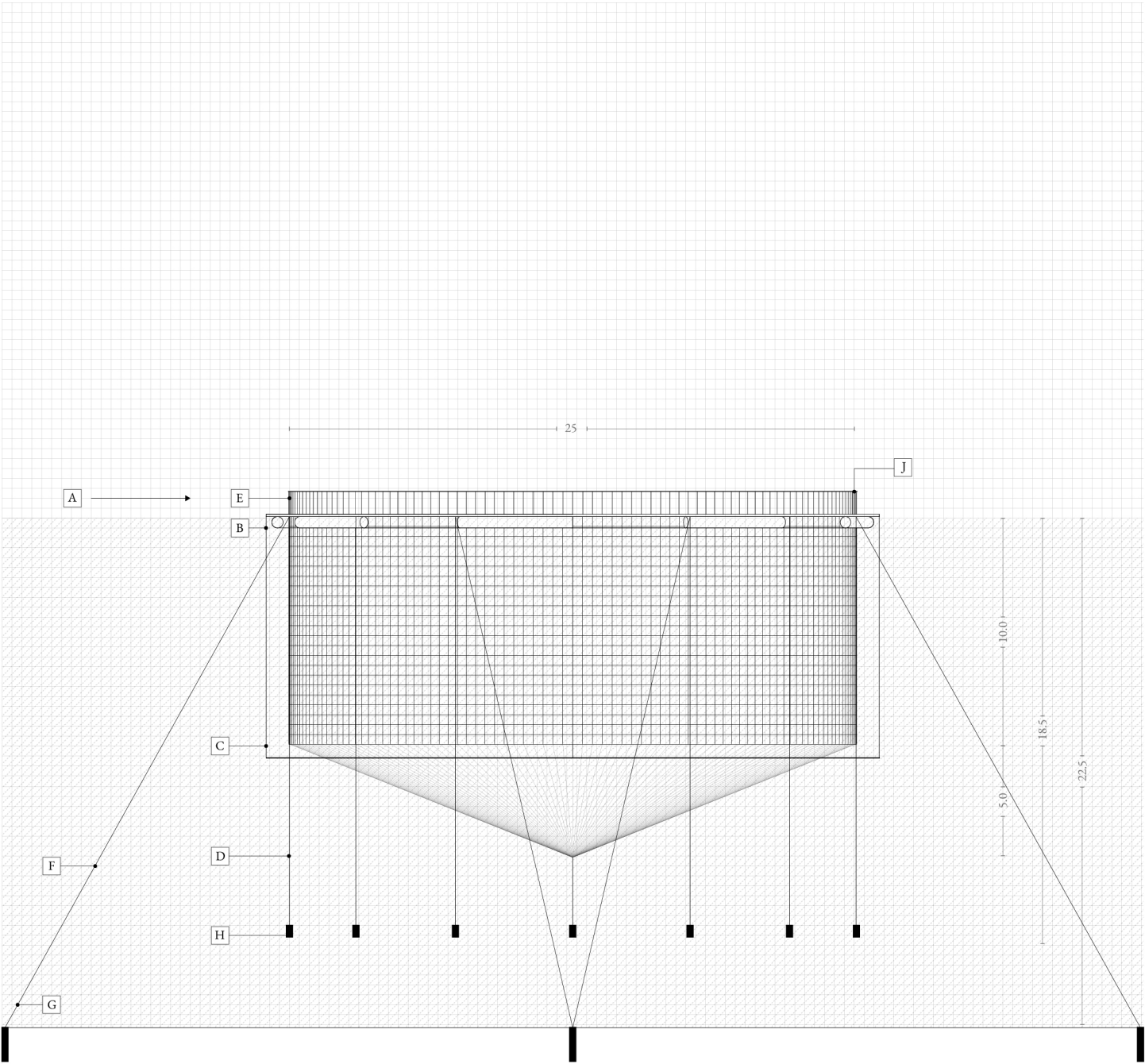
Drawing 71. Biogenic reefs: sediment and vortex motion dynamics



Drawing 73. Biogenic reefs as offshore platforms, serve as mussel spawning grounds

