REVIVING A DYING DELTA

Cultivating Human and More-Than-Human Synergy in the Indus Delta through Networks of Care

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Reviving A Dying Delta:
Cultivating Human and More-Than-Human Synergy in the Indus Delta through Networks of Care

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*”It’s quite simple, really. If the **green turtle is affected**, or the **egret is affected**, or if the **mangroves are affected**, or if the **crab is affected**, then **we don’t want such development**.”*

Arif Hasan (Omar, 2016)

Figure 1: A view of Karachi and its adjacent mangroves, Source: (Omar, 2015)

Acknowledgements

This thesis would not have been possible without the support of my friends and family. I'm especially grateful to Saad, whose unwavering encouragement and love gave me the strength to keep going. To my parents, for their constant curiosity and deep engagement with my work – and to my brother, Faiz, without whom this opportunity would not have been possible.

I'm also deeply thankful to my mentors, Luca and Anne Loes, for grounding me when needed, pushing me when it mattered, and guiding me with honesty, clarity, and care throughout this journey.

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A heartfelt thank you to the residents of Rehri Goth, especially Shah Mehran, whose deep knowledge of the Indus Delta and generous spirit opened countless doors. Through him, I met Mubarak Ali, who led me to the residents of Khuddi Creek, and Daniyal Samoo, who introduced me to Keti Bandar – each encounter weaving a web of hospitality, openness, and extraordinary cooperation. Your generosity shaped this project in ways words cannot fully express.

Table of Contents

Abstract

This thesis investigates the socio-ecological degradation of the Indus Delta – particularly its mangrove ecosystems – caused by upstream freshwater loss, coastal urbanization, and extractive economic activity. Situated at the intersection of the Karachi metropolis and the agricultural landscapes of Sindh, the project combines research and design to examine and reimagine the interdependencies between communities, ecologies, and governance systems. Drawing on field observations, informal interviews, critical mapping, and systemic analysis, the study traces both localized practices and broader structural forces that shape the delta.

The research culminates in a spatial strategy structured around three networks of care: preservation, production, and recreation. These interlinked strategies aim to restore ecological balance, support adaptive livelihoods, and build synergies between human and more-than-human actors. Envisioning a gradual inland-to-sea transition in land uses that respond to salinity, biodiversity, and socio-economic needs, the project offers a replicable model for climate-adaptive coastal urbanism rooted in situated knowledge, collaboration and care.

Keywords: Indus Delta, mangrove regeneration, freshwater scarcity, anthropogenic pressures, socio-ecological interdependencies, networks of care, deltaic livelihoods, human–more-than-human collaboration, climate-adaptive land use

Figure 2:

A crab hunter returning from a night of collecting mud crabs from nearby mangrove forests. About 90% of Indus Delta's fishing villages rely on fisheries as a source of income (Shahid, 2013).

Figure 3: A view of mangrove islands of the Indus delta from the expanding reclaimed coast of Karachi.

1.1 Motivation

In 2022, Pakistan experienced catastrophic floods that submerged a third of the country (Pakistan Floods: Post-Disaster Needs Assessment, 2022). Rural areas in Sindh were particularly devastated, with relief efforts struggling to reach many of the affected regions. In trying to understand the deeper causes behind such disasters, I came across an article by Pakistani urbanist Arif Hasan, who linked the increasing frequency of both coastal and urban flooding to the deforestation of mangroves in the Indus Delta (Hasan, 2006). This insight became the starting point of my thesis.

As someone born and raised in Karachi – adjacent to the delta – I was struck by how little I knew about the region and its mangrove ecosystems. Despite living in such close proximity, the delta had remained invisible to me. During my research, I found it repeatedly described by various news articles as a “dying” landscape. The Indus River, now heavily dammed and diverted upstream, reaches the Arabian Sea at just 20% of its historical flow (Ahmed & Kidwai, 2024). As a result, the delta has already lost 92% of its original surface area (Ali Siyal, 2018), putting both ecological and human communities at severe risk.

This thesis became a journey to understand the delta not only as an endangered landscape but also as a space of potential care, adaptation, and cohabitation – where both human and more-than-human actors might play a role in shaping its future.

Figure 4:

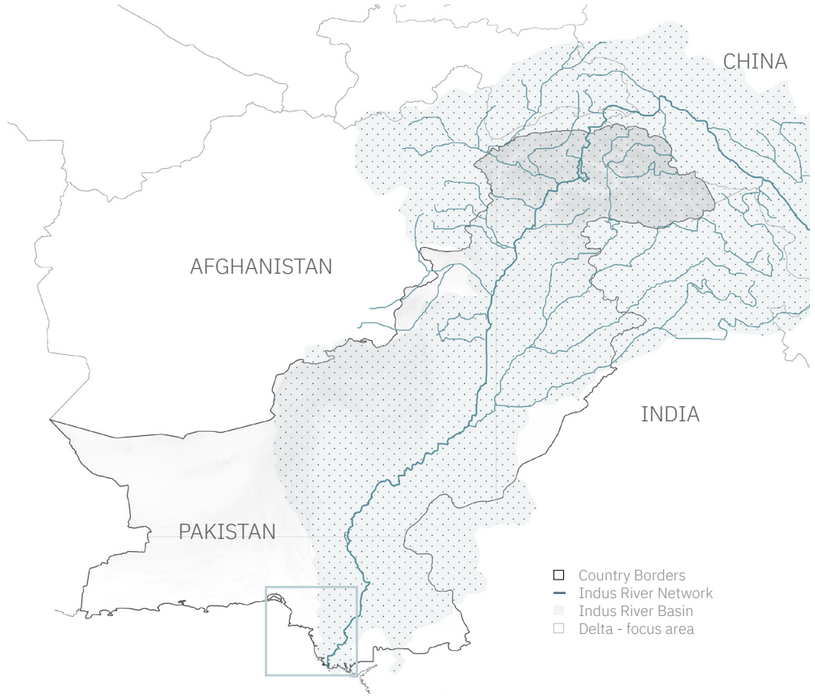
Screenshots of news articles from 2012 to 2025 that highlight the decline of the Indus Delta and protests against future canal projects.

Source: Google Search

What is the Indus Delta?

Figure 5: View of Avicennia Marina Mangroves in the Indus Delta.

1.2 What is the Indus Delta?



The Indus Delta is the southernmost point of the Indus River Basin, where the river meets the Arabian Sea after traveling across multiple countries, including China, India, and Pakistan. Its formation is deeply dependent on the flow of freshwater and sediment from upstream. This delta is not only the world's 5th largest delta, but also a critical ecological and socio-economic zone (Indus Delta, Pakistan | WWF, n.d.).

This delta hosts the 7th largest mangrove ecosystem, which is also the largest arid climate mangrove forest, in the world (Mangrove Forests of the Indus Delta, n.d.).

Figure 6 (top):

The Indus Basin emerges from Afghanistan, China, India and Nepal, converging in Pakistan as the Indus River and eventually draining into the Arabian Sea.

Source: World Bank, OSM

Figure 7(right):

Google Earth Satellite view of the adjacency of the Indus Delta with the city of Karachi.

1.2 What is the Indus Delta?

The Indus Delta is more than a geographic feature – it's a dynamic zone where natural systems and human activities like agriculture, fishing, and trade intersect. Located next to Karachi, it connects ecological, rural, and urban landscapes. Its future depends on the continued flow of freshwater from upstream, making water management a key concern.

Various stakeholders have different layers of relationships with the delta. The agriculture industry of Sindh province supports the livelihood of farmers, feeds the residents of the region and earns 23% of the agricultural contribution to the GDP of Pakistan (The World Bank, 2022). The fishing industry also functions locally and globally, supplying seafood products to the UK, Europe and the Middle East. Karachi is also home to the two largest ports of the country, that is, the Bin Qasim Port and Karachi Port. These, along with supporting industries, fishing villages and an expanding residential fabric, form the main coastal front of Karachi. The activities of all these typologies and related stakeholders have a direct or indirect impact on the well-being of the delta.

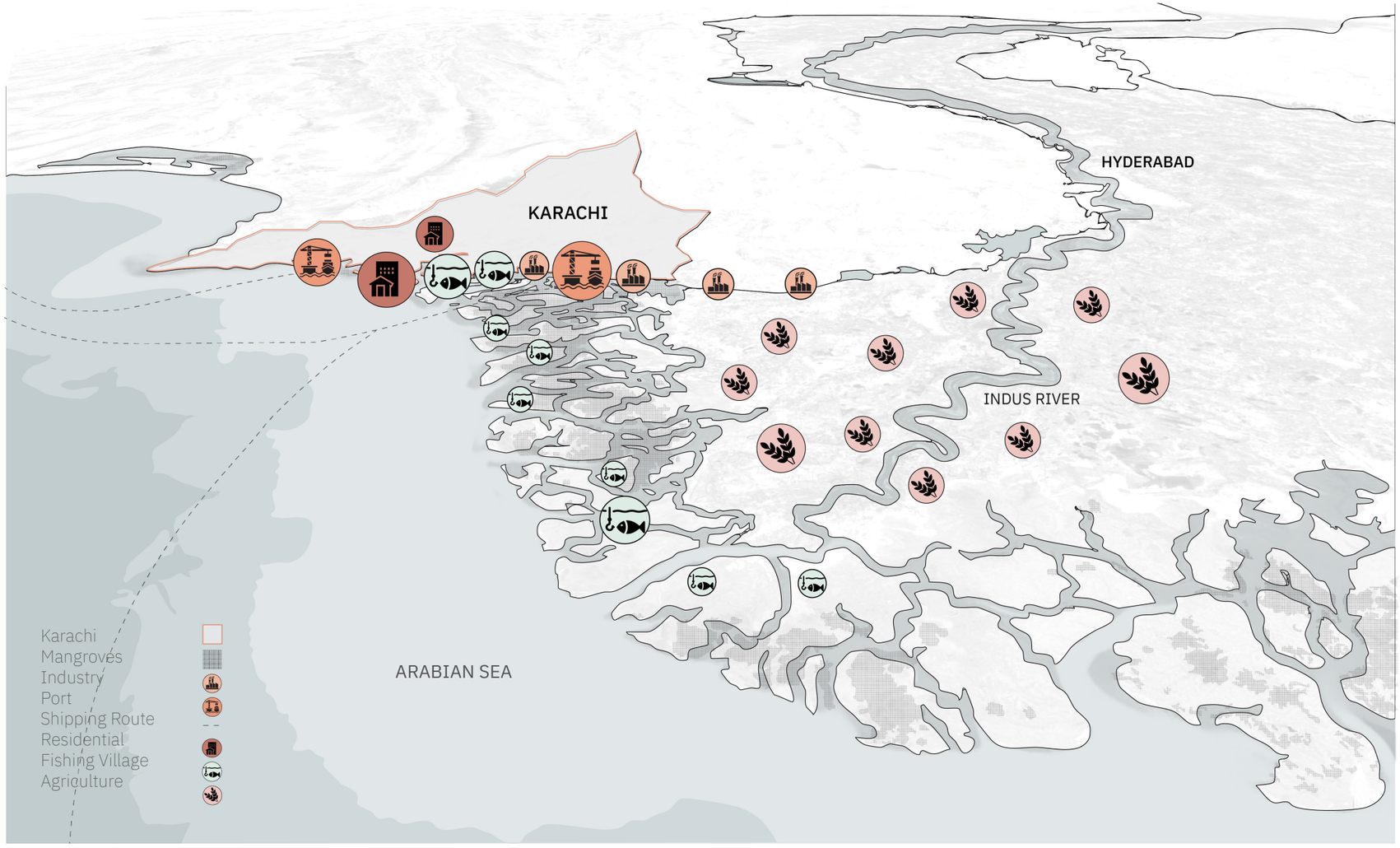


Figure 8:

Typologies dependent on the Indus Delta.
Source: (Potapov et al., 2022), (GEBCO, n.d.)

1.2 What is the Indus Delta?

The Indus Delta reflects the extractive relationship between humans and other systems, such as water, soil and coastal habitats. Practices such as mangrove deforestation, land reclamation, industrial fishing and poor waste management have caused severe damage to the delta's fragile ecology. Mangrove forests, which were once vital buffers and breeding grounds, remain excluded from formal planning and are treated as peripheral wastelands.

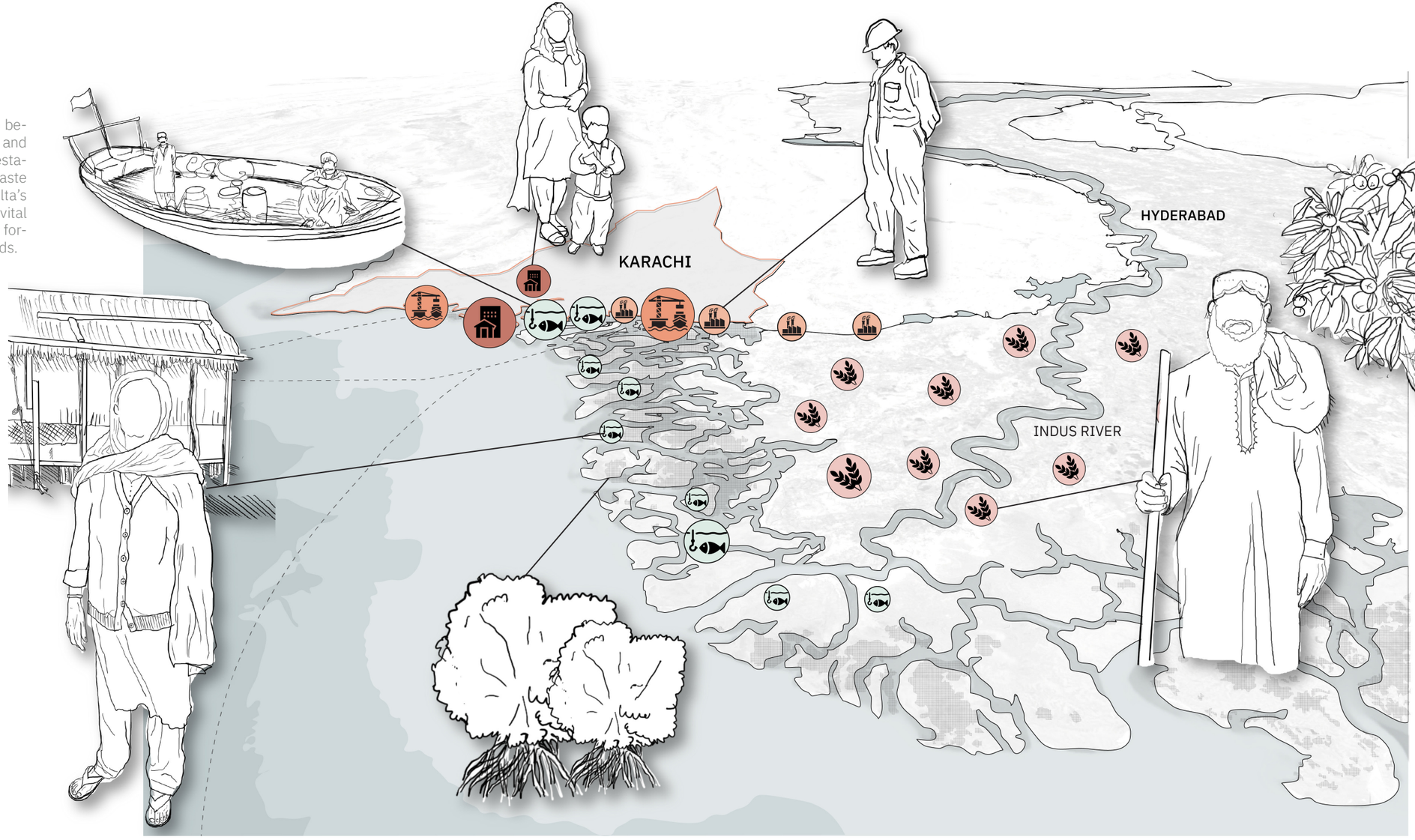
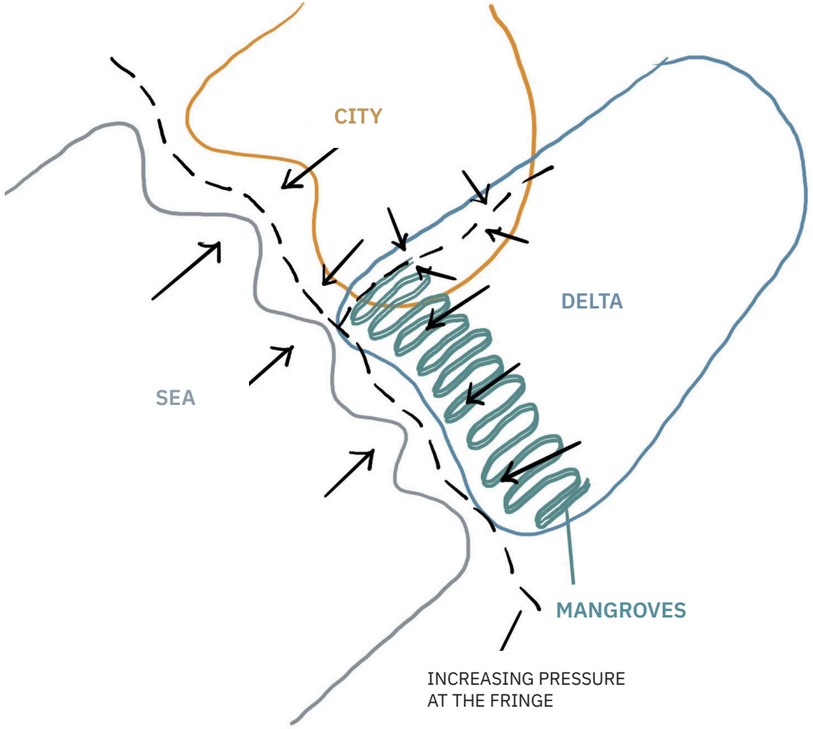


Figure 9:

Stakeholders dependent on the Indus Delta.
Source: (Potapov et al., 2022), (GEBCO, n.d.)

1.2 What is the Indus Delta?



The Indus Delta Mangroves are thus located at the critical intersection of a densely populated, expanding city; a rising sea; and a delta starved of freshwater. This results in increasing pressure at the point where these three systems meet. This project recognizes that any intervention for the well-being of the mangrove forests would need to consider the above interacting systems.

Figure 10:

Diagram showing how the expanding city of Karachi and the rising Arabian Sea all create an increasing pressure at the Indus Delta, particularly where the mangrove forests lie.

Figure 11: Polluted water resulting in stunted mangrove growth in Clifton Urban Forest, Karachi.

1.3 External Pressures on the Indus Delta

The Indus Delta is under threat because of various anthropogenic reasons exacerbated by climate change uncertainties. The following three can be summarised as the main external pressures that the delta faces:

Source: Google Earth Satellite

Freshwater Scarcity and Sediment Disruption

Sea Level Rise and Salinisation

Urban Densification

1.3.1 Freshwater Scarcity and Sediment Disruption

River Mismanagement and Hydro-politics

One of the major reasons for the decline of the Indus Delta is Pakistan's extensive dammification of the Indus River. This is in large part due to the country's dependence on the agricultural industry. More than 65% of exports from the country are directly or indirectly related to agriculture (Food and Agriculture Organization of the United Nations, n.d.), resulting in a mass demand for irrigated land. This also attracts settlements and it can be seen that majority of the country's settlements are around the river system. The density of these populations can be seen, with Karachi having the highest due to its strategic connection to the Arabian Sea. Thus, the two largest ports of the country, Bin Qasim Port and Karachi Port are both located adjacent to the Indus Delta and its mangrove forests. This proximity puts the mangrove ecosystems in further threat.

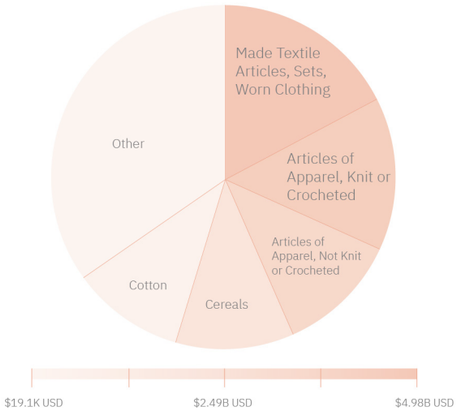


Figure 12 (left):

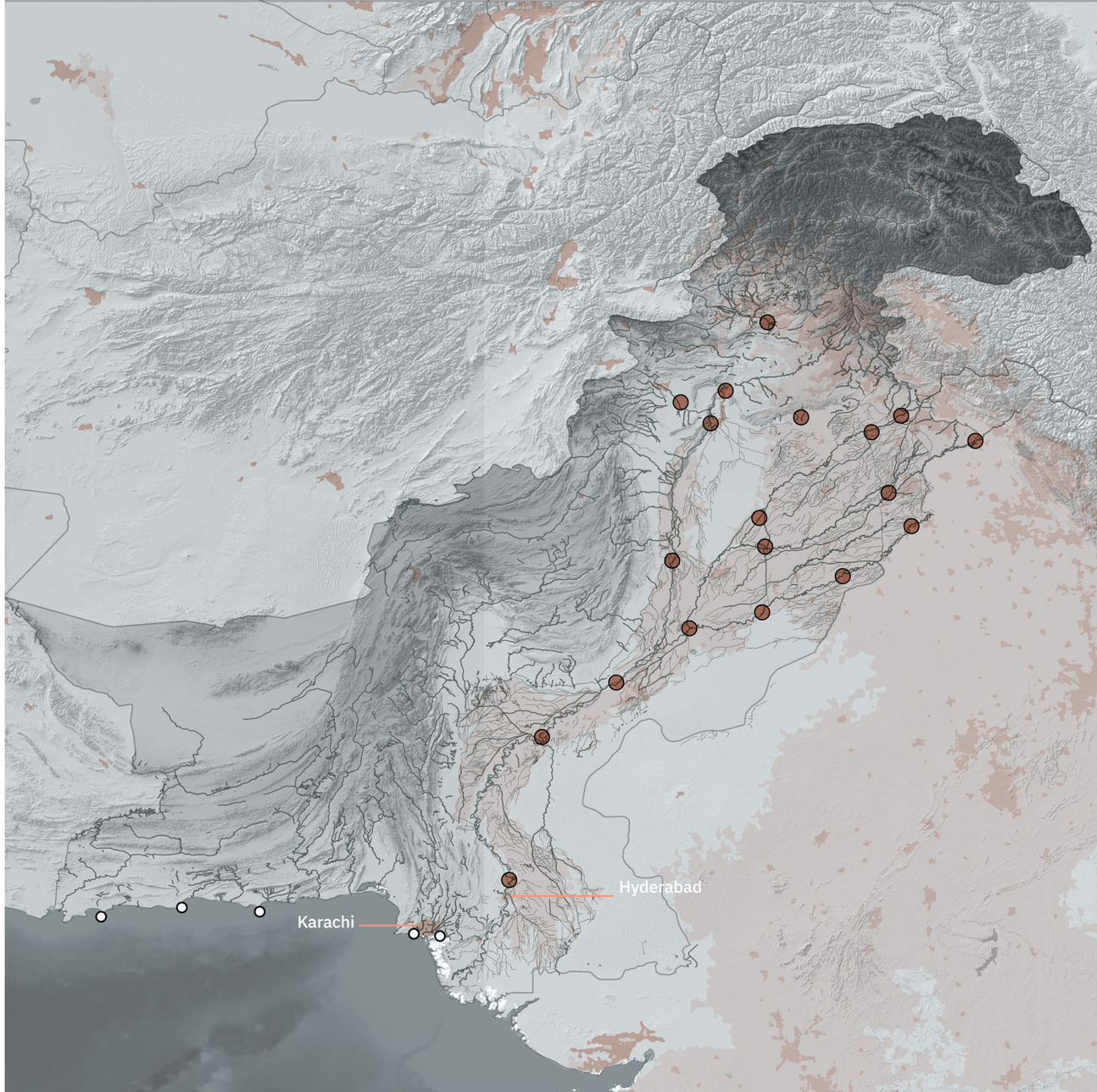
Top 5 exports of Pakistan that account for more than 65% of the country's GDP are directly or indirectly derived from agriculture.

Source: (Pakistan at a Glance | FAO in Pakistan | Food and Agriculture Organization of the United Nations, n.d.)

Figure 13 (right):

Map of Pakistan showing concentration of dams and barrages upstream in the Indus River.

(Source: OSM, GEBCO, GHSL)



1.3.1 Freshwater Scarcity and Sediment Disruption

Increased Flood Risk

With most of the country's settlements located along the Indus River network, the increasing control and manipulation of this system has reduced the river's natural capacity to retain excess water and discharge into the Arabian Sea. As a result, communities situated along the river and within the delta are becoming increasingly vulnerable to flooding, particularly during the monsoon season (June–September).

In 2010 and again in 2022, Pakistan experienced the two most devastating floods in its history—the latter submerging one-third of the country. These events have significantly contributed to internal migration, as vulnerable populations are forced to relocate from rural areas to relatively safer urban centres (Pakistan Displacement Data, n.d.). This climate-induced displacement is also visible in the Indus Delta, where growing numbers of families are moving to cities like Karachi in search of safer living conditions and better livelihood opportunities. However, this continuous influx of rural migrants places additional pressure on an already overpopulated metropolis of 17.6 million people.

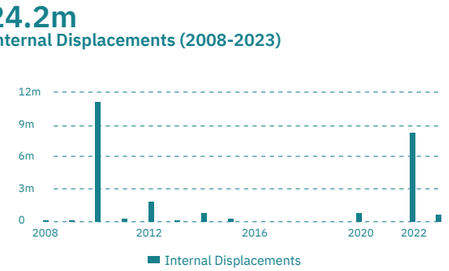


Figure 14 (left):

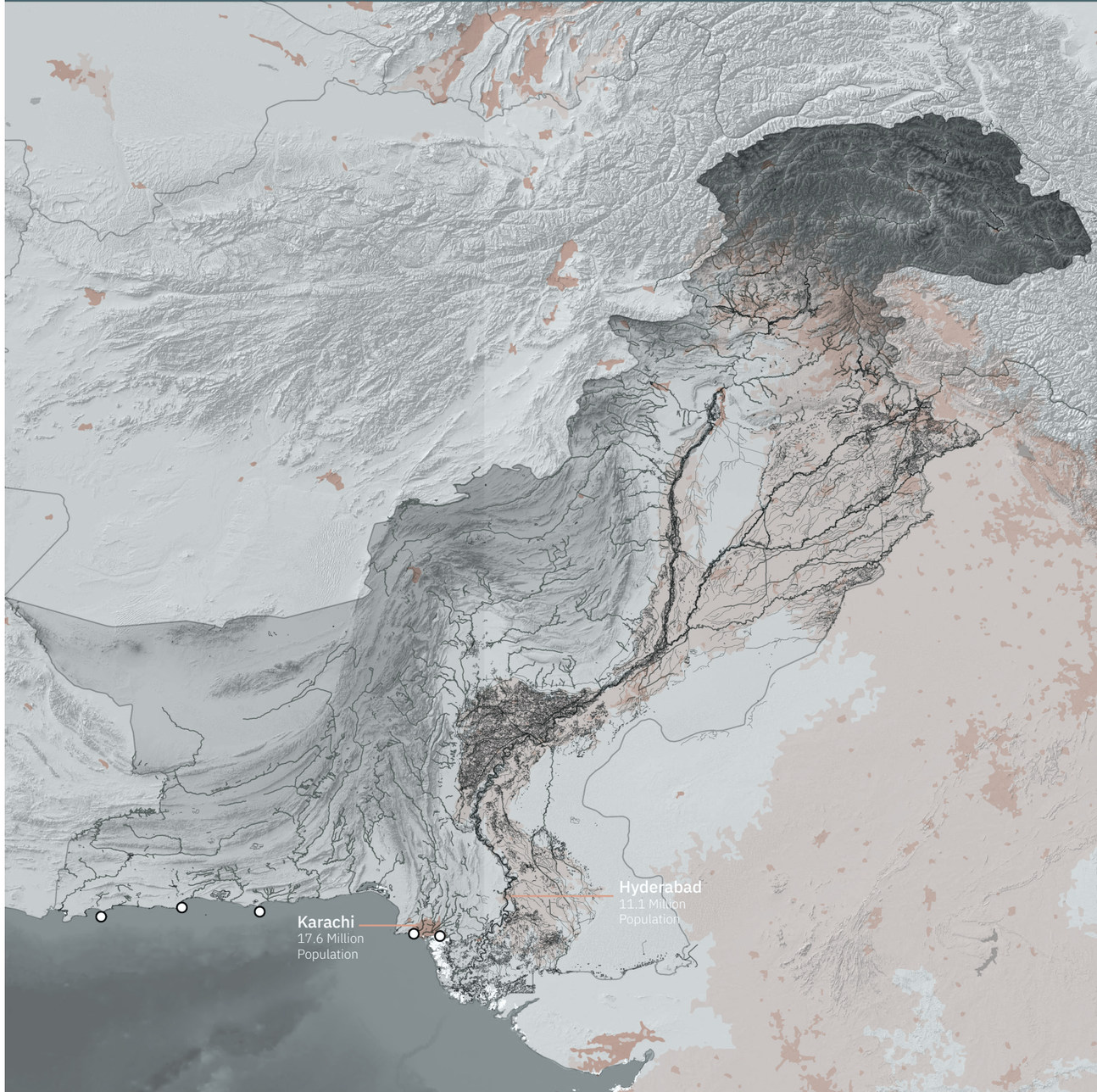
Graph showing frequency of internal displacement of people in Pakistan due to floods in the last 15 years, with highest peaks in 2010 and 2022.

Source: (Pakistan Displacement Data, n.d.)

Figure 15 (right):

Map of Pakistan showing concentration of population and associated flood risk.

(Source: OSM, GEBCO, GHSL, UNOSAT Flood Extent)



1.3.2 Sea Level Rise and Salinisation

Saltwater Intrusion

The Indus Delta received 80% less freshwater in 2015 than it did in 1955, from Kotri Barrage to the Arabian Sea as shown. This declining trend has made it possible for the sea to push its way inland, as the river retreats. The saltwater from the sea moves into freshwater systems, through aquifers, surface water bodies and soils (Sea Water Intrusion | UNDRR, 2023). This challenge is exacerbated by over-extraction of freshwater for agriculture, industries and drinking.

In addition, climate change uncertainties such as the increased probability of cyclones and storm surges has also made the delta more vulnerable to saltwater intrusion (Xiao et al., 2019).

Salinisation

This intrusion leads to increased salinity in soil, groundwater, and surface water, which harms agriculture (as many crops cannot tolerate high salinity), disrupts mangrove ecosystems, and makes water unfit for drinking. In the Indus Delta, seawater intrusion has turned 2.2 million acres of fertile agricultural land into unproductive salt flats (Hayat, 2019). In coastal districts like Thatta, Sujawal, and Badin – once rice- and wheat-growing heartlands – 90% of farms have been abandoned or shifted to salt-tolerant, low-yield crops (Soomro & Ghani, 2025).

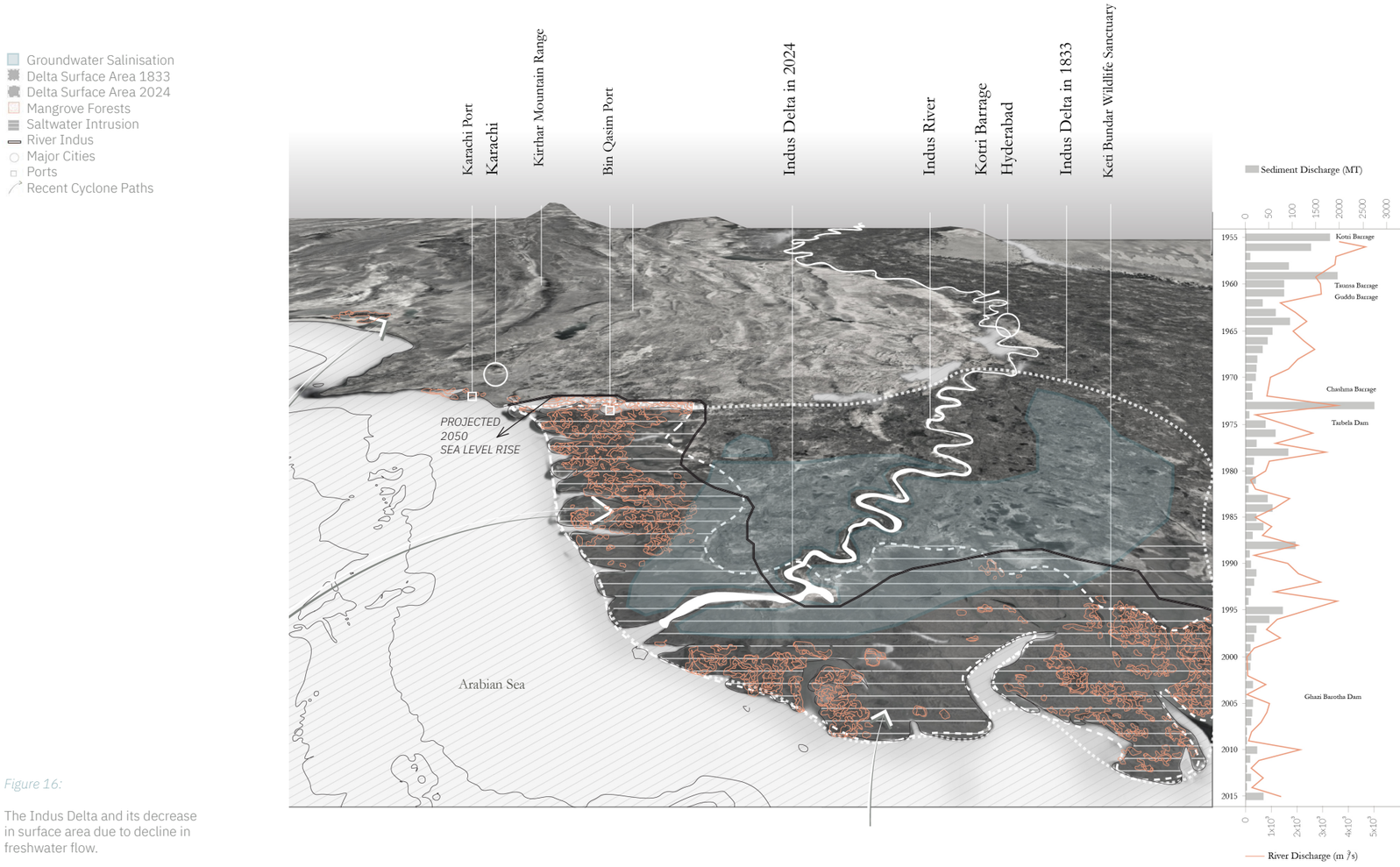


Figure 16:

The Indus Delta and its decrease in surface area due to decline in freshwater flow.

Source: Google Earth Pro, (Climate Central | Land Projected to Be below Annual Flood Level in 2050, n.d.), (Global Mangrove Watch, n.d.), (Qureshi, 2009)

1.3.3 Urban Densification

Rural to Urban Migration

Rural to urban migration in the Indus Delta is deeply tied to the region's ecological decline and increasing vulnerability to climate-induced hazards. As mangrove degradation, declining fisheries, soil salinization, and recurrent flooding undermine traditional livelihoods, many families are forced to leave their villages and move towards urban centers like Karachi in search of economic stability and safety. This continuous migration adds further pressure to an already overstretched metropolis, while also eroding the socio-ecological fabric of delta communities.

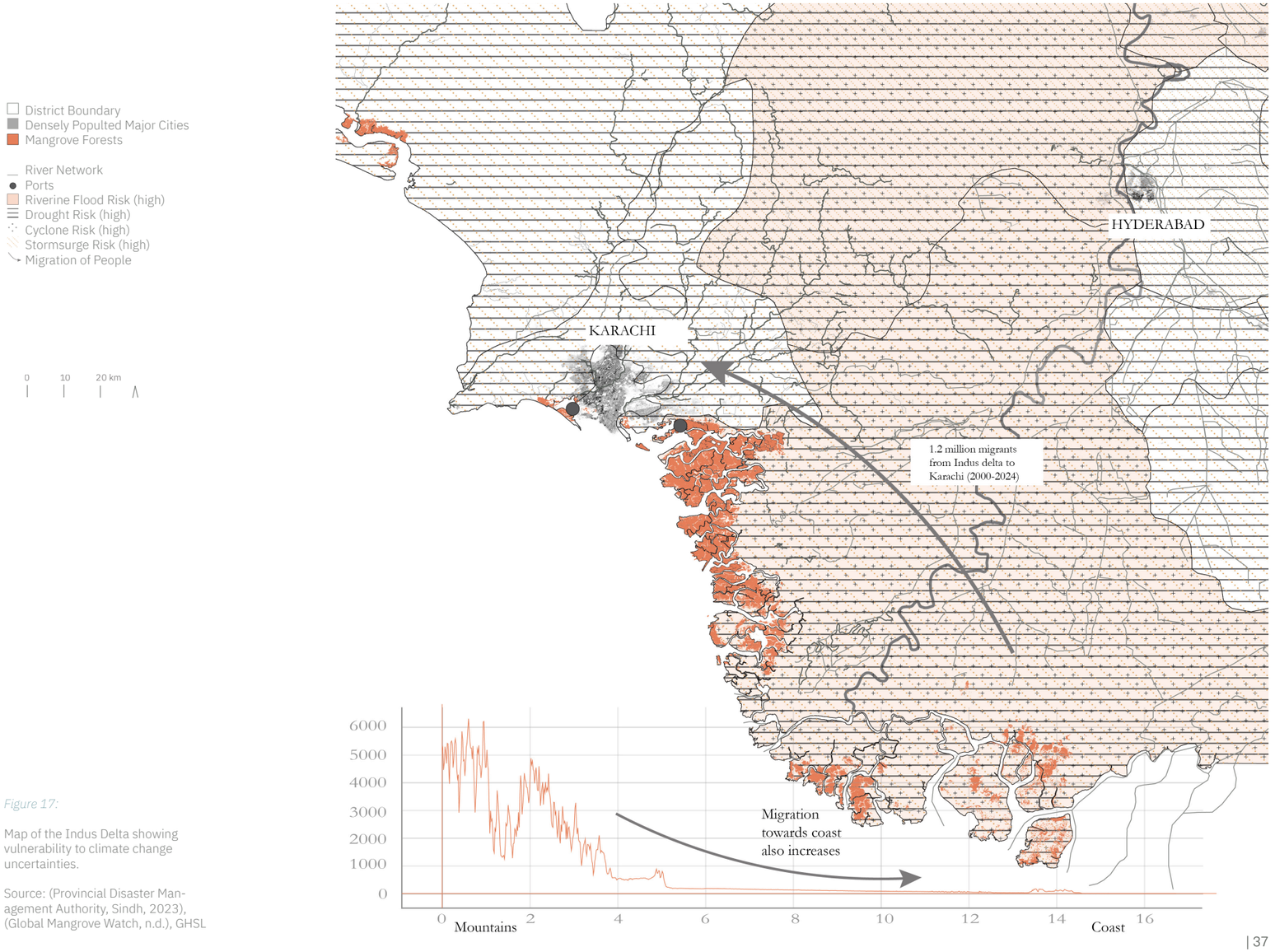


Figure 17:

Map of the Indus Delta showing vulnerability to climate change uncertainties.