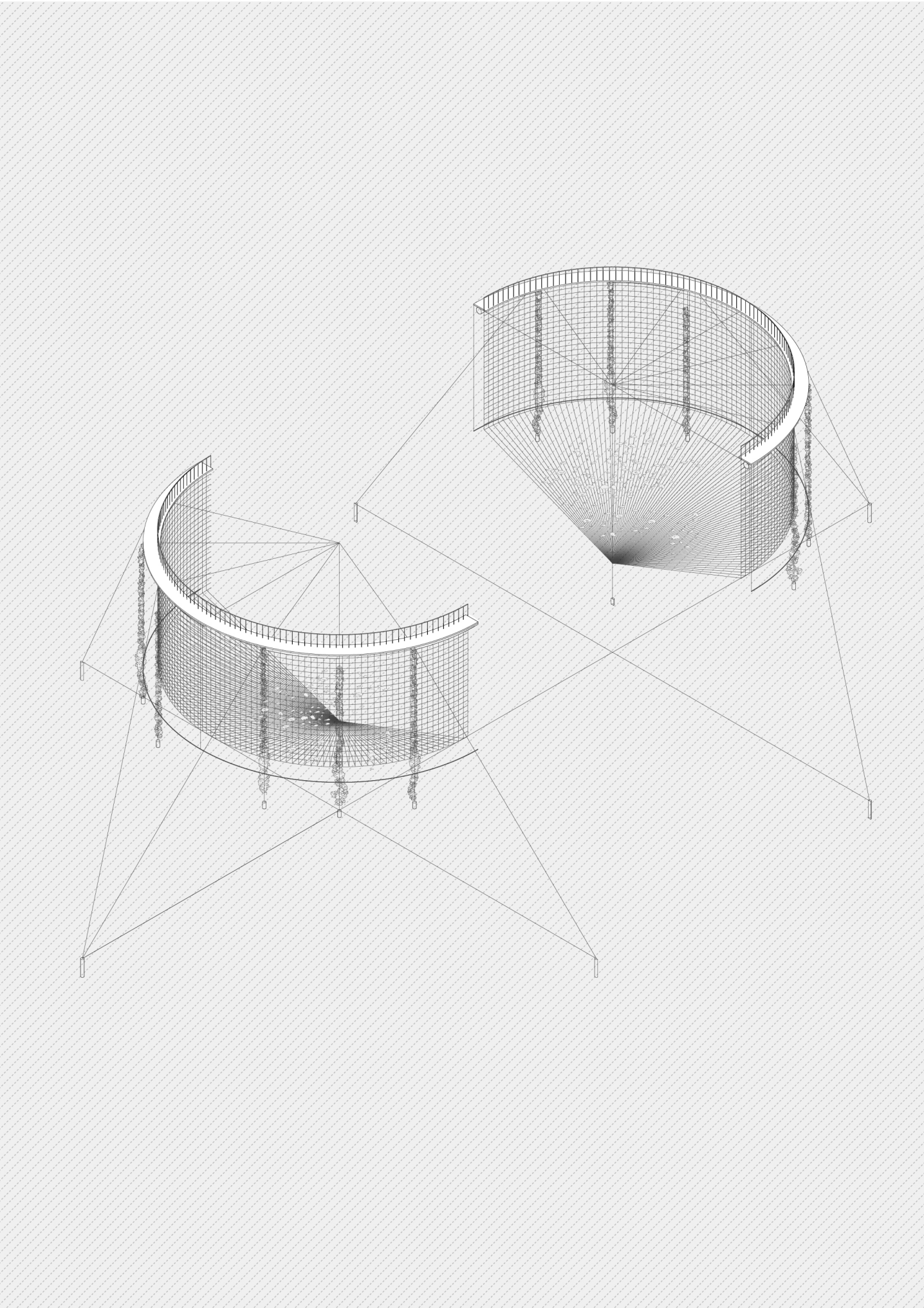


Drawing 74. Biogenic reefs transform into fully developed reefs

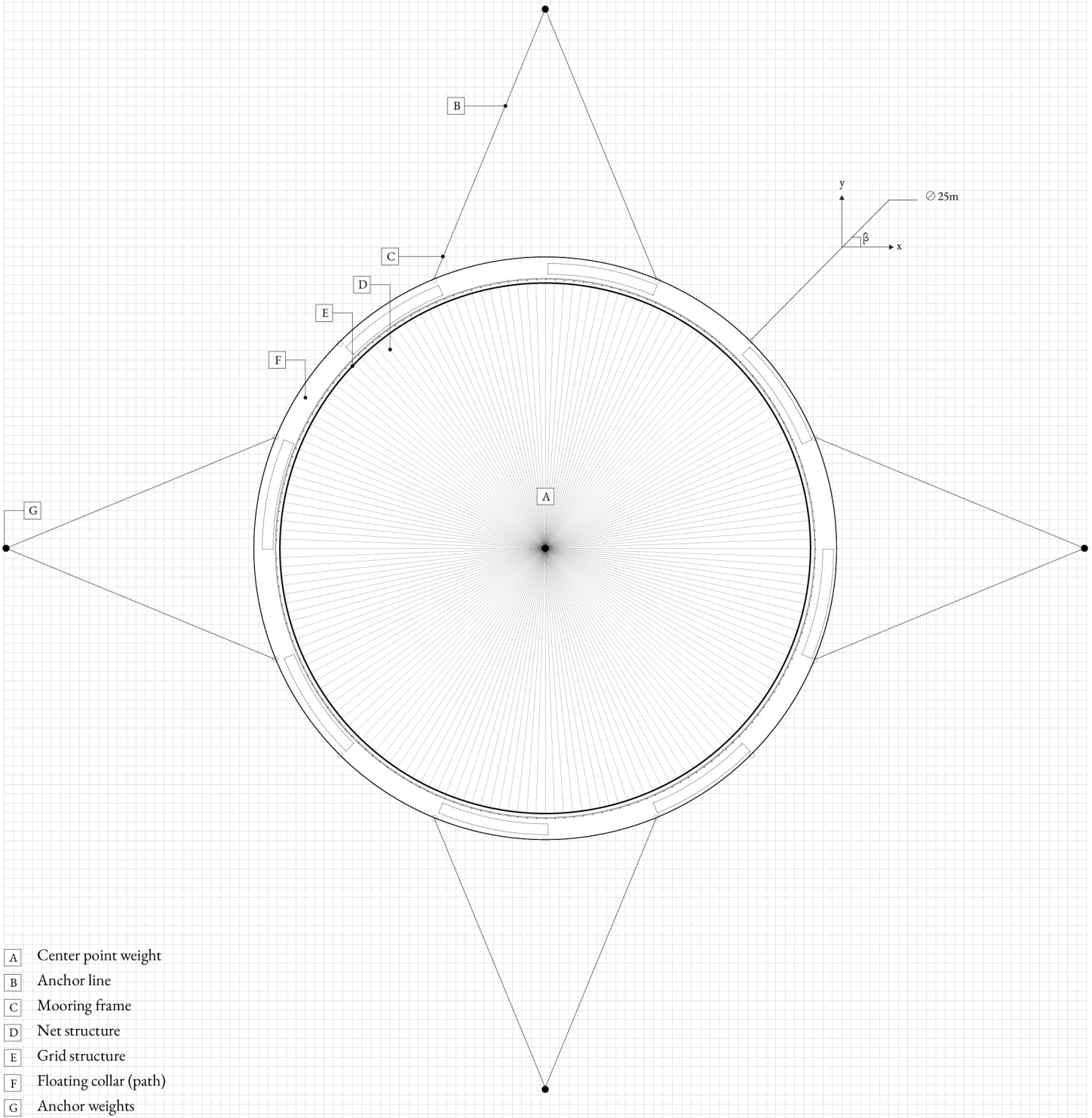


- A Incident wave direction
- B Floating bouy
- C Sinker tubes
- D Bridle ropes [reef accumulation ropes]
- E Floating collar
- F Anchor ropes
- G Anchor
- H Weights
- I Center-point weight
- J Floating path