Source: (Provincial Disaster Management Authority, Sindh, 2023), (Global Mangrove Watch, n.d.), GHSL

1.3.3 Urban Densification

Urban Densification and Land Reclamation

On the western edge of the delta lies Karachi, Pakistan's largest metropolis. Rapid urban and industrial expansion in Karachi has taken a heavy toll on the delta's coastal ecology due to significant mangrove deforestation along its coastline. Between 2010 and 2022, approximately 200 hectares of mangrove forests were cleared for housing schemes, commercial, and industrial projects (WWF Pakistan, 2024). This loss threatens coastal protection, biodiversity, and the livelihoods of local communities. The WWF-Pakistan's geospatial analysis highlights areas where mangrove cutting is still occurring at an alarming rate (The Waning Guardian of Karachi, 2024).

Pollution and Waste Mismanagement

Karachi, Pakistan's industrial and economic hub, houses approximately 30% of the nation's industrial output. However, this industrial activity has led to severe environmental degradation. An estimated 37,000 tons of industrial waste and 20,000 tons of oil are discharged into Karachi's coastal waters annually (Amjad et al., 2007). Additionally, around 110 million gallons per day of untreated sewage flow into the sea and creek systems (Amjad et al., 2007). This lack of functional wastewater treatment exacerbates the situation.

These pollutants have severely impacted mangrove ecosystems, leading to stunted growth, dieback, and signifi-

Local Extraction of Mangroves

Aside from land reclamation and pollution, another cause of mangrove loss is the cutting down of trees by local fisherfolk for fuel, fodder and timber. Though this is not the main challenge faced by mangroves, it increases their vulnerability and reduces their chances of survival.

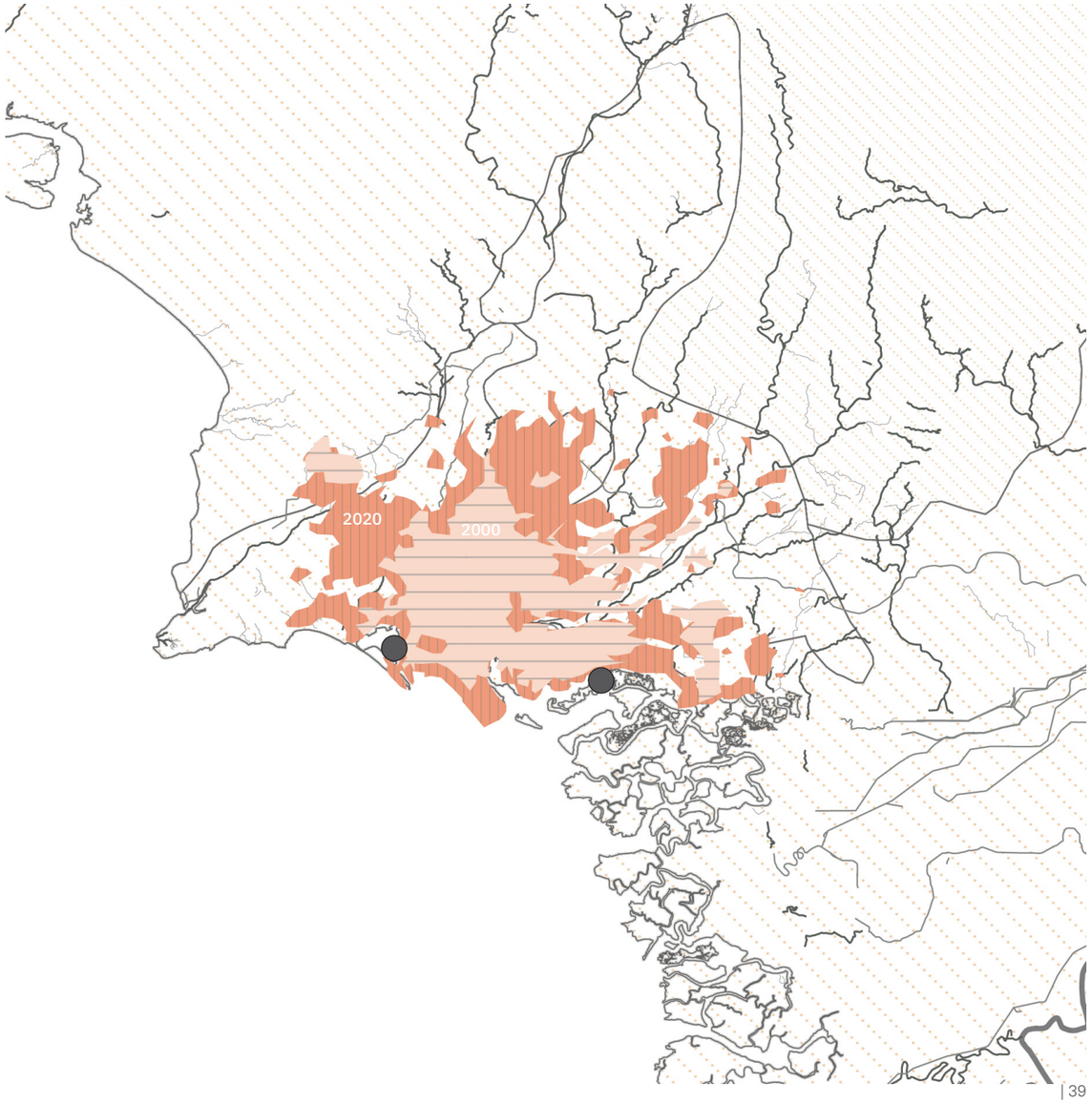


Figure 18:

Map of Karachi showing its Urban Footprint expansion from the year 2000 to 2020.

Source: (Yan & Wang, 2021)

1.3.4 Conclusion: Impact on the Deltas Inhabitants

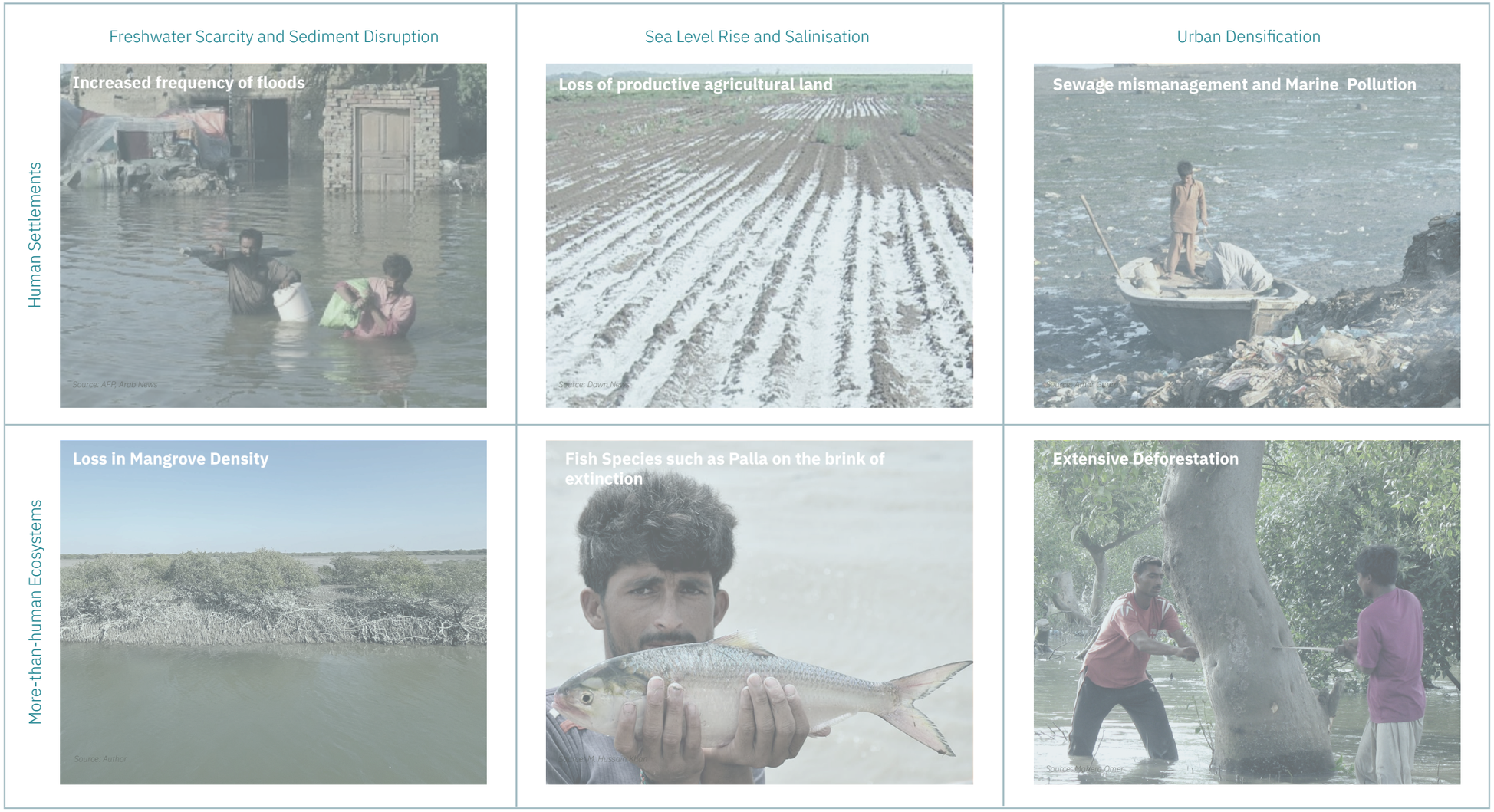


Figure 19:

Impact of Delta's challenges on its Human and More-than-human inhabitants.

1.4 Problem Statement

The Indus Delta, once a thriving and self-sustaining ecosystem, is now on the verge of collapse. Decades of upstream water diversion, dam construction, and extractive practices have severely reduced the freshwater and sediment that once nourished the delta. As a result, saltwater now pushes further inland, mangrove forests are disappearing, and entire deltaic ecologies are becoming more fragile with each passing year.

At the same time, regional pressures—like land reclamation, industrial waste, and agricultural expansion—have fragmented and polluted this landscape even further. What remains is an increasingly vulnerable coastline, where the mangroves that once buffered storms and supported rural livelihoods are shrinking faster than they can regenerate. These forests are not just trees—they are habitats, nurseries, and lifelines for both biodiversity and fishing communities.

The effects of this degradation are not just ecological, but deeply social. As rising seas, floods, and unproductive soils make rural life less viable, more and more families are forced to migrate—often to overcrowded cities like Karachi. These migrations sever long-standing relationships between people and place, placing new pressures on both ends of the system: the delta that is emptied out, and the city that must absorb what it cannot sustain.

This thesis takes the “dying delta” not as an end point, but as a call to reimagine how we live with and care for such vulnerable landscapes. It explores how networks of care—through ecological restoration, community resilience, and adaptive land-use strategies—can offer new ways of inhabiting the delta. Through design, the aim is to reconnect inland and coastal processes, restore damaged ecologies, and support both human and more-than-human life in a future where the delta can not only survive, but regenerate.

Figure 20:

Fishermen at Ibrahim Hyderi preparing fishing nets and other equipment before departure.

1.5 Research Aim and Outcomes

Research Aim

This research aims to understand and reimagine the regeneration of the Indus Delta by exploring how ecological restoration—particularly mangrove regeneration—can also become a driver for economic resilience and safer living conditions under changing climatic realities. Rather than treating ecology and economy as separate concerns, the project investigates how they can be interlinked through spatial strategies that work with the dynamic conditions of water, soil, and salinity in the delta.

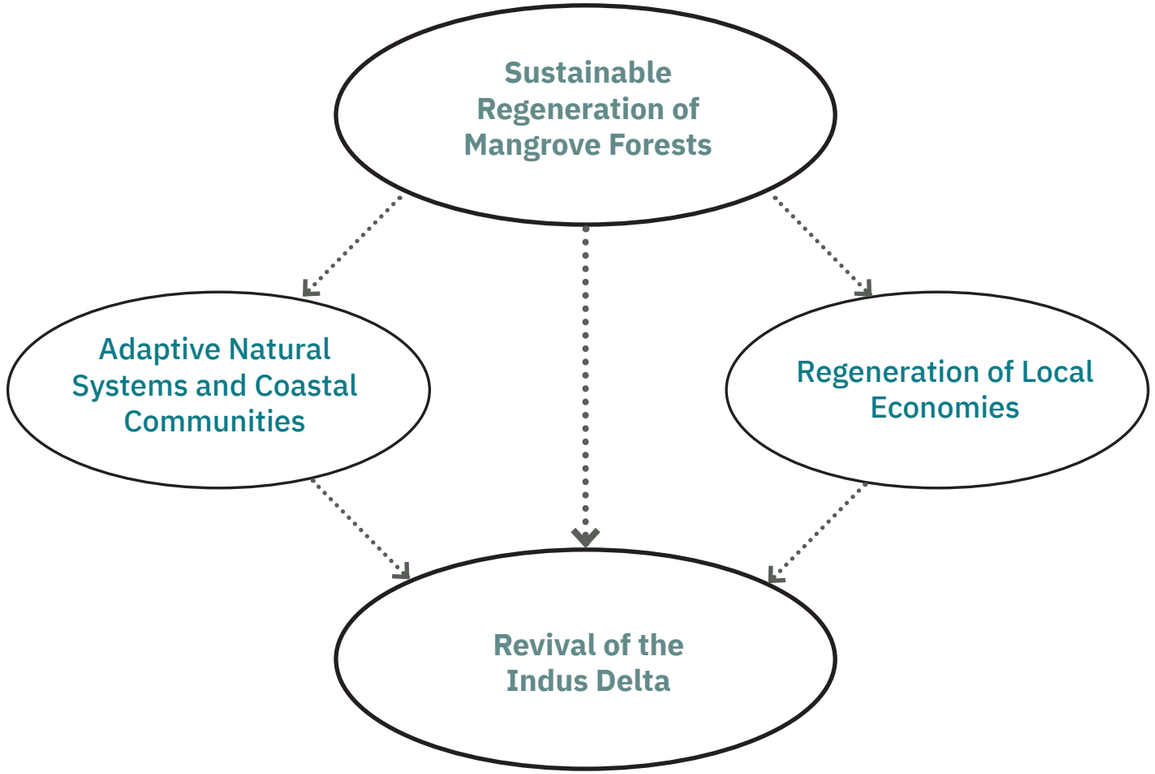
The research begins with a multi-layered analysis of the delta through fieldwork, stakeholder interviews, and mapping of environmental, social, and economic dependencies. By grounding the project in lived realities and scientific data, it identifies pressures and opportunities across multiple scales. Building on this, the design process aims to propose a more integrated and adaptive network of care—one that enables more flexible, sustainable forms of living in the delta, not only for rural communities but also in urban areas that absorb climate-induced migrants. The goal is to find ways for people and ecosystems to coexist and adapt, rather than be displaced by one another.

Outcomes

Using a research-by-design approach, the thesis develops and tests strategies for delta regeneration. This includes identifying critical intervention areas and designing scenario-based strategies at three scales: national, deltaic, and local. These scenarios are not fixed solutions, but iterative models that test what kinds of interventions might work—and under what conditions.

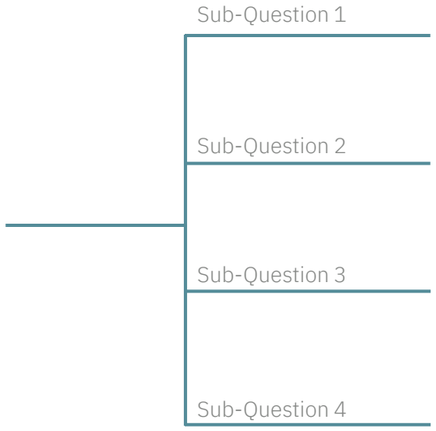
Each strategy is assessed in relation to its ecological impact, feasibility, and implications for local stakeholders, including rural communities, urban authorities, and environmental agencies. These scenarios are used to spark dialogue between actors, test spatial ideas, and challenge assumptions about what is possible.

The final outcome includes a spatial vision for the Indus Delta—one that weaves together preservation, production, and recreation into a coherent, care-based framework. It suggests that regeneration is not only about restoring what was lost, but about building new relationships between people, land, and water that are more just, adaptive, and long-lasting.



1.6 Research Question and Sub-Research Questions

How can **networks of care**, enable humans to nurture the **Indus Delta mangrove ecosystem**, fostering **harmony** between **human** and **more-than-human** populations?



Sub-Question 1

How has the **Indus Delta mangrove ecosystem deteriorated** due to **social and economic dependencies** and c**limate change uncertainties**?

Sub-Question 2

How has this ecological deterioration in turn affected **human** populations and the delta's complex flows of **water, soil and waste**?

Sub-Question 3

How can **networks of care** be established using the existing dynamics of **external forces** within the delta such as the **sea, river and urbanisation**, to **regenerate mangrove ecosystems**?

Sub-Question 4

How can the **mangroves** of the **Indus Delta** become **tools** to create **social, economic and ecological harmony** to **revitalise** the dying **delta?**

1.6.1 What is '*Care*'?

In her book Matters of Care, María Puig de la Bellacasa introduces 'care' as a lens to critique existing norms and highlight the need for a shift in priorities (De la Bellacasa, 2017). This idea inspired the thesis to reflect on the effects of human actions on more-than-human entities, and to explore how this relationship can evolve from one of extraction to one of mutual benefit. A key understanding that emerged through this research is that care is deeply political: the communities and ecosystems that are not cared for are often those deliberately neglected by governance structures, left to survive on their own.

By learning from how mangroves care for the inhabitants of Karachi and the Indus Delta—providing protection, livelihoods, and ecological stability—this thesis also confronts the consequences of their degradation. As the mangroves lose their ability to care, the urgency to rethink our approach to the delta grows. Any spatial transformation must begin with a shift in our behaviours and values.

This thesis therefore explores how care for the mangroves can extend beyond individual actions to form wider networks grounded in care. These networks can be strengthened by weaving together relationships between society, economy, and ecology—three interdependent layers that continually shape one another. At the same time, the research investigates the potential of indigenous knowledge in regenerating the mangroves sustainably, offering an opportunity to return agency and ownership to local fisherfolk and farming communities.

Figure 21:

A displaced mother cooking a meal near Baghan, while her home can be seen submerged under water due to the 2022 floods.

Source: Zuhaib Ahmed Pirzada (Pirzada, 2022)

1.6.2 Why Should Mangroves be Cared For?

Indus Delta Mangroves as the More-than-human

Indus Delta is the 5th largest delta in the world, with the 7th largest mangrove forest system (Indus Delta, Pakistan, n.d.). They not only provide a habitat for birds, including many migratory birds such as flamingoes, but their roots form great nurseries for fish, shrimp and crab populations. These are hunted to be sold locally or globally. These mangroves also protect the shore, increase sedimentation, and protect against floods and cyclones by attenuating waves. Local fisherfolk also rely on mangrove leaves for fodder for livestock and wood as fuel.

Existing Replantation Efforts

There is rising awareness in the country about the need for mangrove regeneration but the efforts to do so are not replacing mangroves at the same rate we are losing them. The dense and complex root system of mangroves takes years to achieve and the new plantation in many saline areas is becoming stunted due to lack of freshwater.

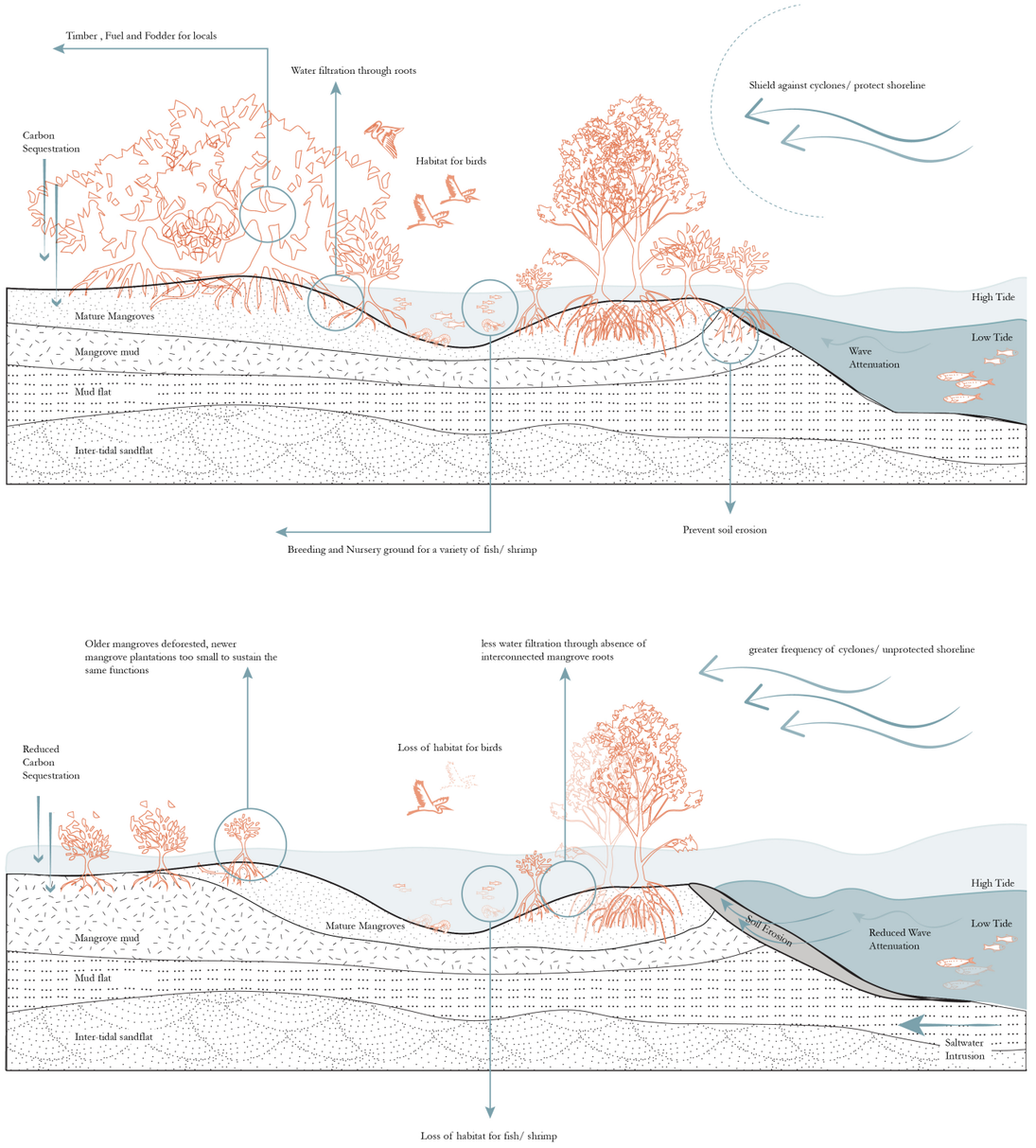


Figure 22:

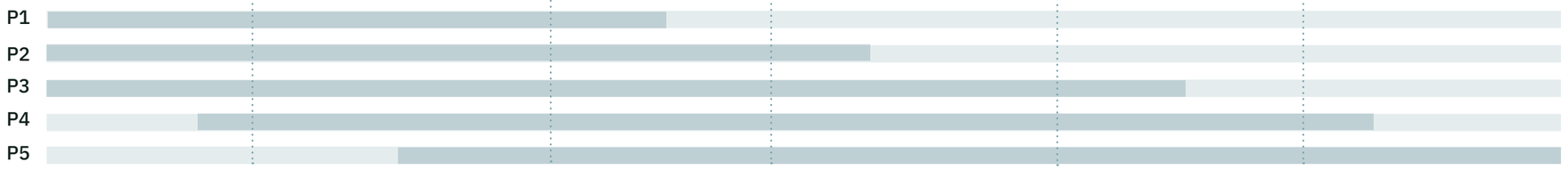
Role of mangroves and effects of deforestation.

Figure 23: Growth of Algae next to Korangi Fisheries due to increased nutrient pollution.

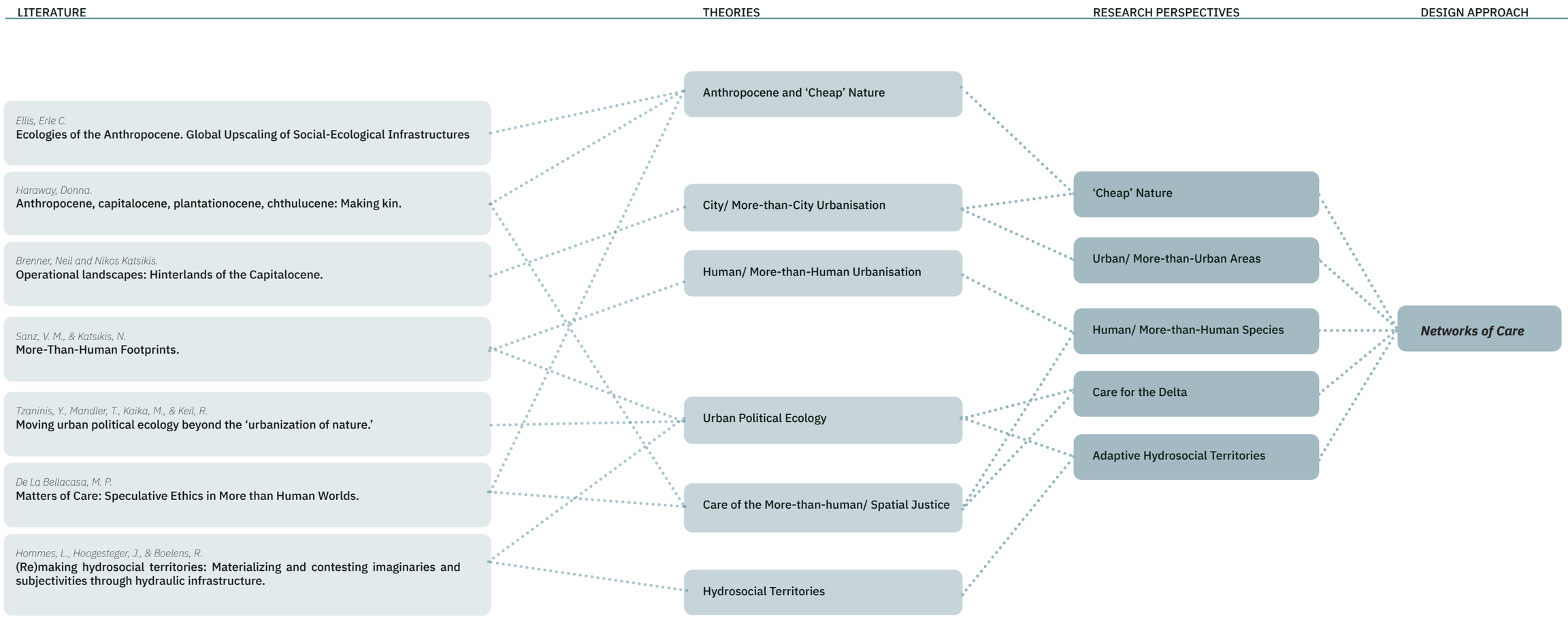
2.1 Methodological Framework

How can **networks of care**, enable humans to nurture the **Indus Delta mangrove ecosystem**, fostering **harmony** between **human** and **more-than-human** populations?

	Contextualisation	Theoretical & Conceptual Framework	Analysis	Research by Design (*Networks of Care*)	Proposed Design Vision	Conclusion and Reflection
How has the **Indus Delta mangrove ecosystem deteriorated** due to **social and economic dependencies** and c**limate change uncertainties**?	Literature Review Analytical Mapping	Literature Review	Literature Review Data-based Analysis Analytical Mapping Fieldwork Observations	Case Study References		
How has this ecological deterioration in turn affected **human** populations and the delta's complex flows of **water, soil and waste**?	Literature Review Analytical Mapping	Literature Review	Literature Review Analytical Mapping Fieldwork Observations Informal Interviews Microstories	Case Study References	Case Study References	
How can **networks of care** be established using the existing dynamics of **external forces** within the delta such as the **sea, river and urbanisation**, to **regenerate mangrove ecosystems**?		Literature Review	Literature Review Analytical Mapping Systemic Analysis Policy Overview	Case Study Reference Scenario Design (Networks of Care)	Vision for the Delta Local Scale Interventions Stakeholder Evaluation	Evaluation Ethical Considerations Scientific and Societal Reflection
How can the **mangroves** of the **Indus Delta** become **tools** to create **social, economic and ecological harmony** to **revitalise** the dying **delta?**		Literature Review	Literature Review Fieldwork Observations Analytical Mapping Systemic Analysis	Case Study Reference Scenario Design (Networks of Care) Phasing	Vision for the Delta Local Scale Interventions Stakeholder Evaluation Phasing	Evaluation Ethical Considerations Scientific and Societal Reflection



2.2 Theoretical Framework



2.2 Theoretical Framework

Anthropocene and 'Cheap' Nature

This research began with a critique of how human actions have degraded landscapes over time in order to sustain themselves (Ellis, 2014). Anthropogenic activities in Pakistan such as agriculture and increased urban infrastructures have led to the maximization of control over natural resources such as freshwater and mangrove forests. Donna Haraway reveals how this over-extraction of natural resources cannot be limitless (Haraway, 2015). Our perception of nature as a 'cheap' resource starts to change when we start needing to replace the natural functions of nature with human interventions, such as canals to redirect water from the river when its natural flow changes. When nature is mismanaged, it also loses its capacity to give 'refuge' to human and more-than populations (Haraway, 2015). This has created unprecedented loss and migration due to homelessness in Pakistan as well.

Urban and More-than-Urban

This then brings in the question of what we understand as a city and what systems support it indirectly without being included as the core part of the city. Brenner and Katsikis elaborate on the idea of 'hinterlands' or 'more-than-city' landscapes that support the city by providing the functions of 'supply zones, impact zones, sacrifice zones, logistic corridors' and others, that a city pushes to its peripheries (Brenner & Katsikis, 2020). The urban can then be understood as both the city, that is the core and the more-than-city, that still exists within the peripheries of the city.

With reference to this research, the urban in the delta region is the city of Karachi and also its sub-urban fishing villages, industrial areas and ports. The author then situates the more-than-urban in the Indus Delta, as it is physically removed from the urban but still has socio-economic ties with it, such as the fisherfolk community of the delta. The more-than-urban Indus Delta has been reduced to simply a landscape of production without any care for its more-than-human entities (Brenner & Katsikis, 2020).

Human and More-than-Human

Urban Political Ecology sheds light on how the way humans organize nature to suit our means is always political (Tzaninis et al., 2020). The reclamation of land and consequent deforestation of mangroves in the coastal areas of Karachi, has capitalist motives as these biodiverse landscapes are replaced by industrial complexes and elite residential areas (Sanz & Katsikis, 2023).

The more-than-human inhabitants of the delta can be recognized as the mangrove ecosystems that support both terrestrial and aquatic life. These perform 'unpaid labour' (Sanz & Katsikis, 2023) as they cater to local and global economy without any compensation.

Care for the Delta

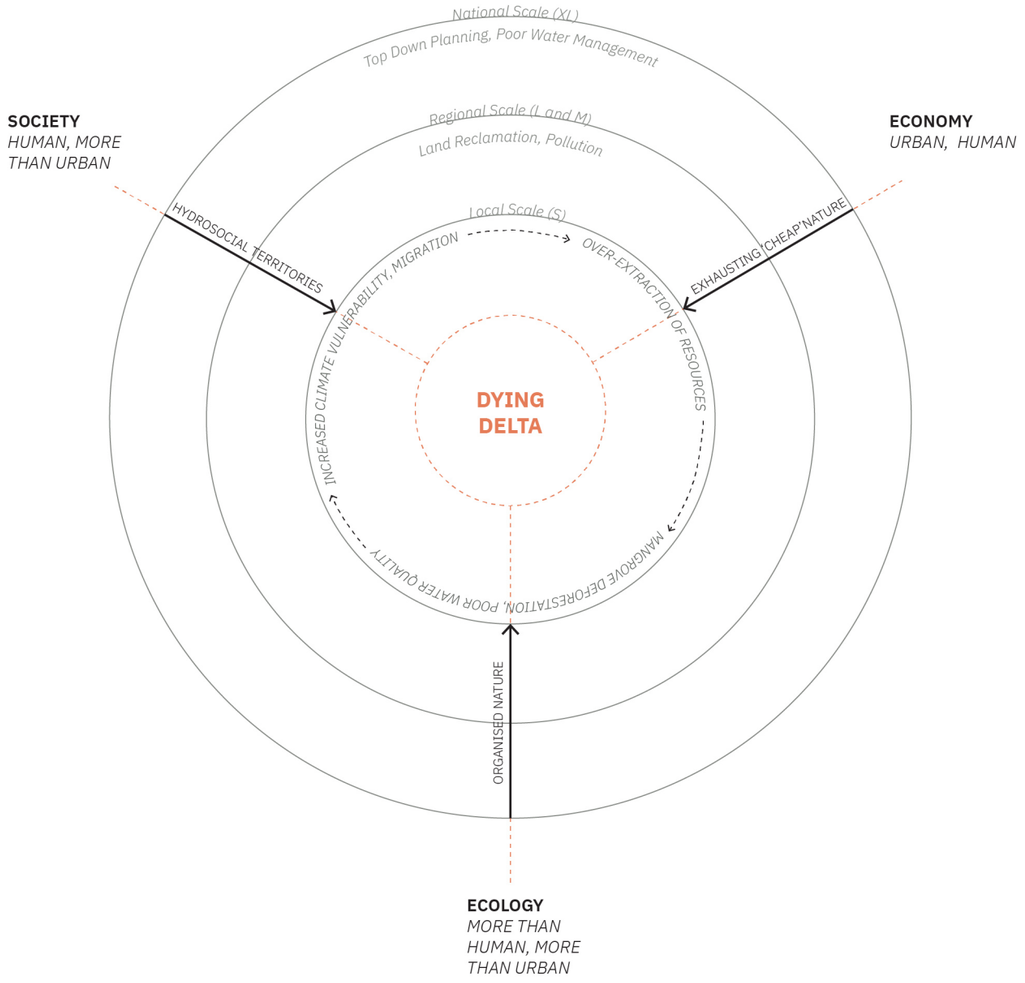
De La Bellacasa introduces 'care' as a way to critique existing norms and how a shift in priorities is needed, that is, moving the focus away from humans to the more-than-humans (De La Bellacasa, 2017). This brings in the urgent need to care for the delta since it has lost the capacity to care for its own inhabitants (De La Bellacasa, 2017). This idea of care becomes the premise of this thesis, as indigenous knowledge of the mangrove ecosystems can help sustainably regenerate the delta, while also giving more ownership to local fisherfolk communities.

Adaptive Hydro-social Territories

The relationship between humans and the Indus Delta has drastically transformed with the decrease in freshwater and increased frequency of climate related vulnerabilities. If human 'subjectivities' change when infrastructure fixes relations between people and water (Hommes et al., 2022), this thesis also aims to understand how this relationship between space, water and people can be made more flexible and adaptive, to create a more transformative way of living.

2.3 Problem Framework

The framework situates the “dying delta” at its core, illustrating how interconnected issues across scales contribute to its degradation. At the national scale, poor water management and top-down planning exacerbate hydro-political challenges, while at the regional scale, land reclamation and pollution intensify environmental degradation. Locally, the over-extraction of resources and increased climate vulnerability lead to the displacement of rural populations and the collapse of mangrove ecosystems. The framework highlights three intersecting domains—society (human and more-than-human), economy (urban and rural), and ecology (more-than-human and more-than-urban)—to emphasize the need for integrated strategies addressing resource exhaustion, climate vulnerability, and mangrove regeneration to explore how mangroves can become the tool for change.



2.4 Conceptual Framework

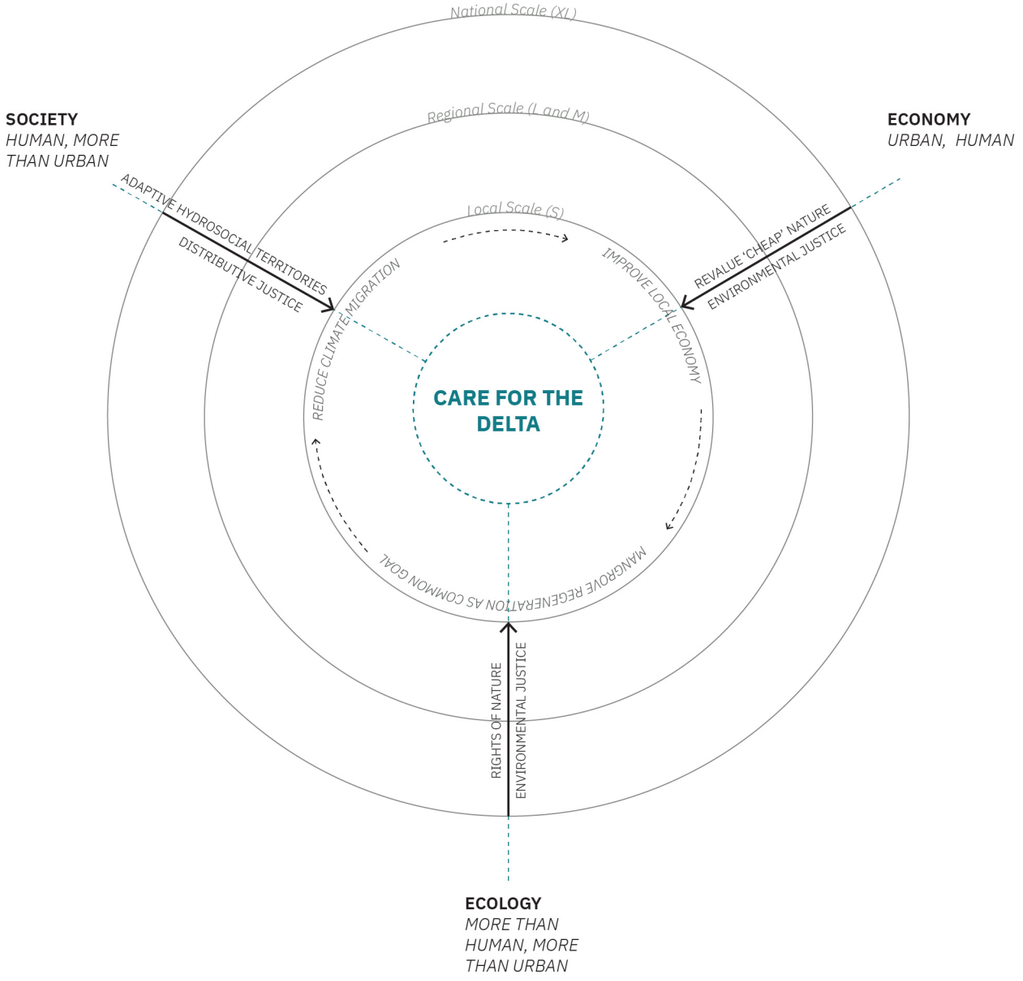
The conceptual framework centres on the idea of “Care for the Delta,” addressing the complex socio-environmental challenges of Indus Delta’s ecosystem. It integrates three core dimensions—society, economy, and ecology—and aims to use mangroves as the main tools for change. This central objective is supported by interventions at local, regional, and national scales, reflecting the interconnected nature of the issues and solutions.

The society dimension focuses on reducing climate migration and promoting adaptive hydro-social territories that ensure distributive justice. This aims to give more ownership to local fisherfolk within the process of reviving the delta including mangrove regeneration. It emphasizes inclusivity and equity in creating systems that are socially resilient and responsive to climate change.