Drawing 75. Offshore fish quadrats elevation

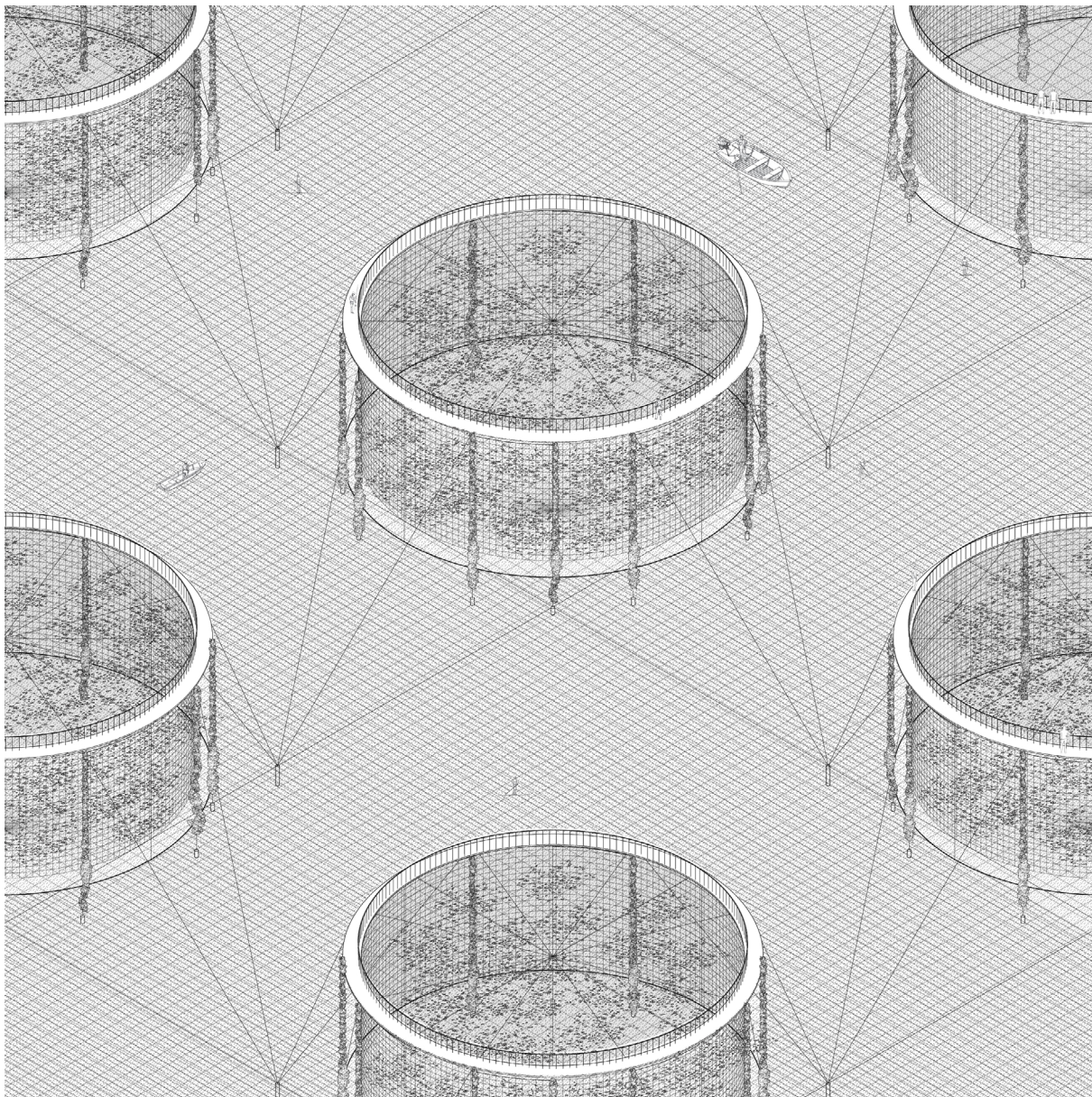


Drawing 76. Offshore fish quadrats composition

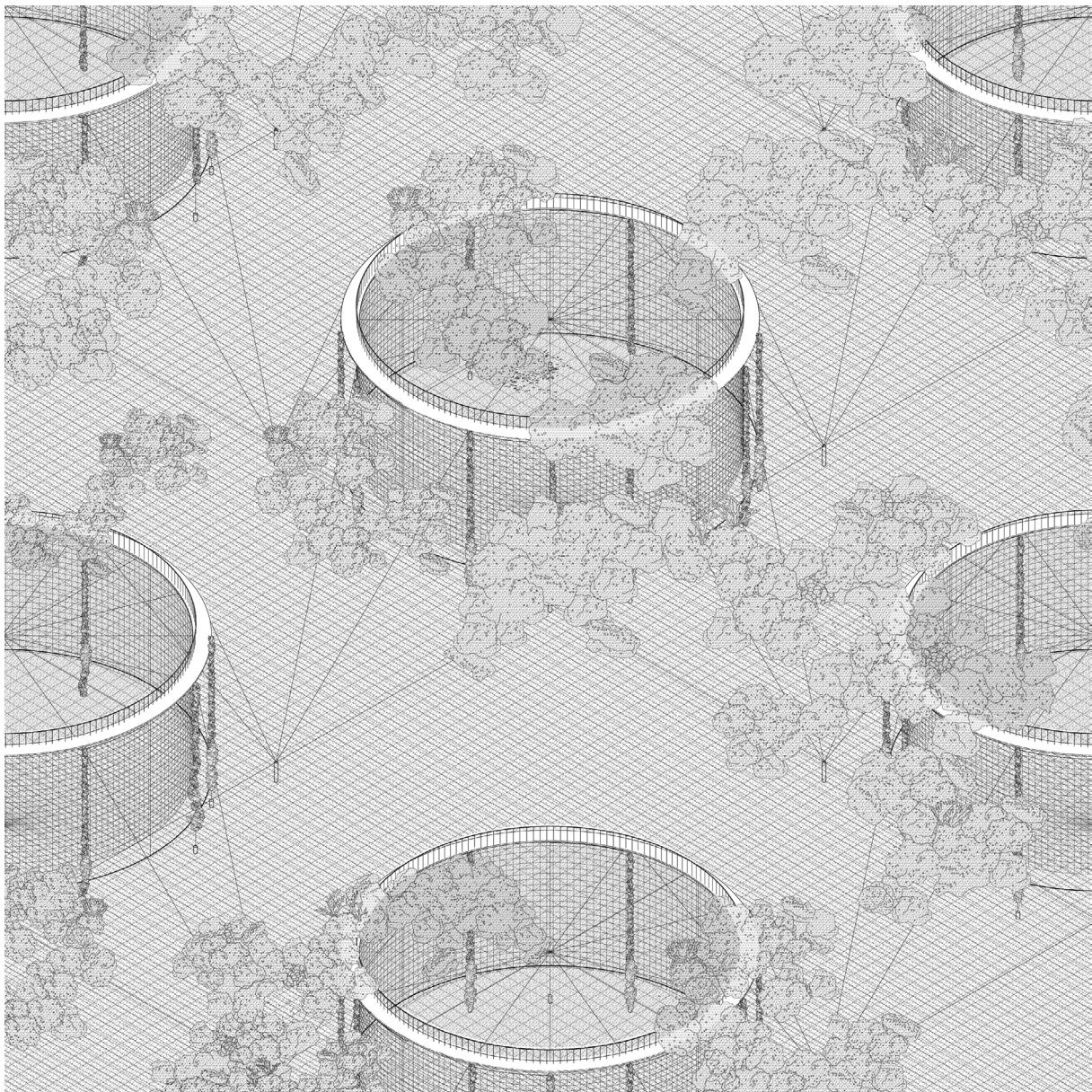


- A Center point weight
- B Anchor line
- C Mooring frame
- D Net structure
- E Grid structure
- F Floating collar (path)
- G Anchor weights

Drawing 77. Offshore fish quadrats plan



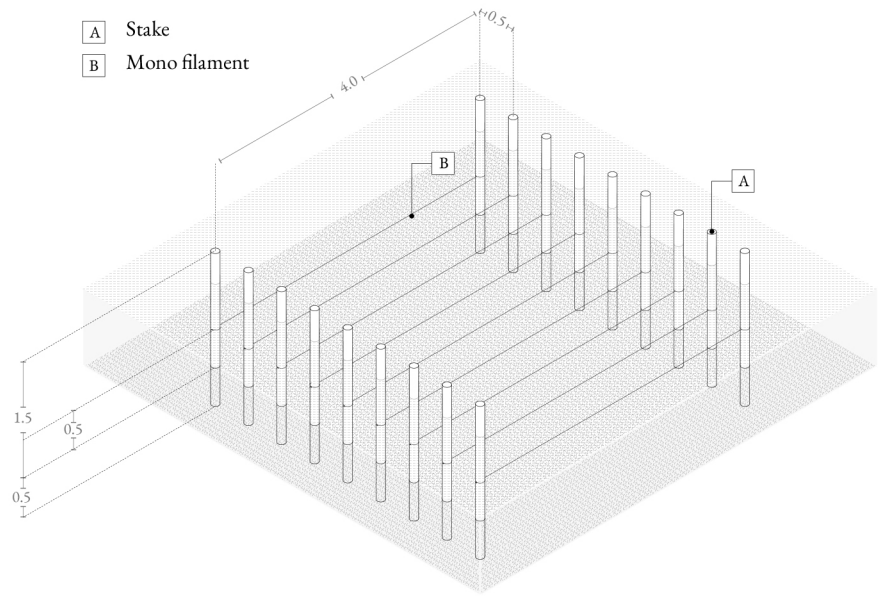
Drawing 78. Offshore fish quadrats



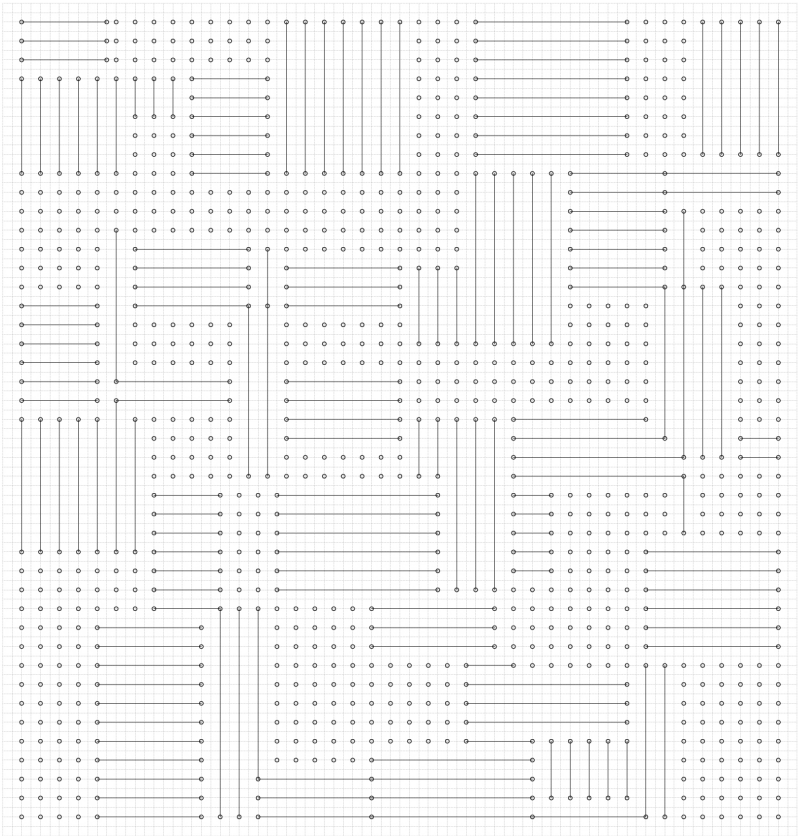
Drawing 79. Offshore fish quadrats transform into reefs