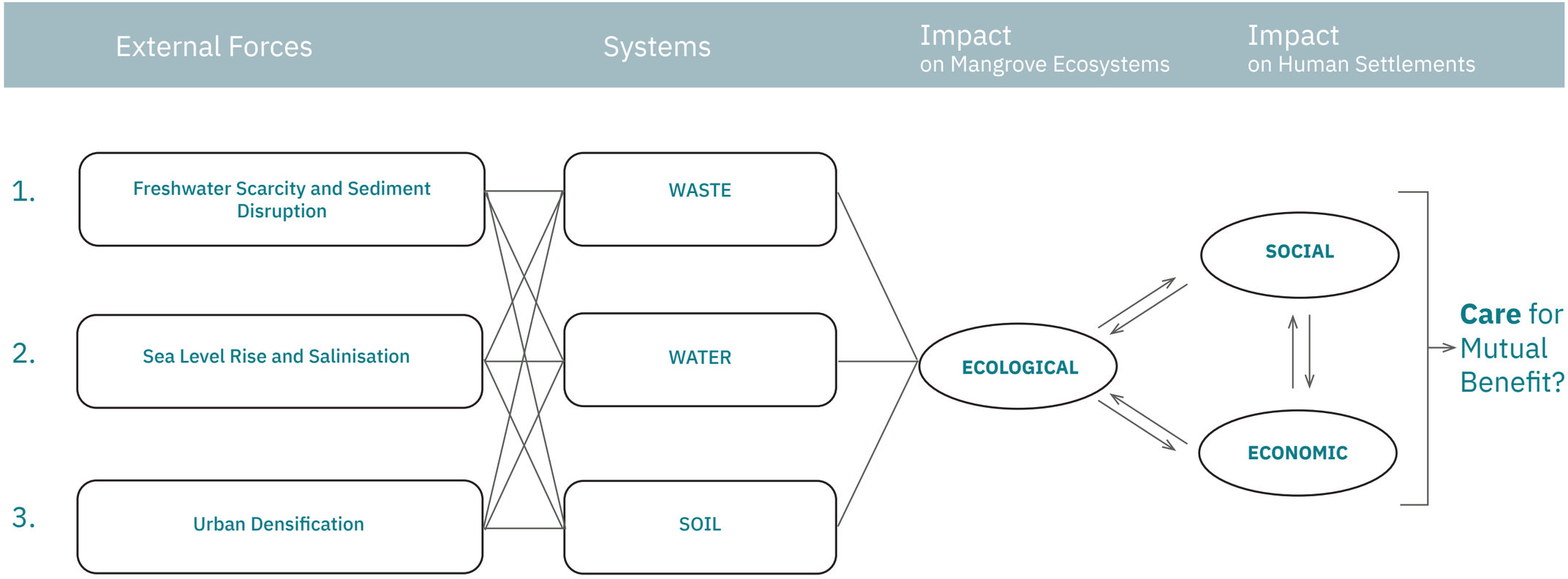
The economic dimension highlights the need to improve local economies while valuing natural ecosystems and their services. It aims to explore how local economy can flourish without relying solely on mangrove ecosystems. Environmental justice and mangrove regeneration are key, offering mutual benefits for both economic and ecological stability.

Finally, the ecology dimension stresses the rights of nature and the importance of more-than-human systems in ensuring a sustainable future. It calls for informed reforestation, habitat restoration, and environmental justice to mitigate environmental risks and restore balance.

Together, these dimensions form a synergistic framework that integrates social, economic, and ecological considerations, advocating for a sustainable future for the Indus Delta.



2.5 Analysis Framework: Care for Mutual Benefit



2.6 Methods

Literature Review:

To develop a conceptual and theoretical framework, various theories and concepts will be analysed and then understood through the narrative of the project. Literature will also be needed to collect data, understand policies and identify suitable case studies to take forward to the design phase.

Stakeholder Analysis:

There is a need to understand the ways people live in this region, what they are influenced by and how water and waste management, conservation and regeneration of mangroves and climate change uncertainties affect them. The aim of this exercise is to identify potential ways various stakeholders are already engaging with mangrove ecosystems and how that can change from an extractive to a more mutually beneficial relatonship.

Analytical Mapping/ Data-based Analysis:

This will be used as a tool to not only analyse but also design scenarios by overlapping systems that might conflict with each other. This comparision will require quantifiable data where possible.

Fieldwork:

The aim of fieldwork is to understand the socio-economic dependencies on site through field observation notes, photographs, videos, informal interviews and micro-stories. The field observations will not only be used to verify desktop research but to also see what potential new relationships can be made between different stakeholders by understanding their existing roles.

Case Study References:

These will be used to test various new ideas through existing research. It will be a combination of local knowledge from the Indus Delta, but also compared with Global case studies, especially in other Asian Deltas such as the Mekong Delta or the Sundarbans.

Scenario Design:

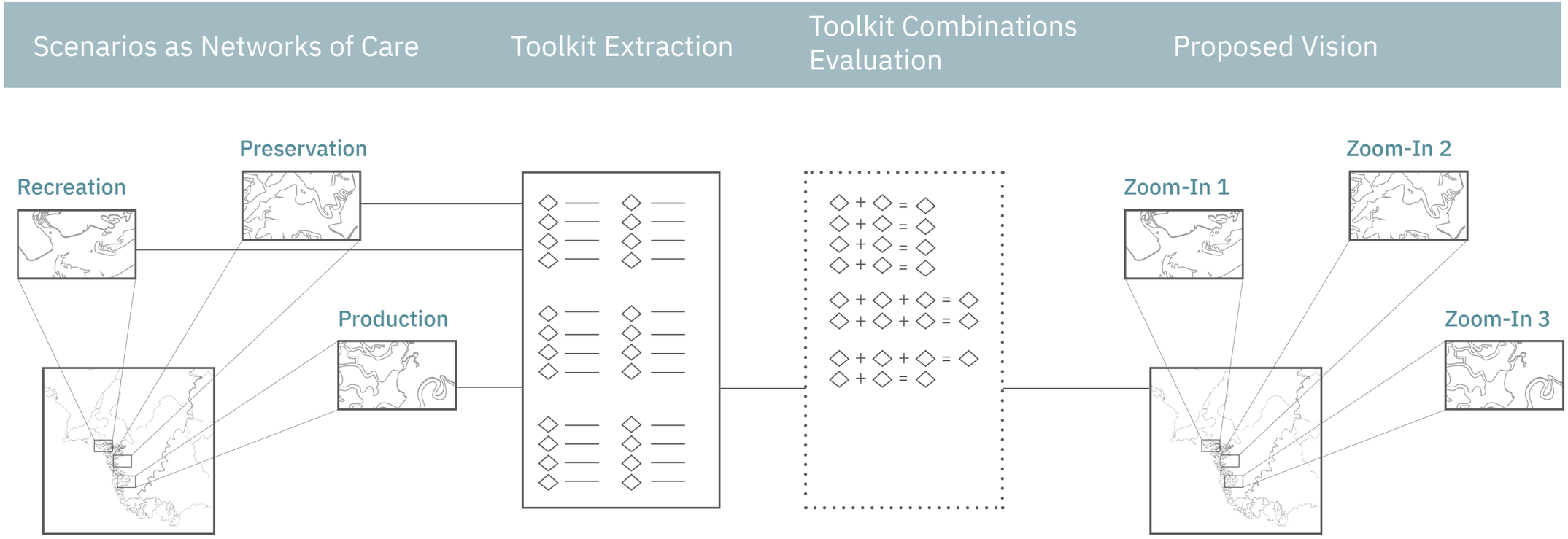
By first exploring the agency of existing systems in improving mangrove populations through three different *Networks of Care*, the effects of changes to the city, the delta and the sea will be tested with regard to the urban waste, water and soil conditions. The networks of care will be identified by looking at existing ways locals interact with mangroves and how that relationship can be further built upon. These will be evaluated based on certain indicators and then a multi-scalar design proposal will be made as a potential proposal to the government, using a toolkit derived from the three networks of care. The final outcomes would include:

| a delta-scale vision plan with spatial interventions derived from the three toolkits.

| zoom-in of critical locations with detailed plans and sections of local interventions.

| an analysis of local impact on stakeholders involved

2.7 Approach: Research by Design



2.8 Scales

Scales of Analysis

Scales of Intervention

Individual Stakeholder Impact (S)
Impact on Human Scale

+

Zoom-in Locations (M)
Local Scale Operational Strategies - Critical Areas

Delta (L)
Strategic Plan for the Delta

National (XL)

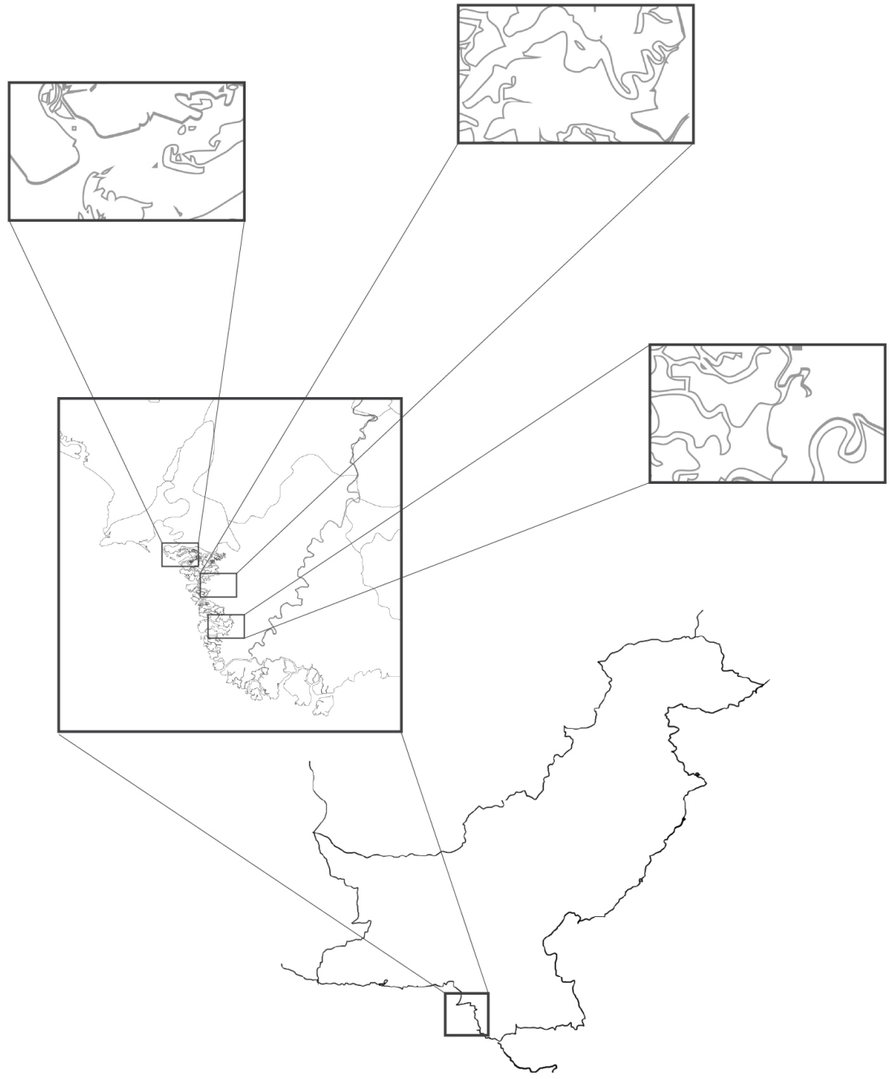


Figure 24: View of Karachi from the Clifton Urban Forest, where wastewater is drained before emptying into the sea.

3.1 Delta: Water System

The extensive canal network that diverts water away from the Indus River is shown. The Malir River can also be seen draining into the delta, also bringing with it the untreated wastewater of Karachi (Situational Analysis of Water Resources of Karachi, 2019).

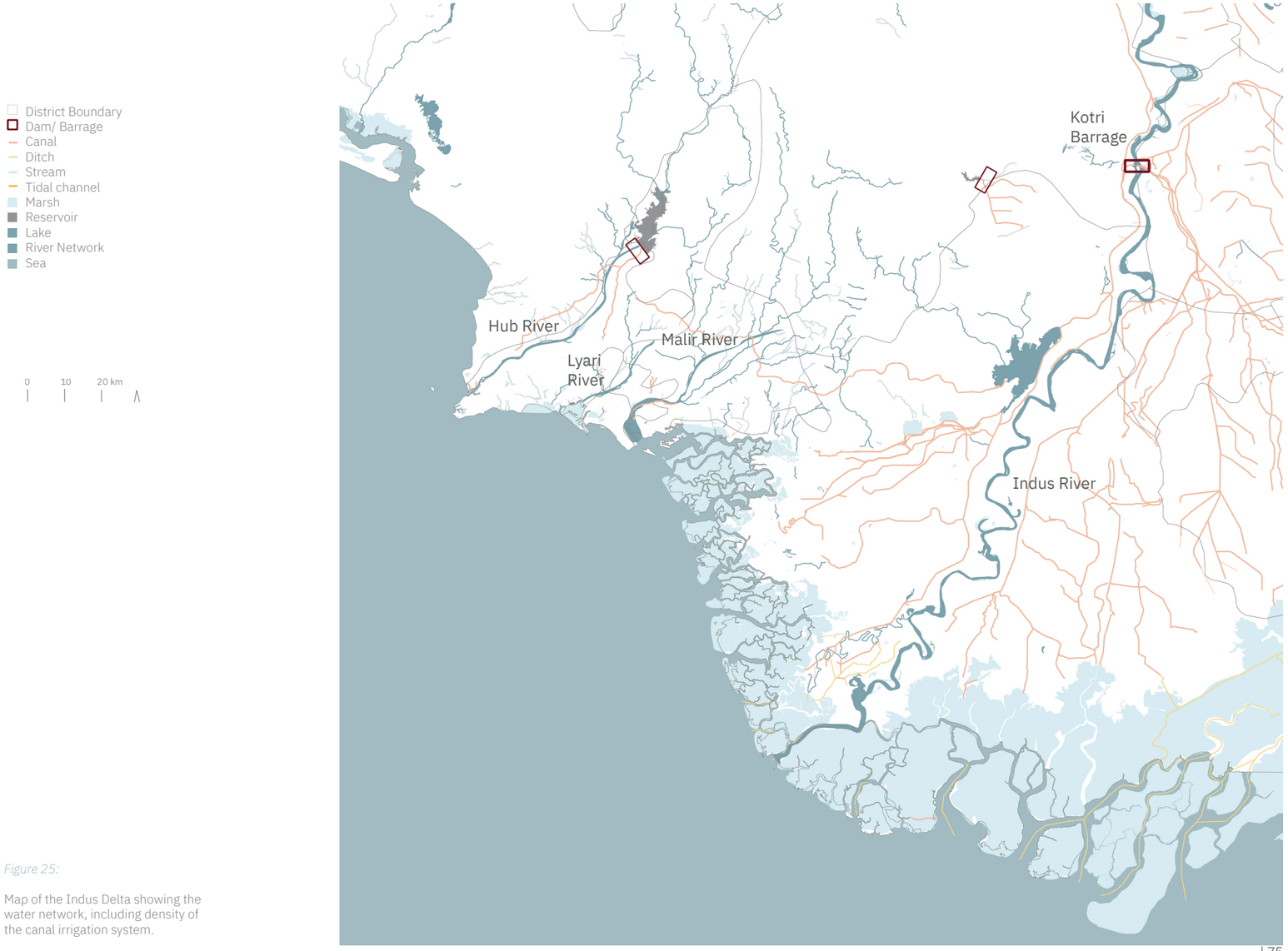


Figure 25:

Map of the Indus Delta showing the water network, including density of the canal irrigation system.

3.2 Delta: Land-Use

When overlaid with the land-use of the delta, it can be observed how intensively agriculture extracts water for use, while the city of Karachi can be seen adjacent to where the densest mangrove forests are also present. This shows how closely tied, the urban fabric of Karachi as well as the agricultural footprint upstream, is to this fragile ecosystem.

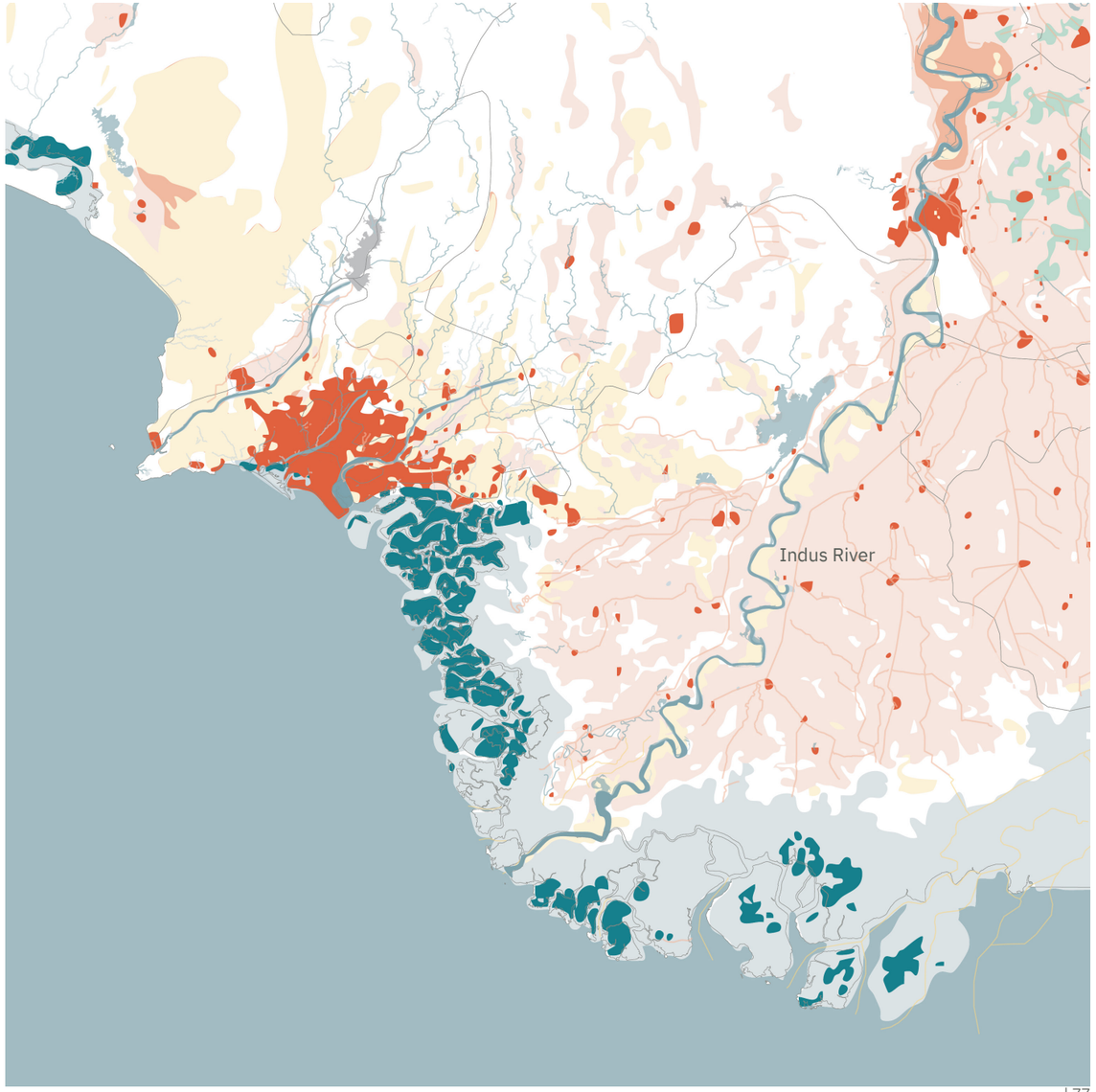


Figure 26:

Map of the Indus Delta showing land-use, with agriculture as the most dominant typology.