Basic guidelines

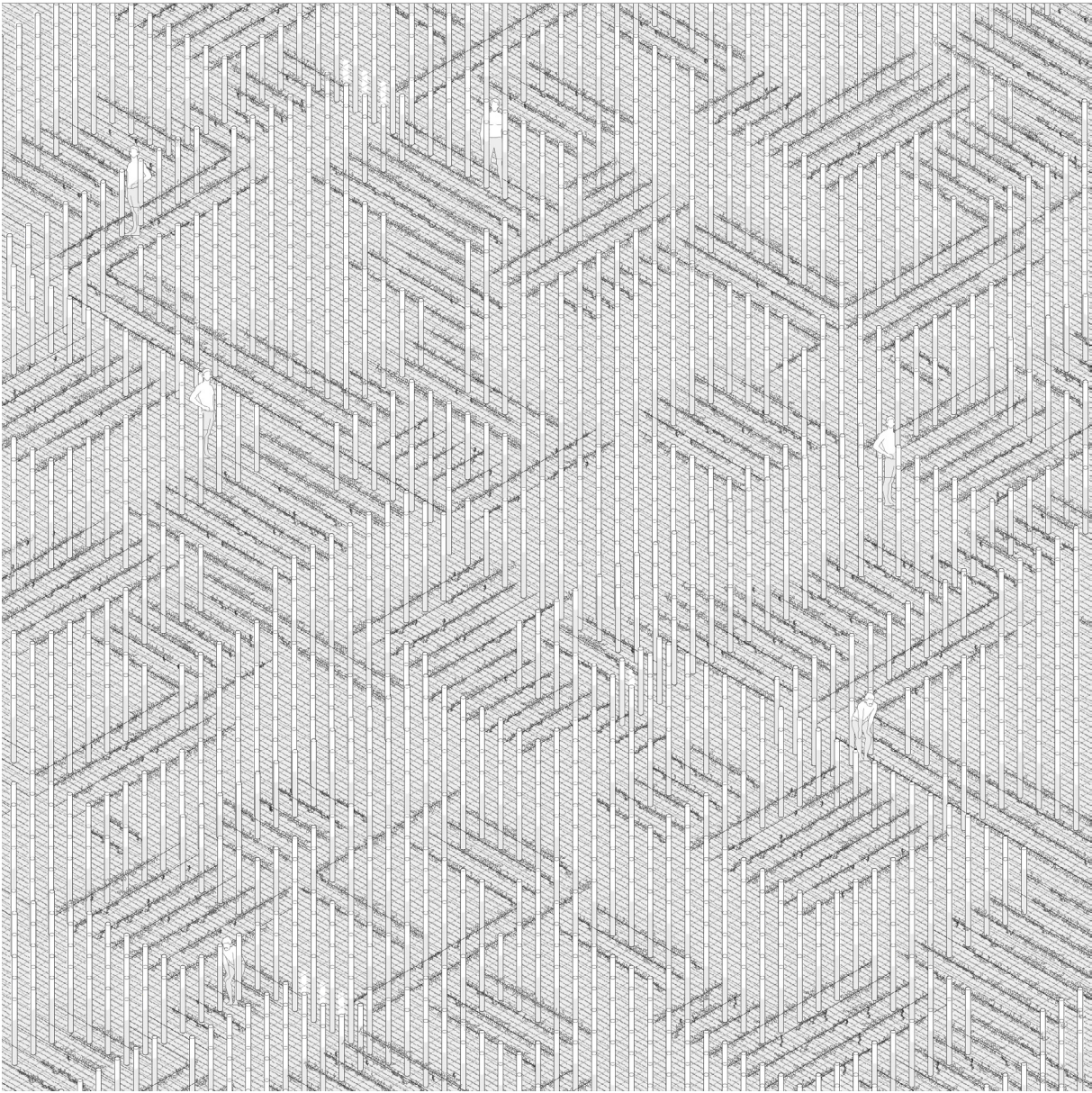
- A Stake
- B Mono filament



Layout configuration example



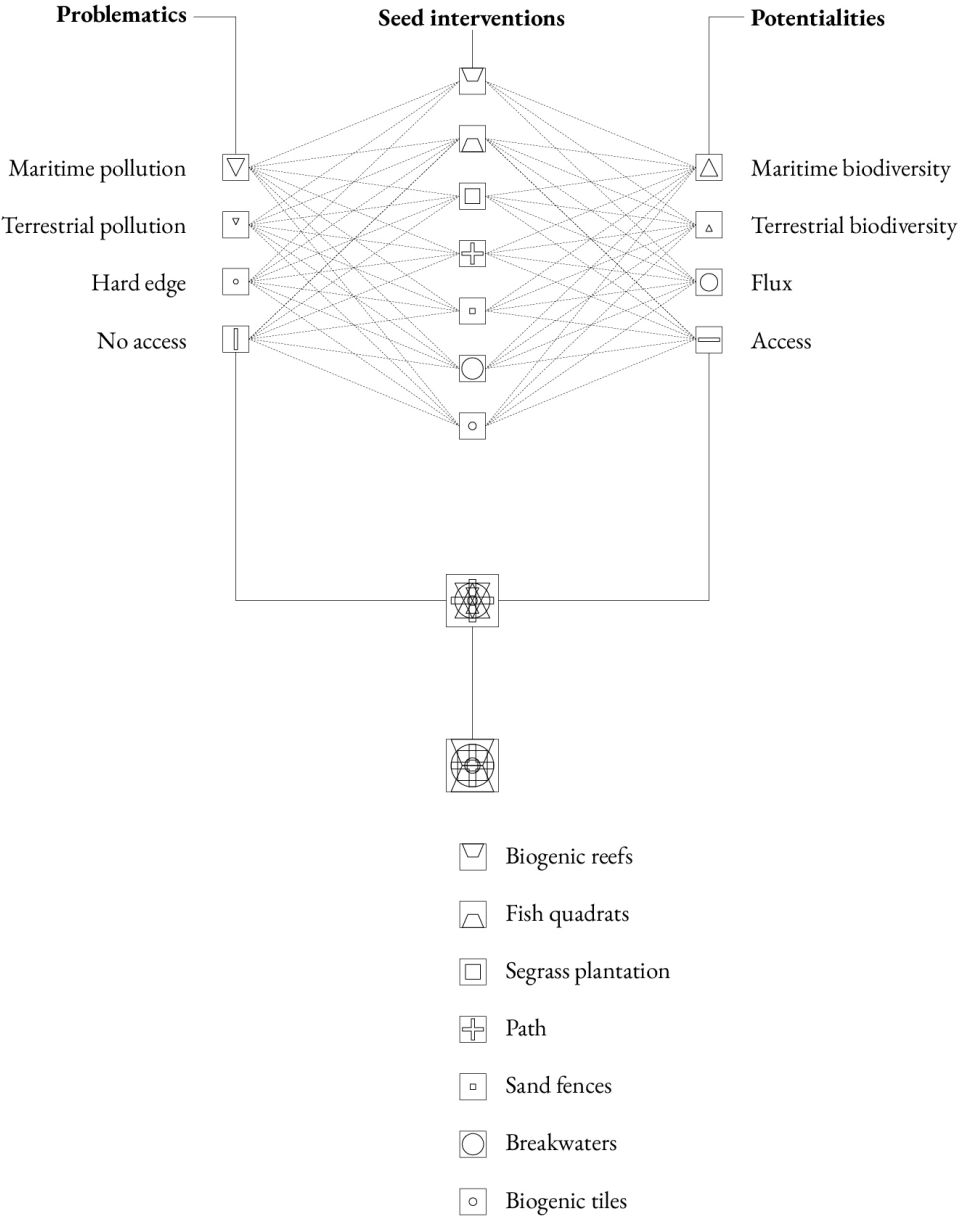
Drawing 80. Seagrass plantations



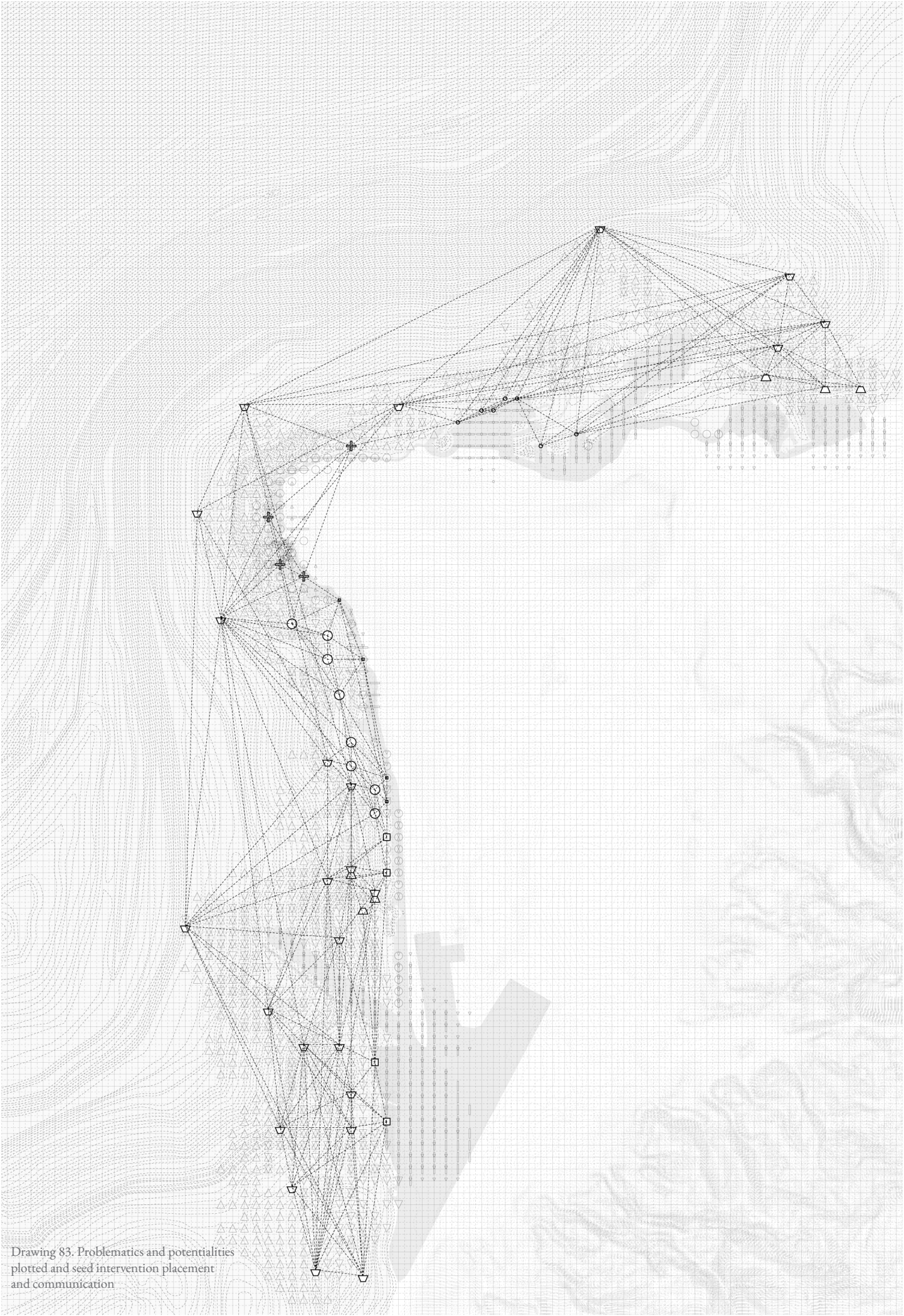
Drawing 81. Seagrass plantations

[H] Their placement and interaction

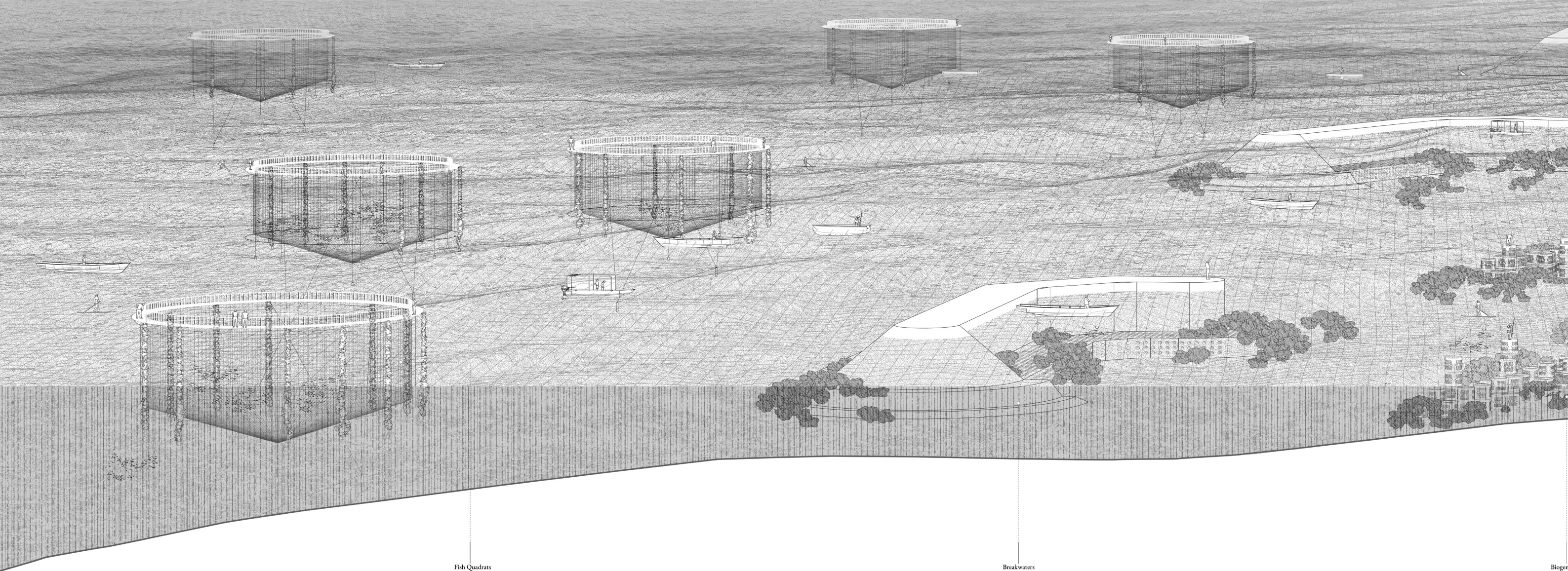
The seed interventions in this project operate both independently and in dynamic interaction with each other, creating various permutations of communication. Their placement along the coastline is guided by the identified problematics and potentialities discovered through the assessments [Drawing 82]. Notably, regions where these factors overlap significantly inform the strategic positioning of each seed intervention. The success of achieving the goal of restoring the beach relies on their deliberate interaction with one another [Drawing 83], the coastline itself, and the existing morphologies. They communicate as a volume of permutations [Drawing 84].



Drawing 82. Potentialities and problematics overlap into seed interventions



Drawing 83. Problematics and potentialities plotted and seed intervention placement and communication



Fish Quadrats

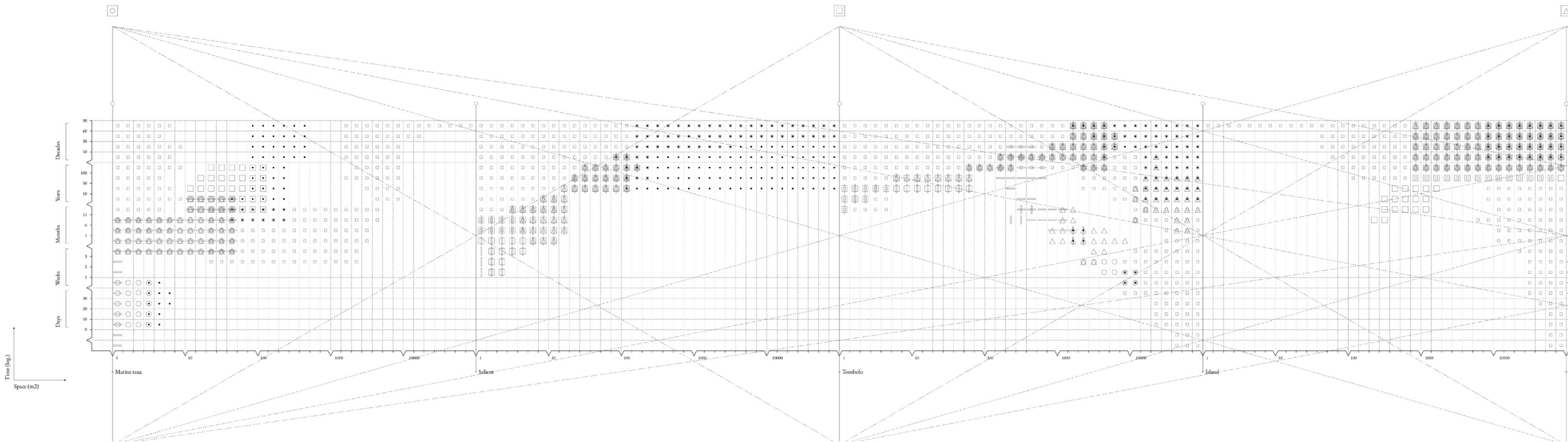
Fishing in Lebanon holds a rich cultural heritage as it has played an important role in coastal communities for centuries. It has been an integral part of the economy and serves as a primary source of livelihood for a large part of the population. The practice of fishing has been significantly hindered by environmental degradation and rapid occupation and imposition of the coastal fragments, leading to a substantial decrease in available viable onshore fishing locations. Fishing ports are neglected and pushed to the edge, often adjacent to sites of mass violation, such as landfills, sewage outflows, or coastal dams. Fish quadrats, designed with an accessible floating path, provide a controlled and monitored environment for the reintroduction of fish species in proximity to filtered water, thereby enhancing their biodiversity. The nets provide protection from predator species allowing threatened fish species to thrive, restoring ecological balance, and reinforcing the overall health of the aquatic ecosystem. While a portion of the fish is harvested, a specific number is designated to be returned to the