3.3.1 Delta: Freshwater Flows

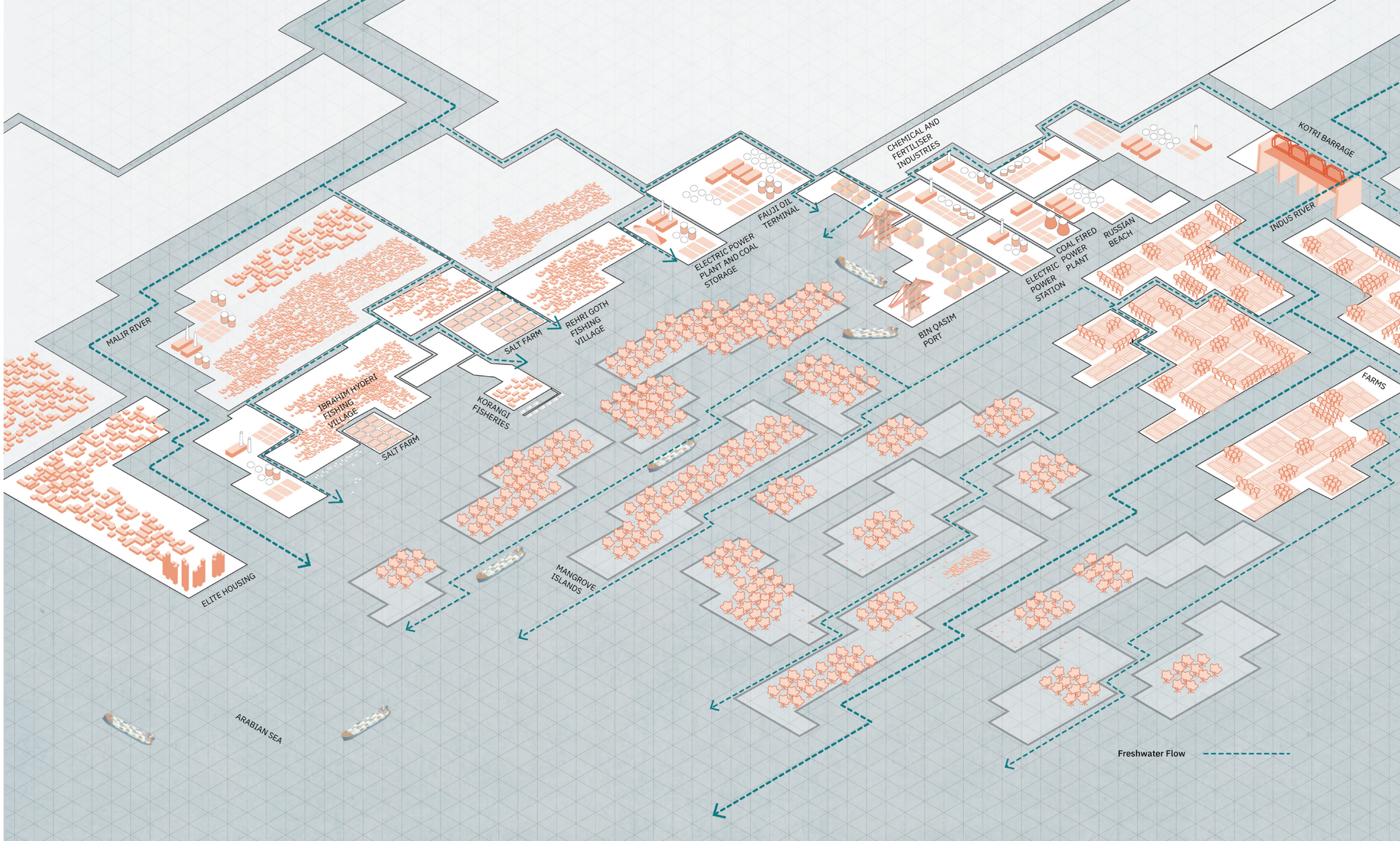


Figure 27:

As freshwater flows at a reduced rate beyond the Kotri Barrage, it is divided into various canals that flow through agricultural fields before draining into the delta. The Malir river, and various stormwater drains from the city, also travel through residential and industrial areas into the Indus Delta.

3.3.2 Delta: Salinisation and Seawater Intrusion

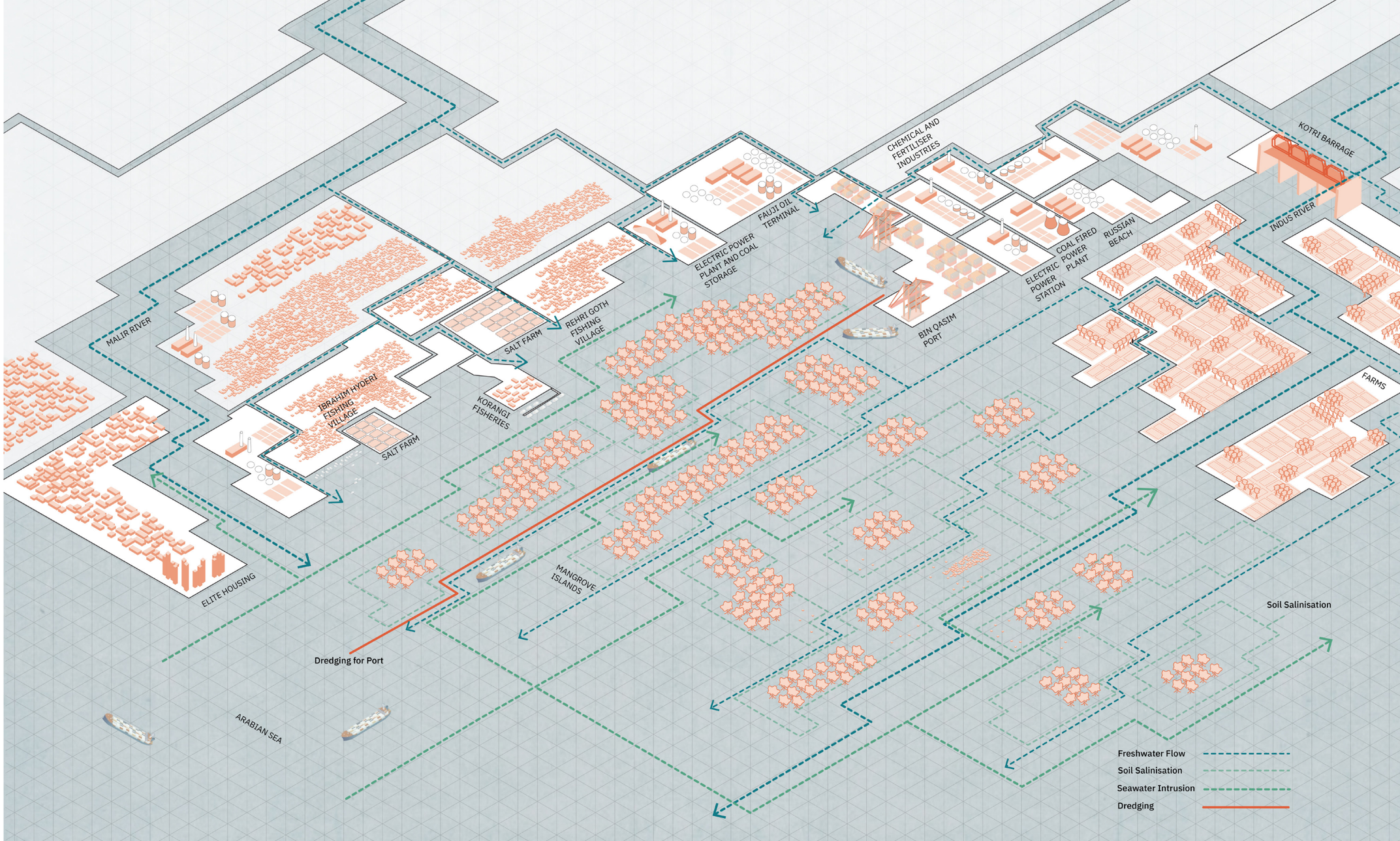


Figure 28:

As sea level rises, various islands in the delta as well as the coastal areas of Karachi are affected by increasing soil salinisation. Dredging for the port also affects soil health and biodiversity.

3.3.3 Delta: Wastewater Flows

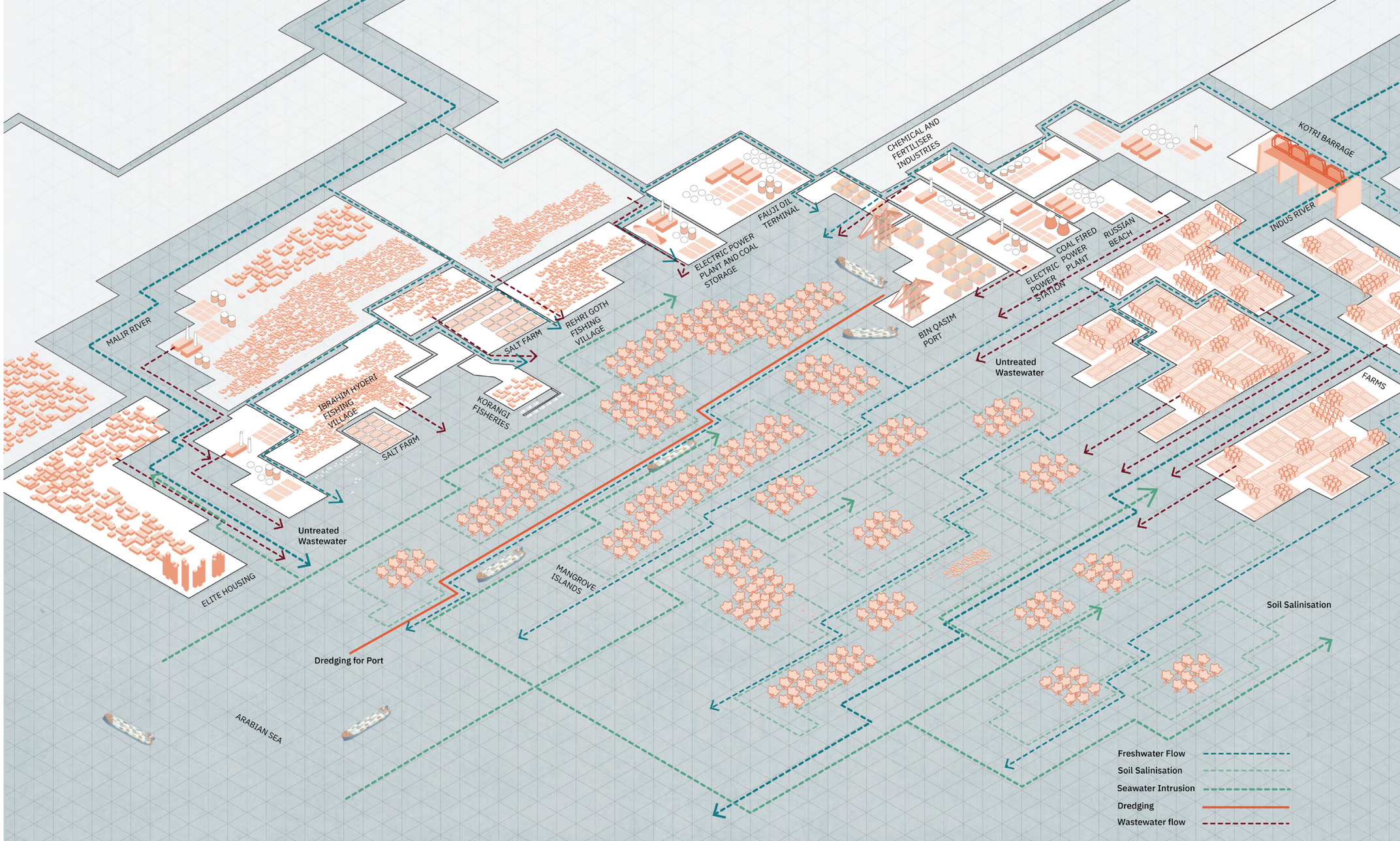


Figure 29:

The untreated wastewater from agriculture and various residential and industrial areas, also ends up being drained into the Delta. Mangrove ecosystems thus suffer from this excessive pollution of water and soil systems.

3.4 Impact of Delta's Challenges on Mangroves

The forces of freshwater scarcity through river mismanagement, sea level rise and salinisation as well as urbanisation, affect mangroves on various layers.

This thesis builds on the failure of replantation drives of mangroves that have a success rate of 45% (Bayraktarov et al., 2016), and tries to look at the root of the three systems that cause stunted mangrove growth of new seedlings. By looking at waste mismanagement that clogs mangrove wetlands and prevents its roots from breathing, as well as quality of water and soil, mangrove regeneration can become more sustainable. By addressing the causes of failure in the waste, water and soil management systems, not only are the more-than-human entities affected but even humans can have better livability through improved sanitary conditions and livelilihood opportunities.

Addressing these external forces thus helps build synergy between mangroves and humans as they can work towards mutual benefits.

Figure 30:

Efforts to restore mangroves by the Sindh Forest Department

(Source: Respira International, Delta Blue Carbon Project)

Figure 31: Remote Fishing Settlement near Khuddi Creek in the Indus Delta.
Homes here are made of wood, bamboo and tarp and raised on platforms and stilts, to allow for tidal shifts within the landscape.

3.5 Fieldwork Aim and Route

One of the main aims of fieldwork was to verify the many claims i came across during my desktop research. Since this is a region i have grown up adjacent to, but knew not enough about, it was necessary to also understand effects of the external forces mentioned before, through site observations.

Another important goal of fieldwork was also to go with an open mind, and absorb what relationships with the mangroves were visible or invisible. This was intended to understand not only how various typologies of functions within the delta interact with mangroves, but also how the locals interact with them. This particular aspect led to many interesting findings that I had not come across through my earlier literative review and mapping.

Through field observations, photography and informal interviews and by also travelling on land and water both, I was able to document and understand the relationships between the human and more-than-human residents of the Indus Delta.

To accomplish the above, four routes were taken. The first was meant to cover the adjacency of the coast of Karachi and the mangrove islands of the delta. The second was a boat tour to a remote island in Khuddi Creek. The third was to view Karachi's relationship with the Arabian Sea and existing replantation efforts of mangroves in the Clifton Urban Forest. The fourth route was from Karachi to the center of the delta, where a fishing Village called Keti Bandar was explored. The idea behind the planning of these routes was to understand how the typologies of port, industries, residential areas, fishing villages and agriculture were all working with or in conflict with, the mangrove forests.

Figure 32:

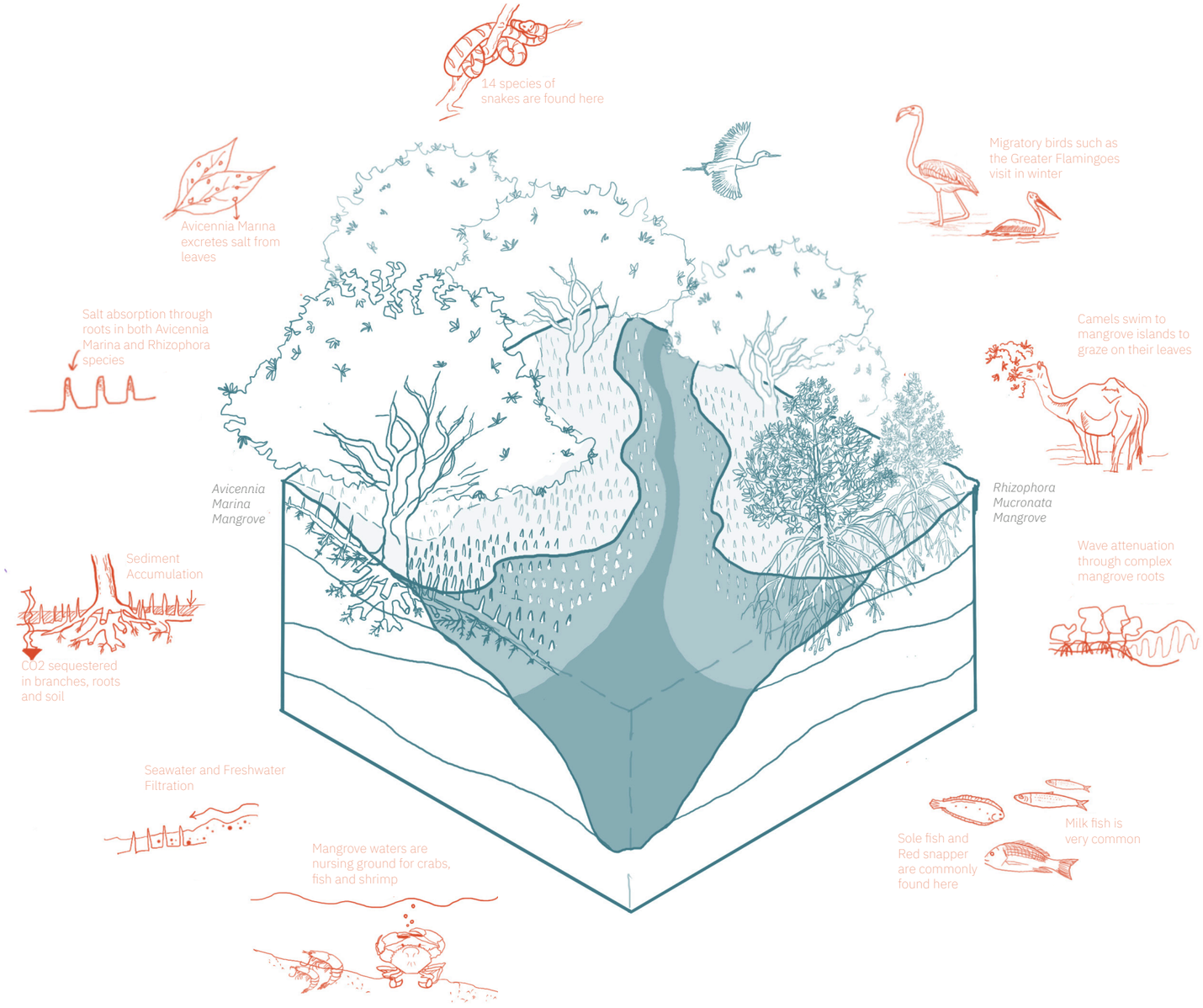
Map of Fieldwork Route (by car and boat).

3.5.1 More-than-Human/ More-than-Urban
Ecology

The mangroves in the Indus Delta include two most common species, that is the Avicennia Marina and the Rhizophora Mucronata. The replanted mangroves are usually Rhizophora and these are not as salt tolerant as the other species.

Mangrove roots are very complex and intertwined, resulting in a variety of benefits such as sediment accumulation, sea- and fresh-water filtration as well as salt absorption. Mangrove roots also create the ideal nursery for fish and shrimp by providing them with nutrients and safety. These roots also act as a great buffer to absorb tidal energy.

Mangrove wetlands attract migratory birds in winter, such as the greater flamingoes from Siberia. They are also home to about 14 different species of snakes in the Indus Delta. An interesting observation during fieldwork was also the presence of camels on isolated islands, left to graze on mangrove leaves until they were older and healthier. These are then sold for their meat or used for recreational rides at Karachi's beaches.