sea, ensuring sustainable fishing practices, and maintaining a robust fishing economy, which is a crucial foundation for fishermen. In addition to its conventional design, a floating path surrounding the net is integrated to enable ease of access for the fishermen. Additionally, fins are extended from the floating path which serve as spawning grounds for mussels. They surround the quadrat net, filtering the water, dissipating the waves, and providing a rich microenvironment. The nets are designed such that the shellfish take over in the future and they are converted into reefs.

Breakwaters

Breakwaters are engineered structures placed offshore to dissipate wave energy and protect the coastline from flooding and erosion. Along sandy coasts, in addition to their protective capacities, breakwaters possess the capacity to morph the coastline through sedimentation dynamics and the subsequent formation of a salient, where sediments are deposited and accumulated at the lee side of the breakwater, or a tombolo, formed through the extended accumulation of sediments attached to the structure. The resulting morphologies are determined by several aspects of the design of the breakwater and its placement. These parameters include the length (L) and height (H) of the breakwater, distance from the shoreline (X), and distance from adjacent breakwaters (G). The breakwaters of this project maintain this mechanism through their strategic placement along the coastline to obtain a determined morphology. The basic strategies for designing a breakwater are adopted, but they are further customized by allowing a shelf on the lee side of the structure to enable docking, and the base of the breakwater includes perforations to enable the proliferation of biogenic reefs, eventually leading to the complete disappearance of the breakwater and its transformation to a reef itself. This is done without compromising the functionality of the breakwater itself. The placement of these interventions along Beirut's coastline was determined by conducting a concise literature review that examined the diverse impacts of sedimentation in relation to the aforementioned parameters. The findings of this review are summarized in the table below. Accordingly, different forms are explored and placed on a matrix based on their extent of access in relation to sedimentation accumulation ratio.