3.5.1 More-than-Human/ More-than-Urban
Ecology

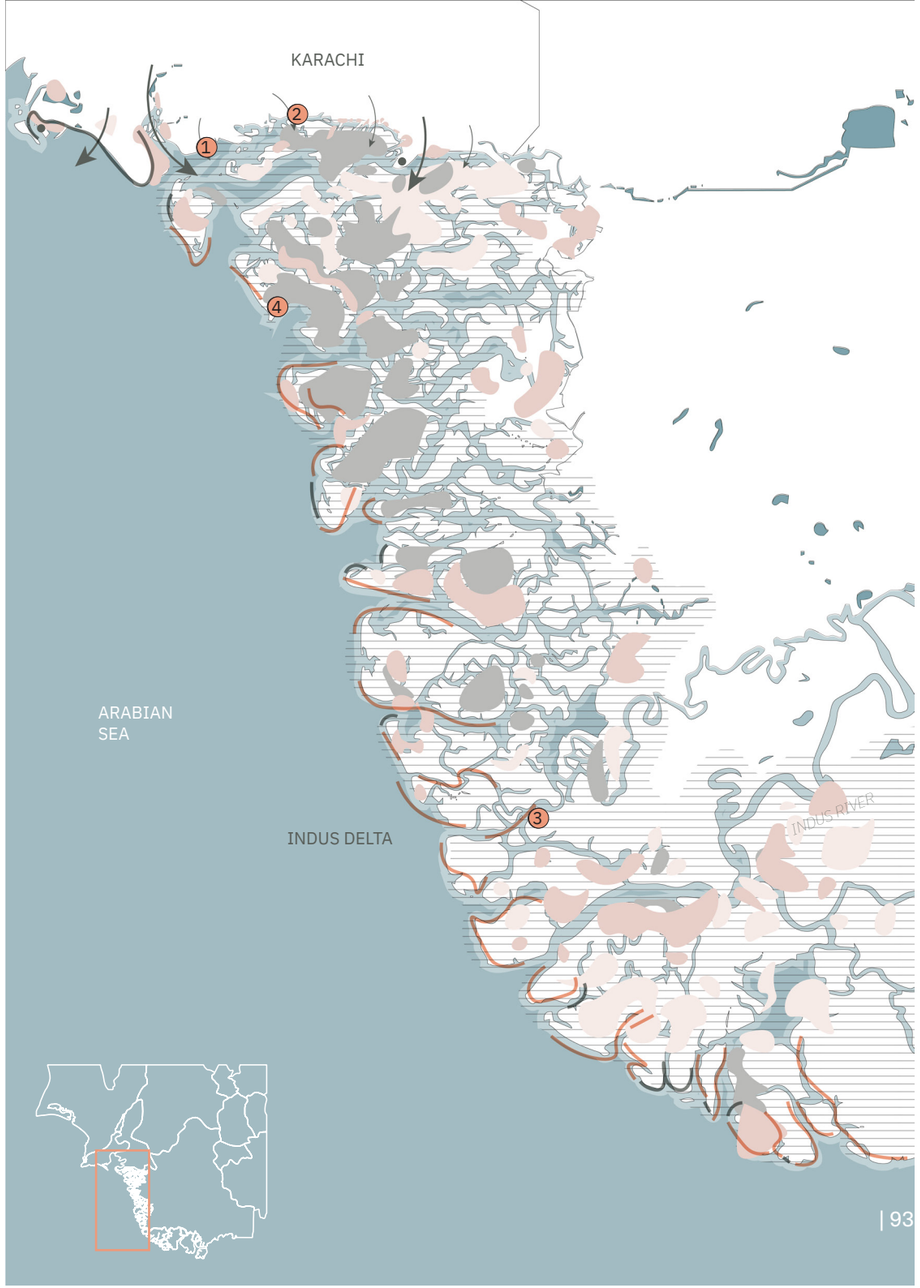
Mangrove forest cover has changed much recently in the last 10 years with regeneration efforts aiming to increase it. However, in many areas, even if the surface area matches that of the mangroves being replaced, the newer mangroves do not necessarily survive. They face challenges such as salinisation, seawater intrusion and these aspects stunt their growth after some time. Thus they are not always able to flourish into the densely connected mangrove forest ecosystems that we need to protect the shoreline.

Figure 33 (left):

Stunted growth of replanted mangroves in extremely saline and polluted soil.

Figure 34 (right):

Map of Western Indus Delta, showing changes in mangrove forests from 1990-2020.



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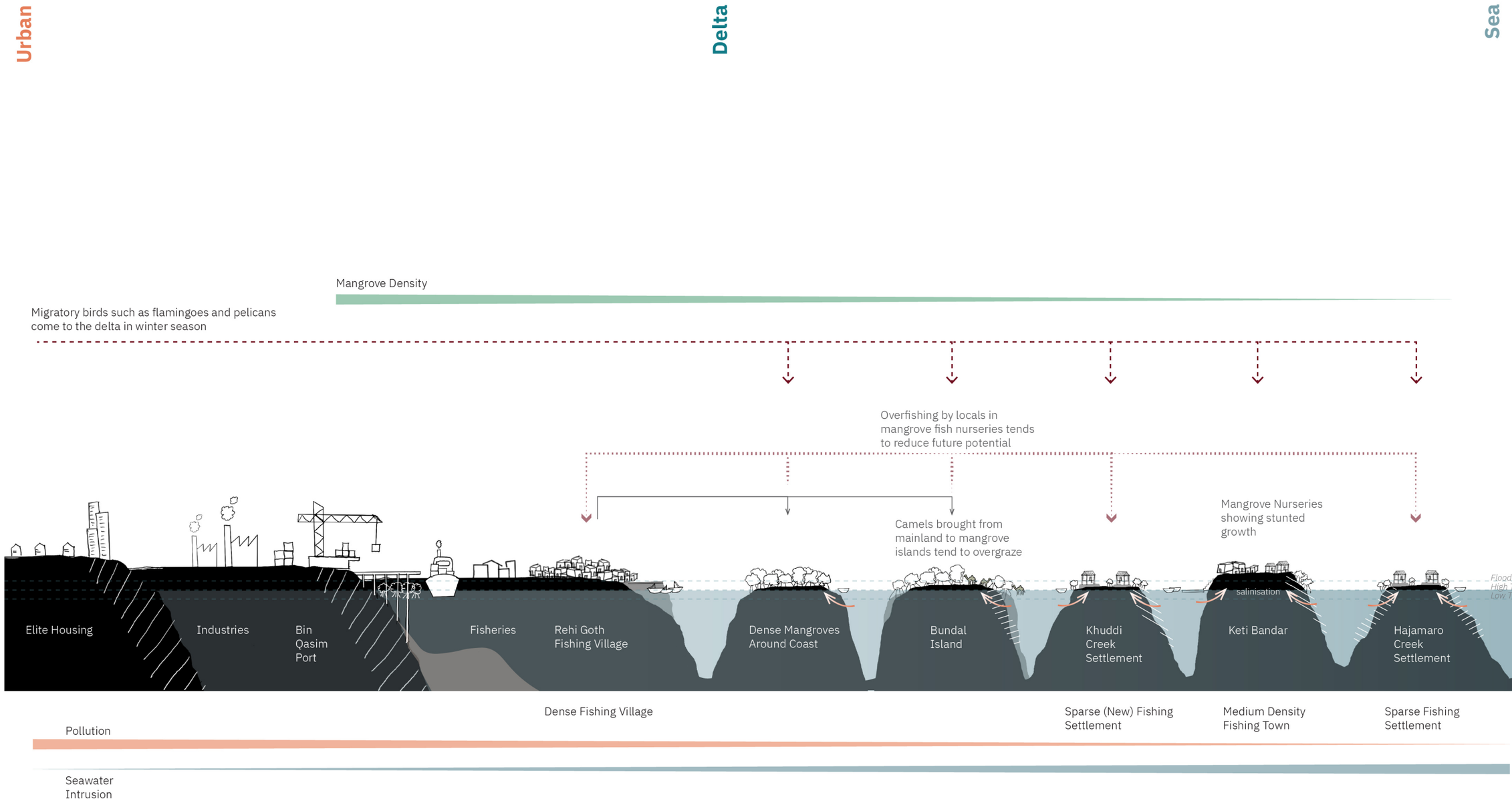


Figure 35:

Mangrove forests are densest closer to the coast of Karachi and become more sparse as we move away. These mangrove islands are a source of tourism, but also local livelihoods. Intensive commercial fishing has compromised the future fish populations, with the Palla fish now becoming almost extinct. This is exacerbated by increasing seawater intrusion.

3.5.2 Human/ More-than-Urban *Society*

The fishing villages at the coast of Karachi and beyond into the Indus delta, are very varied in their densities. Ibrahim Hyderi and Rehri Goth are very densely populated and historically significant fishing villages that existed before the city of Karachi itself. Keti Bandar is less populated, but still connected by road to Karachi and other parts of the country. This connection to local and global markets, and its elevated embankments, make it a popular destination to migrate to from the islands around it. Many residents I met had moves from nearby islands of Kharo Chan or Hajamaro Creek to Keti Bandar for safety from sea level rise and floods.

Another interesting finding from fieldwork was that, though there is a trend of migration away from remote islands to more secure and populated areas, there are also fisherfolk who are choosing to migrate away from Karachi's Rehri Goth to remote islands such as Khuddi Creek. This is due to there being no more space in Rehri Goth to lay out and dry fish and these remote fisherfolk, who migrated just 15 years ago, find remote island life much more convenient for fishing.

This gives great insight in how Karachi's capacity for growth is reaching its peak, and perhaps it is time to reflect and regenerate the delta so it's residents can return to their older homes.

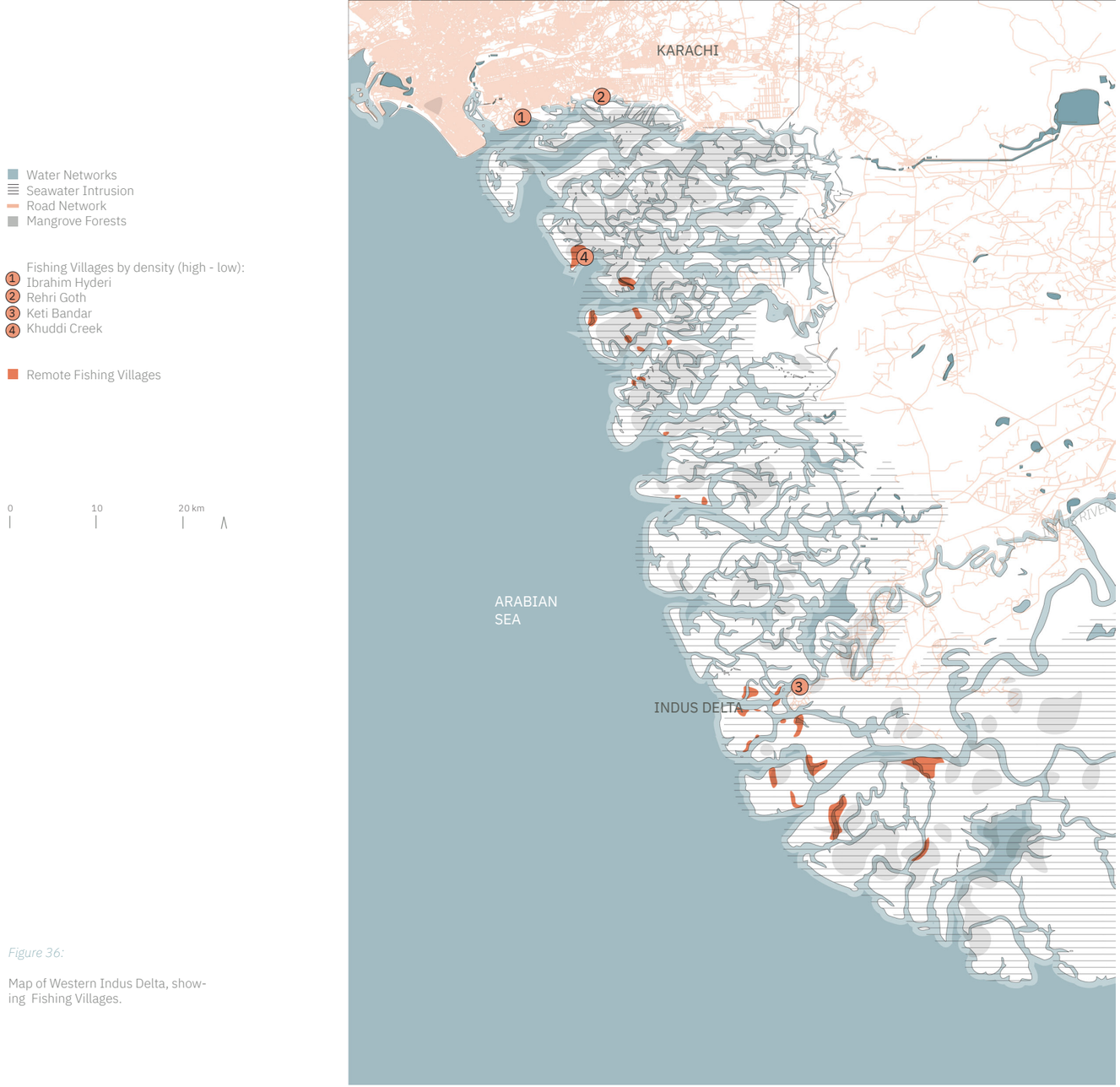


Figure 36:

Map of Western Indus Delta, showing Fishing Villages.

3.5.2 Human/ More-than-Urban
Society

Rehri Goth

Keti Bandar

Khuddi Creek

Dense Urban Village

Small cluster of homes

Keti Bandar

Khuddi Creek

Rehri Goth

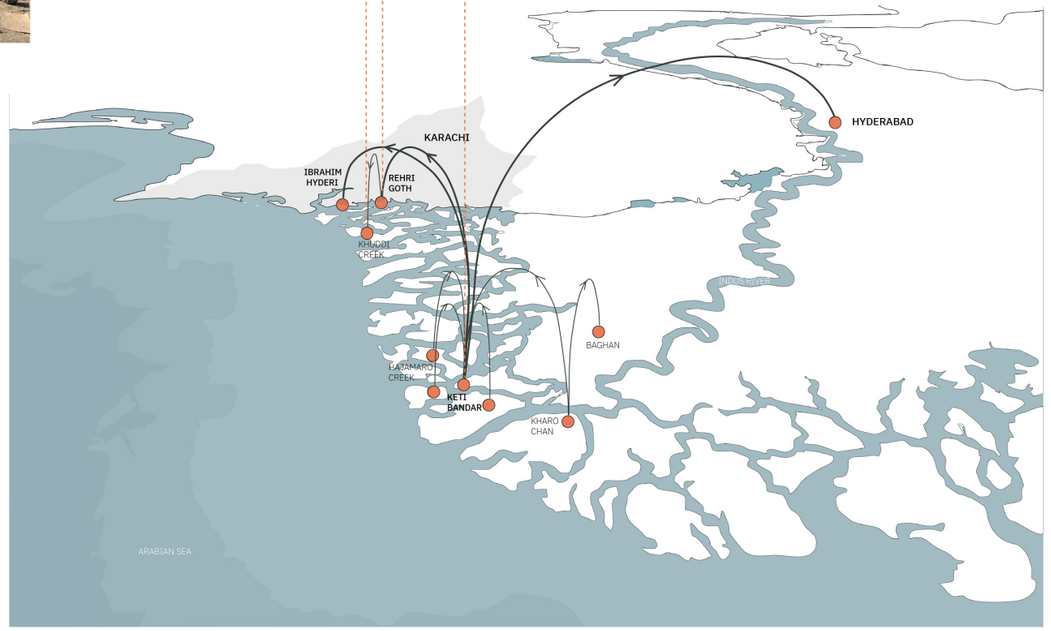


Figure 37:

Gradation of housing densities and related internal migration to and from the delta.

Urban

Delta

Sea

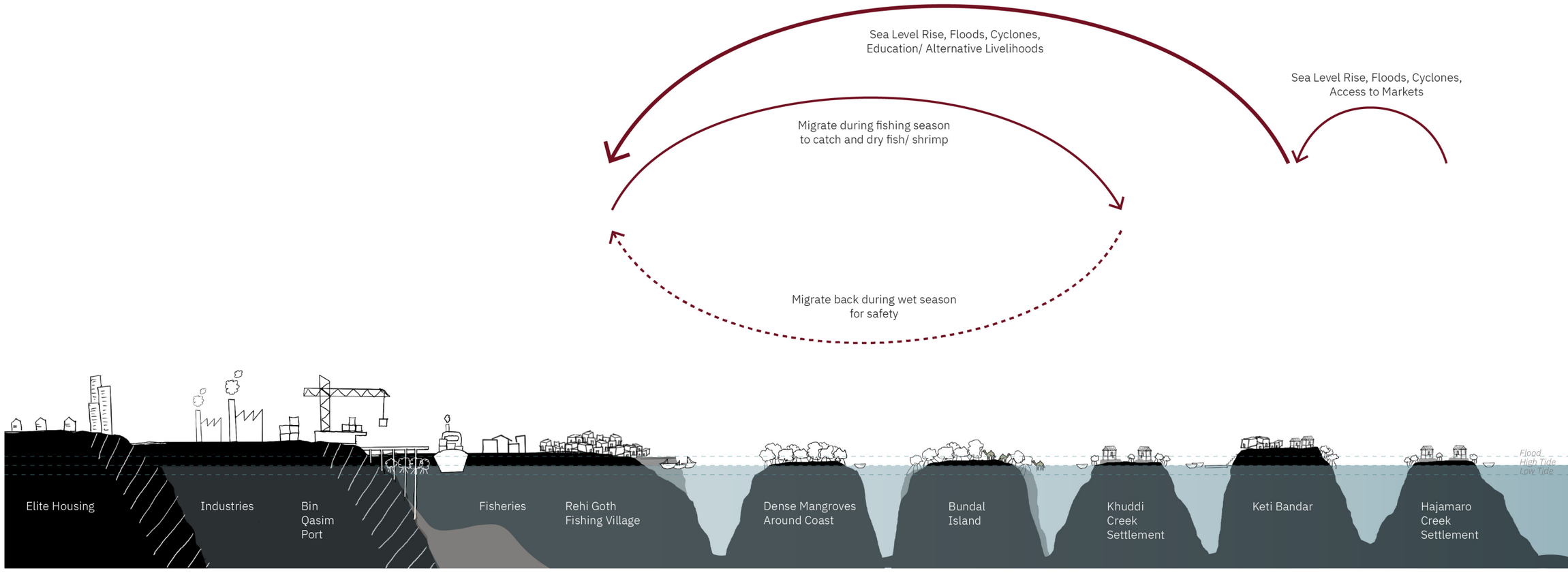


Figure 38:

Reasons for Migration between the Indus Delta and Karachi. It is interesting to note that there is a recent trend of informal migration back to the Delta's remote islands due to lack of space at the Karachi coast for functions such as drying fish.

3.5.2 Human/ More-than-Urban

Society - Remote Fishing Settlement at Khuddi Creek

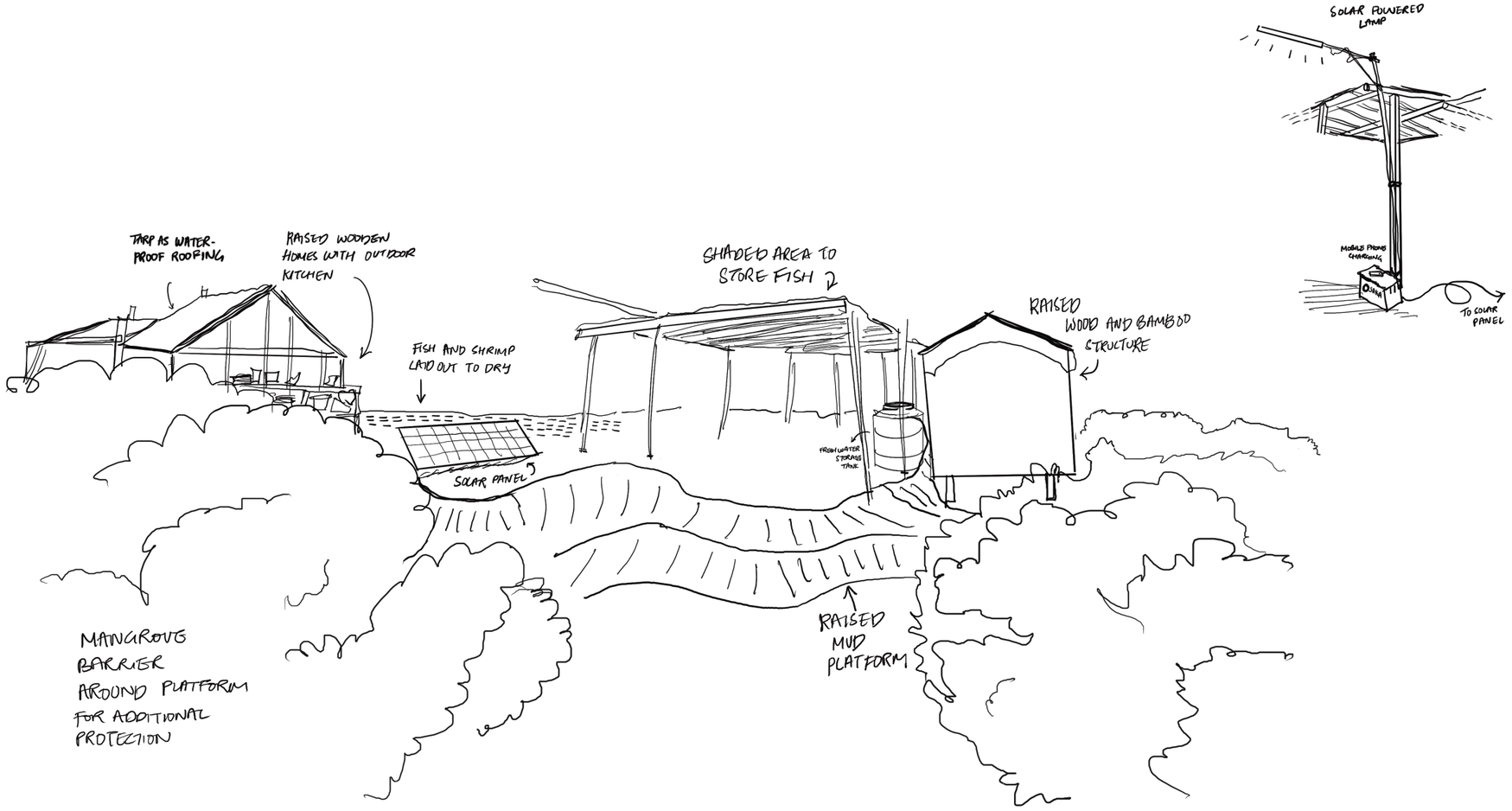


Figure 39:

Housing in Khuddi Creek on raised platforms and stilts, showing how people adapt in ways formal planning rarely acknowledges.