Biogen

The Levantine basin hosts diverse shellfish species, mostly native to their original habitats. These species have adapted to their environment, highlighting the inherent potentialities and maximizing their benefits. Recognizing the importance of these species, the project aims to identify their current distribution and assess their potential for further proliferation. A critical role as a keystone species, offering a multitude of benefits. Similar to other species, they play a vital role in the ecosystem by filtering water, extracting suspended particles, phytoplankton, and organic matter from the water column. They also serve as a food source for other organisms, contributing to the overall health and biodiversity of the marine ecosystem. The project aims to restore the natural habitat of these species, providing them with a safe and secure environment to thrive. The intervention is simply composed of a hollow structure with perforations, which allows the water to flow through it, creating a natural habitat for the species. The structure is designed to be durable and resistant to the harsh conditions of the sea, ensuring its longevity. The project is a collaborative effort between the government and the private sector, aiming to create a sustainable and profitable industry that benefits the local community and the environment. The project is a testament to the power of human ingenuity and the importance of preserving our natural resources.





ic reefs

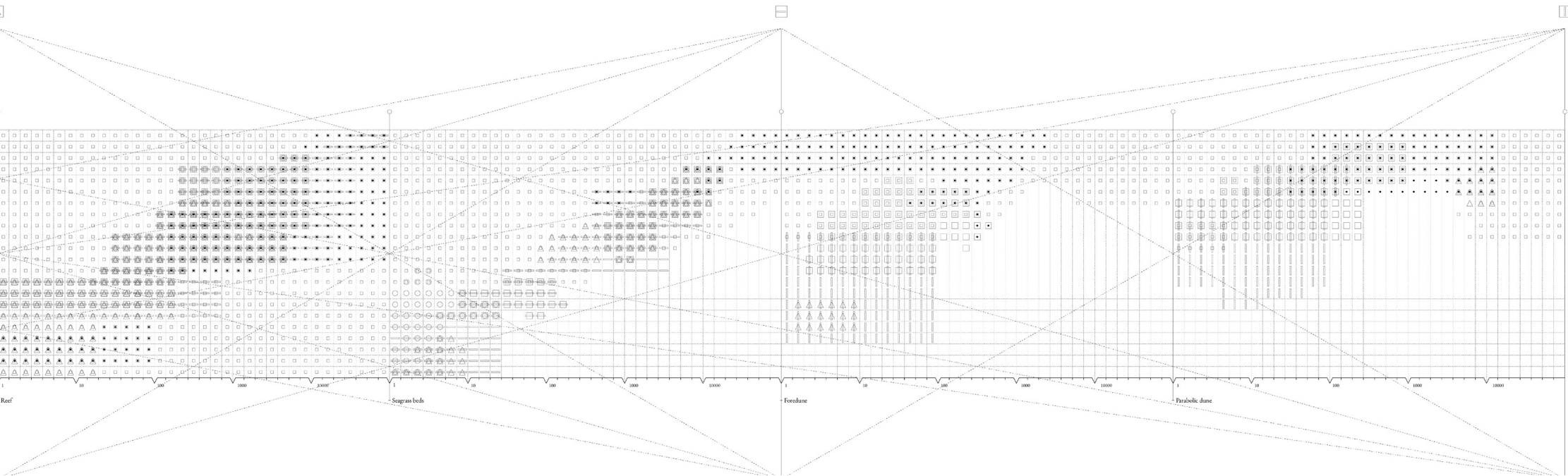
This research effort is once again aimed at shifting the narrative towards the importance of exploring this, extensive research has been undertaken to the Levantine Murex (Mytilus galloprovincialis), native to the Levantine coast, plays a filter feeder, the Mediterranean mussel is a filter feeder. As they feed, they As filter feeders, they are essential components of the nitrogen and phosphorus carbon. Additionally, their presence significantly enhances habitats as they They establish complex habitats by providing shelter, clean water, and feeding sediments and dissipate wave energy through the dense network of byssal threads to play a significant role in local economies as they have a high growth rate. This deployment of Mytilus galloprovincialis and other shellfish native to the Levantine basin, typical of an optimally constructed reef foundation. They are designed in a way ut serves as an optimal habitat for benthic fauna. Two types of vortex motions limits the dissipation of wave energy and attracts a higher diversity of benthic ally in areas which are more protected from harsh waves, and in such a way to of sperm, the fertilized eggs develop into larvae known as veligers, which spend (larval metamorphosis), they transform into juvenile murex (juv), which then between. This settlement process helps establish new mussel populations and and pods eventually disintegrate and transform completely into shellfish reefs.

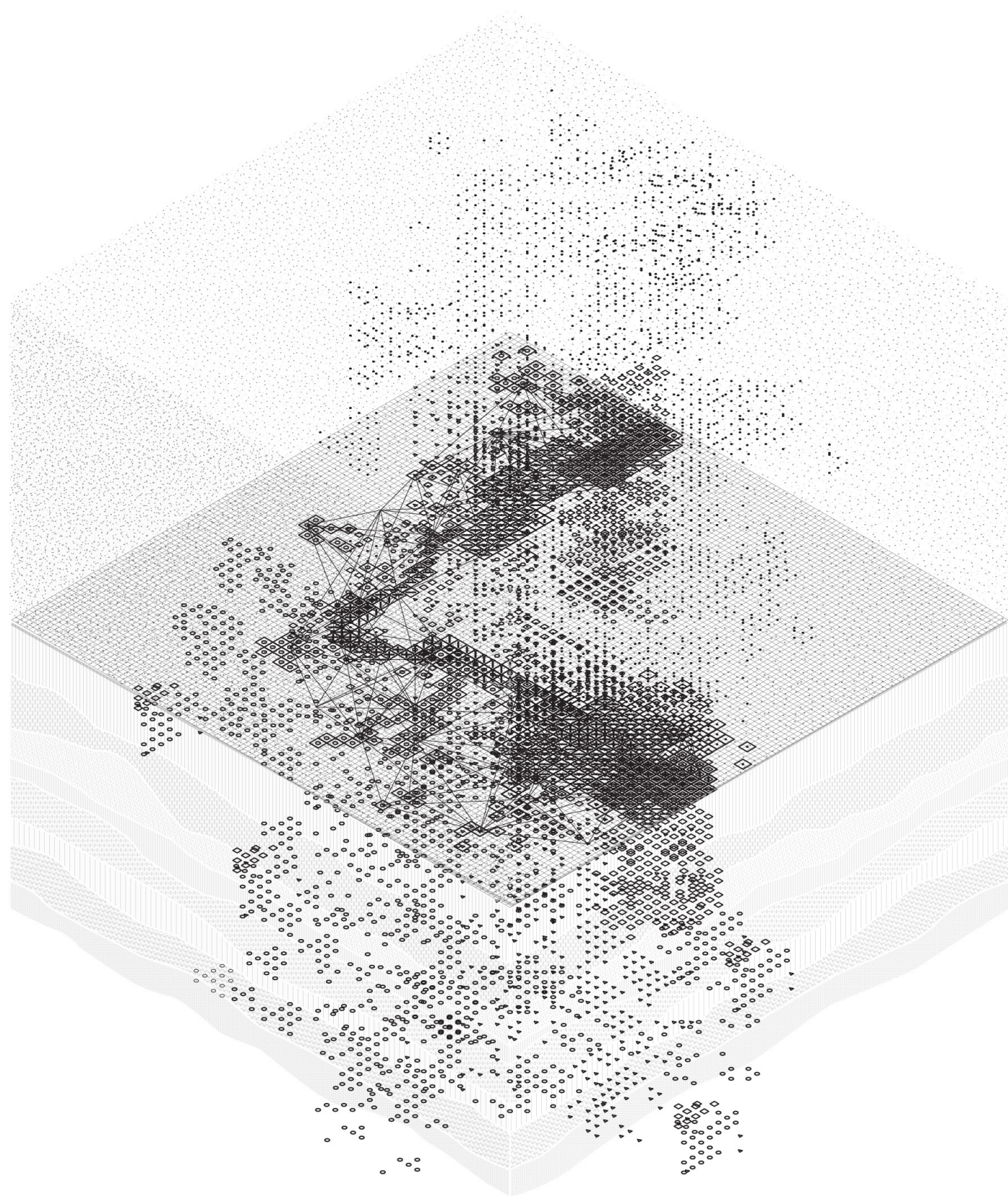
Seagrass beds

This seed intervention encompasses the growth of Neptune grass, and its eventual transplantation into seagrass beds. Neptune grass, a native species of sea-grass to Lebanon, is the primary habitat and nursery ground for the majority of the local benthic fauna. It forms dense interwoven submerged meadows offering shelter for invertebrates, feeding grounds for fish species, and nurseries control for macroalgae. Their extensive root system stabilizes sediments as their dense canopy increases friction, reducing wave and current velocity. Through their active photosynthesis, they significantly contribute to the oxygenation and carbon sequestration of the water column. This helps prevent eutrophication, and attracts endangered benthic species, primarily the Loggerhead sea turtle. This installation simply involves the placement of wooden stakes 1.5m high, 0.5m apart, connected by a monofilament of a maximum of 4 meters. The ease of this setup would enable a participatory approach, allowing the community to actively contribute to the design and establishment of its layout. Additionally, it would involve the participation of divers in the transplantation of sea-grass beds, facilitating their transformation into thriving meadows.

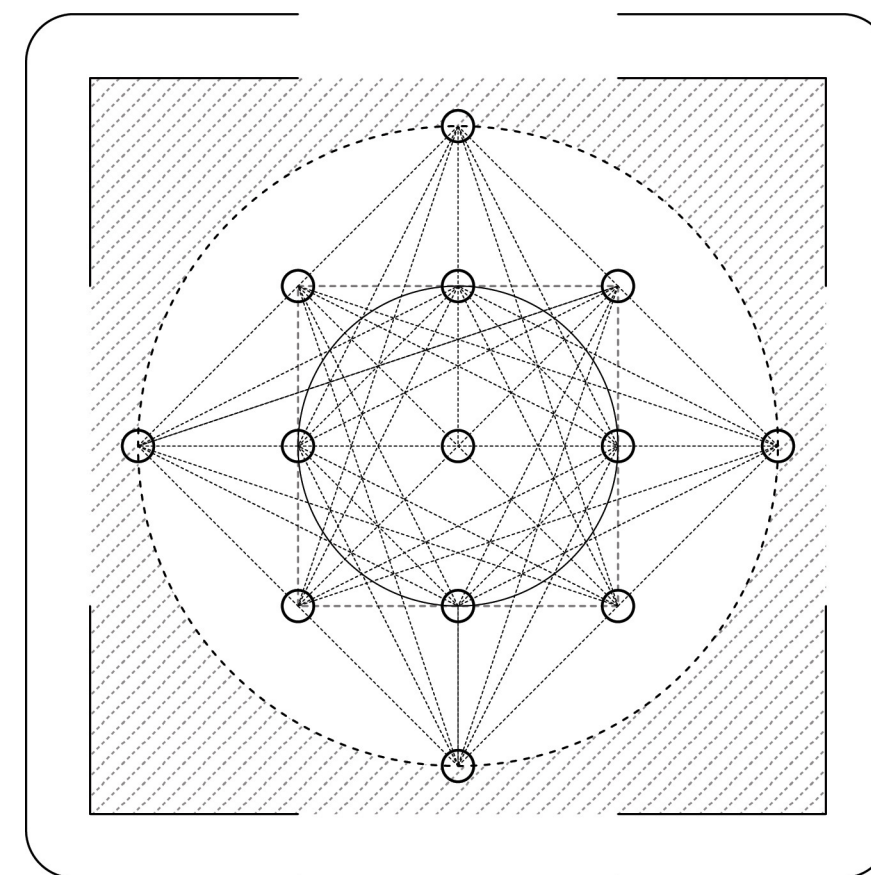
Dune fences

With the aim of capturing and accumulating sand particles, this intervention works symbiotically with offshore structures to further stabilize the shore. The poles, stacked equidistantly 0.5 meters apart, angled perpendicular to the dominant wind direction, decrease the velocity of the wind and the sand particles it carries, resulting in the deposit of sand particles at the base of the fence. This leads to sand dune formation, and together with the further planting of stabilizing dune grasses, the shoreline is reinforced and slowly increases over time, further resisting the threat of sea level rise.





Drawing 84. Seed interventions as a volume of permutations



iv. Intangible elements

As these physical changes manifest, intangible elements unfold simultaneously, revolving around economics, culture, and identity. These morphological changes firstly introduce accessible coastal space, reestablishing the long-lost connection with the sea. That alone reinvigorates economies revolving around fishing which are slowly dying out due to the lack of accessible coastal space and severe pollution. To bring this project to life, it will require a participatory effort revolving around stewardship. The neighborhood actively assumes agency in championing the process of manufacturing and maintaining the proposed structures. Its proper management will lead to an allocation of jobs in the industries of mussel harvesting, sea grass farming, and offshore fish aquaculture, where revenues feed back into the maintenance and improvement of these systems. Memory and heritage are handled with care through the preservation of certain elements in the coastal landscape, both natural and artificial, such as the vermetid reefs and grain silos.

I.	Introduction
II.	Research question
III.	Methodology
IV.	Literature Review
V.	Assessment
VI.	Revised Progression
VII.	The Canvas
VIII.	Conclusion
IX.	Bibliography
X.	Appendix



VIII. Conclusion

i. Closing

Rather than providing a definitive solution, this thesis offers an approach that harbors the tools and philosophies required to design a viable one. It circumnavigates the obstacles of corruption through its humble acknowledgment of immutable barriers. Through this, it avoids fruitless endeavors, and channels focus on what can be changed. Despite the outcome potentially deviating from the ideal or requiring compromise, the key lies in its feasibility, ensuring that it remains a viable possibility. It looks to the fusion of science and spatial planning to preserve the integrity of the coast and its people.

The culmination of this degree marks merely the beginning of comprehending the intricate permutations that shape coastlines of conflict. This study will persistently carry on.

ii. Reflection

1. What is the relation between the graduation project topic, the Urbanism master track, and the master programme?

This thesis delves into the intersection of the coastal morphodynamics of an obliterated coastline and the simultaneous challenges of acute geo-political conflict and social injustice. While traditionally belonging to the separate realms of earth and social sciences, the intersection of these topics presents challenges that can be effectively addressed through the discipline of Urban Design. By undertaking this project, my aim is to harness the essence of Urban Design, utilizing its inherent characteristics to integrate diverse fields and effectively address extreme situations.

The guiding principles of my project draw heavily from the master track of Urbanism, particularly emphasized in the Transitional Territories studio. These principles serve as a compass for addressing the fragility and risks embedded within a coastal landscape. Such tenets include the emphasis on the agency of urban design as an interface between accelerated anthropic repercussions and an exponentially deteriorating natural realm. This principle underscores the profound ability of urban design to effectively communicate and navigate the complexities in this dichotomy.

Throughout the different studios I took part in within the Urbanism track, themes continuously evolved, yet one aspect remained constant: the paramount significance of carefully selecting a lens through which the project would be evaluated and designed. This aspect was especially amplified throughout my thesis project, as the decision to adopt a lens which comprehended the morphology of the littoral landscape as a permutation of natural and anthropogenic mutations would profoundly shape the entire project and its premise.

2. How did your research influence your design/recommendations and how did the design/recommendations influence your research?

The relationship between research and design in this project can be characterized as a cyclical and iterative process. Research informed the design decisions, and in turn, the design influenced further research directions. However, it is important to note that in this context, the term “design” does not solely refer to spatial design. As previously mentioned, the true essence of design lay in the approach and lens that I crafted, and the design proposed is but one of the multiple forms of materializing the possible unfolding relationships which lead to this landscape. To accomplish this, a synergistic combination of various disciplines, methodologies, and perspectives was necessary. As an example, my argument states that it is imperative to assess permutations of forces resulted in the deep research of these subsequent fields. The particular focus and research on coastal geomorphology led to my design interventions highly incorporating technical principles intrinsic to the field of coastal engineering. This in turn provoked further research in more specific fields, such as (and not limited

to) the mechanisms and design engineering of breakwaters, the specific life cycles of benthic flora and fauna, nutrient cycles in aquatic environments, and most importantly, coastal morphodynamics. I believe that this project is still missing the continuum which research-by-design entails due to time constraints. Additional cycles of refining, researching, and reflecting are necessary for more grounded and informed conclusions.

3. How do you assess the value of your way of working (your approach, your used methods, used methodology)?

A reflection on the methodology

In the analytical phase, I presented a comprehensive approach to assess and decipher the context at hand. This involved delving into and selecting a range of pertinent themes, developing an innovative method for cartographic representation, and employing suitable tools to navigate the challenges posed by the scarcity of data. Notably, the cartographic representation successfully managed to depict multiple layers of information concurrently, while ensuring each layer retained its distinct clarity. This occurred through the establishment of an elaborate notation system that permeated the analytical cartographies. The analysis of drone footage proved invaluable in identifying diverse physical characteristics that were otherwise inaccessible to capture on a human scale. It allowed me to grasp the intricacies of relational spaces and uncovering hidden mechanisms and patterns of spatial behavior that would have otherwise remained concealed. I acknowledge that the methodology could have been enhanced through the inclusion of a more extensive collection of qualitative data, specifically ethnographic data on perception and testimonies. It would have also been of great value to spend more time on theoretical readings and concepts which could have potentially strengthened the foundation of the project. Project limitations

As it has been established throughout this thesis, Lebanon is crippled from extreme political corruption which has been accumulating for centuries. Despite my attempt to circumnavigate this corruption as part of my project goals, this entails a myriad of limitations. Foremost among them is the scarcity of accurate and objective data, encompassing qualitative and quantitative information, as well as maps, historical records, events, and even footage. Obtaining such data is exceedingly challenging, if not nearly impossible.

It was part of the project to overcome the limited amount of available data, through the utilization of methods such as manual delineation, drone footage, and further speculations, nevertheless, accurate data is indispensable, especially in the technicalities of coastal engineering. The marine data obtained was through global databases of low resolution, severely impeding its accuracy. I based my design proposals on this data set, assuming its accuracy for the purposes of this project. However, should this surpass a theoretical proposal, it would be imperative to acquire more precise and reliable data obtained through location-based sensors and radars.

During my scheduled site visit, one notable limitation that strongly manifested itself was the pervasive political and environmental instability. Major earthquakes occurred with their epicenters in the neighboring countries of Turkey and Syria. Although Lebanon experienced very minimal destruction compared to the devastation

in Turkey and Syria, there was an underlying state of panic from the fear of a similar event occurring with its epicenter in the north of Lebanon, exacerbated by circulating rumors. The earthquake registered 6.3 on the Richter scale in Lebanon, I was woken up at 4 am in a state of complete panic, instinctually thinking it was a bomb, as the sensation of the ground moving felt identical to what happened during the August 4 explosion in 2020. Despite these limitations, this experience confirmed the relevance of the premise of my project, as I argue that it is indeed the concurrence of these events leading to general state of chaos which has to be assessed and designed for, and not their consideration in isolation.

4. How do you assess the academic and societal value, scope, and implication of your graduation project, including ethical aspects?

Ethical dilemmas and project shortcomings

An ethical dilemma, perhaps one that could even qualify as a shortcoming, stems from the pervasive social class segregation in Lebanon. Unfortunately, this segregation extends not only across economic classes among Lebanese nationals, but also across different nationalities, particularly those resulting from haphazard migration. The spaces of violation that I address along the coastline (such as the public beach with sewage outflows or the informal settlement) are predominantly occupied by refugees and low-income Lebanese citizens. The ethical dilemma here is that the project fails to address how these new spaces that I am introducing will incorporate and overcome this pertinent segregation. It is a matter of highly intertwined concerns which I found difficult to address in the short duration of this project. It would require an alternative approach, one that is ethnographically centered and heavily based on site interviews and interactions, which unfortunately, I did not have the time or resources to perform. The approach of prioritizing underprivileged communities in itself sparks controversy, as it is not a universally shared value in Lebanon.

The dilemma of how to address sites of major catastrophe arose while I was assessing Beirut port; the site of the August 4 explosion in 2020. I grappled with questions such as whether to demolish a painful memory (what remained of the silo structure), or alternatively, should the site be preserved to honor its memory, even if it means leaving the structure obsolete. I opted for the latter; although I acknowledge that this decision, made by myself alone, raises ethical concerns. While I experienced the explosion firsthand and felt its impact deeply, I recognize that my perspective is subjective. To make a more informed decision, it would have been valuable to gather the collective opinions of a wider range of individuals, particularly residents of the neighborhood adjacent to the explosion site.

In search for answers for dissecting the relationship between territory and the pivotal forces that shape it, my graduation project attempted to establish a position on the ethical considerations required when vulnerable communities are involved in confluence with vulnerable landscapes. The premise of the project focused on attaining a middle ground where both aspects are equally considered and addressed. However, it would have been interesting to attempt to answer the difficult question of: if it came down to it, who do we address first? The landscape? the people? The locals? The refugees? Who (if) do we prioritize?

Scientific, social, and professional relevance

The scientific relevance of my graduation work includes the deep incorporation of various scientific fields with the discipline of urbanism. Throughout the assessment of my context, I conducted a literature review on writings encompassing different scientific studies addressing the Lebanese coastline's physical condition. This resulted in the collection of multidisciplinary literature, such as writings on marine geology and biodiversity, tectonic geomorphology, natural disasters, environmental pollution, hydrology, and coastal morphodynamics. There exists an abundance of individual diverse studies assessing specific phenomena occurring on the coast, my research contributes by creating a fusion of said studies and synthesizing them into unified conclusions relevant to the field of urbanism. The design phase required a deep understanding of consciousness coastal engineering and dynamics, displaying the value of attaining such technical knowledge as a designer.

Concerning its social relevance, my graduation project directly addresses quality of life and space, and the limitations of an abundance of convoluted politics, shedding light on spatial injustices and violations. It prioritizes vulnerable communities' right to public space, specifically, the coast.

In terms of its relation to the professional scope, my thesis project proposes a specific approach to address, assess, and design areas of extreme conflict. This proposed method suggests the requirement of a high level of interdisciplinarity and flexibility, adopting to the specificities of the context at hand as a planner. The approach adopted carefully navigates through the paradigm shifts which the discipline of urban design and planning underwent, translating them into the proposed approach through which I advocate for in this project. Ultimately, the research hypothesizes certain tools and approaches which could potentially be utilized in the professional sphere when dealing with conflicted sites. The project lays responsibilities on the planner which extend far beyond the realm of urbanism, displaying the reach that such a professional could attain in the fields of ecology, economics, and even politics.

5. How do you assess the value of the transferability of your project results?

One of the main objectives of this project is to ensure its transferability. Although the design proposal constitutes one of the final outcomes, it merely serves as an exemplification rather than the main focus. The project's essence lay in the proposed approach, rendering the findings I presented relevant and applicable to any professionals of spatial design and coastal engineering working in conflicted littoral zones. This is applied in terms of the more abstract ideas, but also true in certain practicalities, such as the graphical notation system or the significance of drone footage. The extracted and synthesized research data presented here is valuable and applicable to any student or professional interested in the topic. This compilation, which was challenging to assemble and is not readily accessible elsewhere, provides an effective resource for those seeking comprehensive information on the subject matter.

6. What are some exclusions you intentionally left out?

Certain aspects were intentionally excluded in order to be able to maintain focus on the premise of the project in the limited amount of time and resources available. Such aspects include an in-depth economical

and functional cost benefit analysis. I propose alternative spatial models to highly functional and critical landscapes, such as the airport and the capital’s main port. To be done accurately, this requires a meticulous cost benefit analysis which this project omits. It takes into consideration that the proposal is able to present a spatial model for whatever optimal scenario is presented through the cost benefit analysis.

Another aspect excluded is the intricacies of the internal urban fabric. The project focuses on the littoral landscape and the first line of the urban fabric adjacent to it. I address the lack of public space within the city, and take into consideration the major circulation routes, but the specificities of the urban fabric are temporarily set aside.

7. How did the fieldwork affect the project and alter your perception?

Having spent the majority of my life in Lebanon, my most recent visit focused on the field work phase of this project proved to be an incredibly valuable encounter. While the earthquake and protests undoubtedly heightened the intensity of the experience, they also provided invaluable insights into the site, reinforcing the significance and urgency of my proposal. This visit allowed me to perceive certain aspects (both positive and negative) of the coastline that I had previously overlooked, as they were considered part of the familiar landscape. Returning to Lebanon with this particular lens revealed the stark reality that the challenges I had initially depicted were even more severe than I had portrayed. The extent of inaccessibility and physical degradation along the coast became strikingly evident. Equally notable was the significant level of visual inaccessibility, often completely unnecessary.

8. What are some future avenues which you envision for the project?

One potential future direction involves conducting a more in-depth examination into the viability of the seed interventions I am proposing. This investigation would entail studying the neighboring markets and assessing the availability of materials, as well as re imagining the interventions based on the resources and skills accessible in each specific location. The proposal would initially begin with a compromised yet feasible version of the intervention, outlining its compromised effectiveness, while also anticipating its eventual progression towards the optimal version I have put forth.

I. Introduction

II. Research question

III. Methodology

IV. Literature Review

V. Assessment

VI. Revised Progression

VII. The Canvas

VIII. Conclusion

IX. Bibliography

X. Appendix

X. Bibliography

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I. Introduction

II. Research question

III. Methodology

IV. Literature Review

V. Assessment

VI. Revised Progression

VII. The Canvas

VIII. Conclusion

IX. Bibliography

X. Appendix