3.5.3 Human/ Urban
Economy

Not only is Karachi already short of the freshwater supply it requires to sustain its population, but it also deposits its wastewater from households and industries directly into the Indus Delta and the Sea. This pollution severely threatens the health of coastal human populations along with more-than-human mangrove populations.

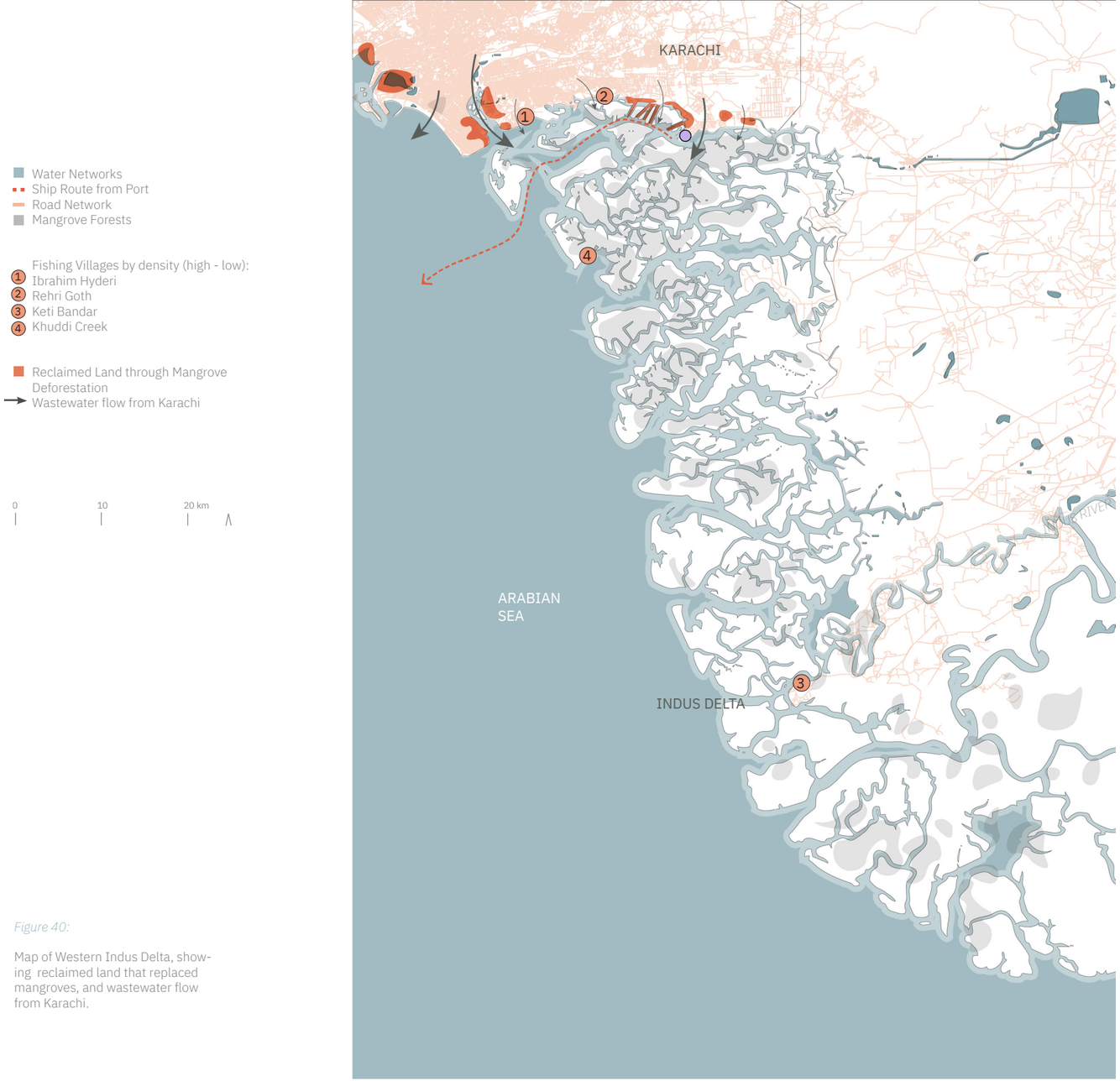


Figure 40:

Map of Western Indus Delta, showing reclaimed land that replaced mangroves, and wastewater flow from Karachi.

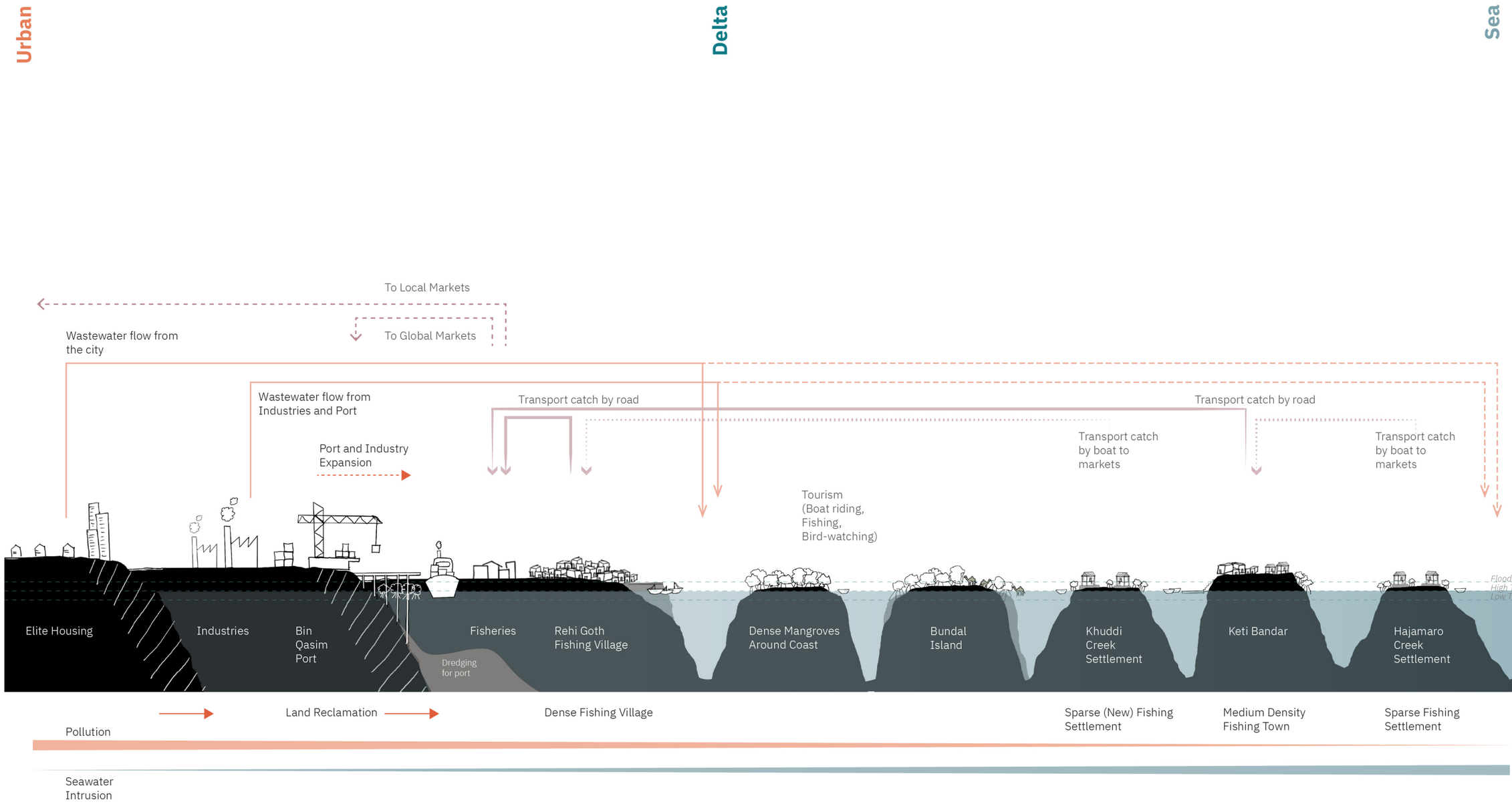


Figure 41:

The western part of the Indus Delta is an economic hub where karachi's Korangi Industrial area and Bin Qasim port meet the fishing villages of Ibrahim Hyderi, Rehri Goth and other more remote fishing settlements on tidal creeks. This also results in land being reclaimed for economic benefit, and mangrove forests are lost in this process.

3.5.4 Mangroves as the Core of the Delta

This diagram is a synthesis of the three lenses and how they all depend directly or indirectly on mangrove ecosystems to survive. This shows how mangroves have the potential to turn the narrative around and become the tool for transformation.

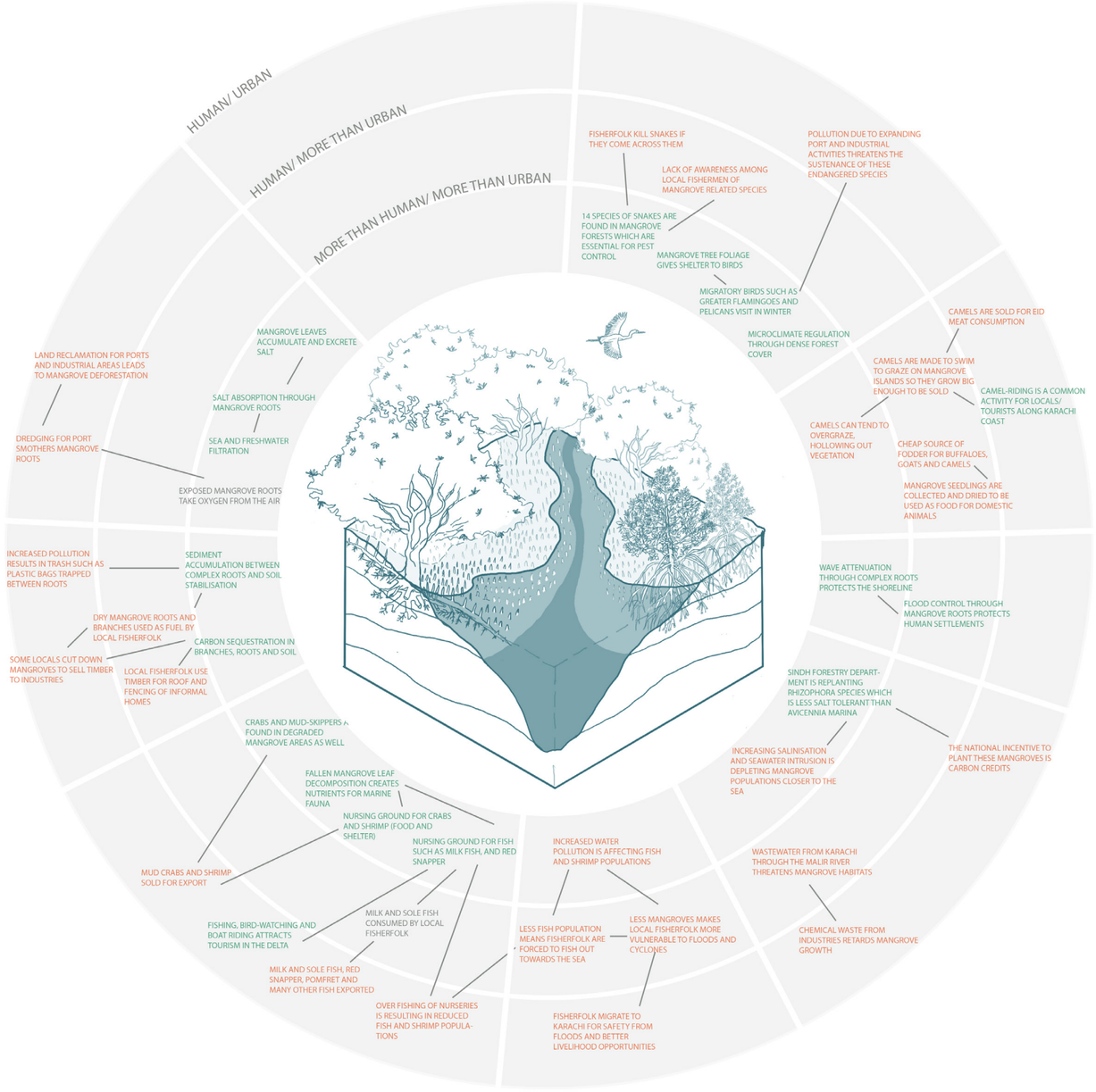


**Figure 42: Children watching boats leave the jetty at Ibrahim Hyderi Fishing Village, as recreation.
With not many alternative occupations in the village, many boys train to become fishermen when they grow up.**

4.1.1 Case Studies - Local
Existing Relationship With Mangroves

RECREATION

Fishing Tours by Local Fisherfolk (Source: khanaymeikyahai)

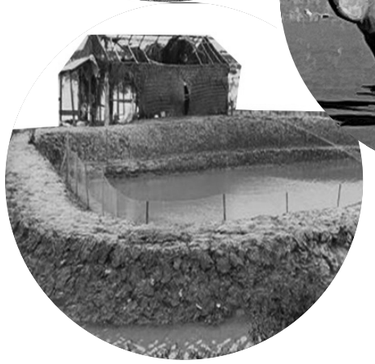
Mangrove Biodiversity Park, Karachi (2024) by TPL (Source: TPL Website)

PRESERVATION

Local Replantation Efforts (Source: Arab News)

Environmental Activists on Social Media (Source: Shah Mehran)

PRODUCTION



Local fishing practices (Source: M. Hussain Khan)

IUCN Shrimp Aquaculture Project - Bottom-up Initiative, Indus Delta. (Source: IUCN)

4.1.2 Case Studies - Global:

Khulna, Bangladesh – Water-Inclusive Urbanism
(Defacto Architecture and Urbanism, 2019)

A city-scale approach advocating for integrated water-sensitive planning. It emphasizes the value of mangrove ecosystems for economic uplift and ecological resilience, calling for stronger policy frameworks to support change at local and national levels.

Pacific Reef Fisheries, Australia – Mangrove-Based Filtration in Aquaculture
(ASC – Aquaculture Stewardship Council)

Uses naturally occurring mangrove systems around aquaculture farms for low-energy water filtration. This approach promotes self-seeding, macroalgae-based purification, and sustainable farming practices within a coastal ecosystem.

UNDP Timor-Leste – Low-Cost DIY Water Filtration

A grassroots innovation lab that developed simple, locally sourced filtration units using materials like sand, coal, and gravel to turn rainwater into potable water. This case shows how decentralized, community-driven technology can improve water access in vulnerable areas.

Mombasa, Kenya – Community-Led Mangrove Restoration
(EarthLung's Mteza Creek Project)

Focuses on empowering coastal communities through mangrove restoration to create biodiversity-rich estuaries, improve fishery productivity, and generate alternative incomes. The initiative supports local stewardship and poverty alleviation.

Jakarta, Indonesia – Economic Incentives for Mangrove Replanting

A small-scale initiative providing livelihood opportunities to locals through mangrove replantation, aligning environmental restoration with economic benefit.

Demak, Indonesia – Permeable Structures for Sediment Capture
(Nanang Sujana)

Local-scale intervention using bamboo fences to trap mud and restore degraded mangrove coastlines, illustrating nature-based engineering for shoreline stabilization.

Deltares Report, 2022 – Climate Adaptations in Salinised Landscapes

A strategic planning reference illustrating integrated water management solutions in salinised deltas, including rainwater harvesting, brackish water reuse, and nature-based infrastructure.

4.1.2 Case Studies - Global:

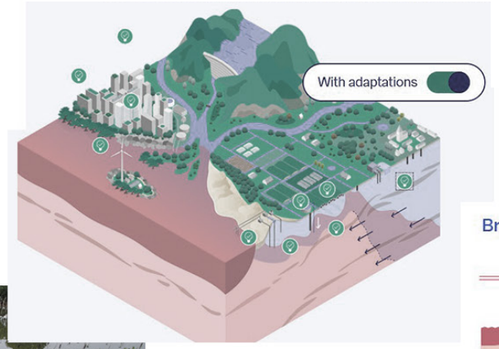
L-SCALE

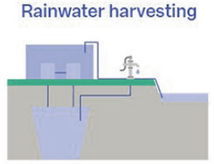
Permeable structures to trap mud to help with mangrove restoration, Nanang Sujana, Indonesia.

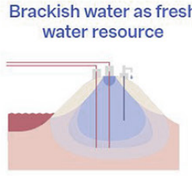
Pacific Reef Fisheries, Australia by ASC

Khulna as a water inclusive enclave. (2019). Defacto Architecture and Urbanism.

M-SCALE







Deltares Report on Salinisation, 2022.

Economic incentive for mangrove re-plantation for locals, Jakarta.

UNDP Timor-Leste Accelerator Lab

S-SCALE

Figure 43:

Case Studies on L-,M- and S-scales, from other parts of the world.

4.2 Defining Networks of Care

This project employs a scenario-based methodology grounded in the central question: “What do the mangroves need?” This ecological perspective serves as the foundation for the design of three networks, each addressing a distinct layer of the mangrove habitat: soil, water, and anthropogenic waste. Rather than treating these layers in isolation, the methodology frames them within the broader interrelated systems of the sea, the delta, and the city, highlighting the complexity of deltaic ecologies and how they are influenced by external forces.

Each *Network of Care* is aligned with a specific role:

Recreation:
Exploring greater permeability within the dense, built environment of the city through water and land-use, and integrating mangroves as an important part of public function through urban parks.

Preservation:
By increasing freshwater flow to the delta, reducing agricultural dependency and highlighting mangrove conservation zones within the delta, the potential for biodiversity and regeneration through protection is explored.

Production:
Exploring Agricultural production in the delta as a gradient from saline to brackish to freshwater zones, and implementing eco-farming practices. This embraces a more saline future for the delta and optimises mangrove growth through greater local involvement.

Together, these scenarios form a regenerative framework in which mangroves are not passive environmental elements but adaptable ecological and socio-economic agents. The methodology promotes their integration into urban and deltaic flows, creating greater incentives and conditions for shared stewardship where the well-being of communities is deeply connected to the health of the ecosystem.

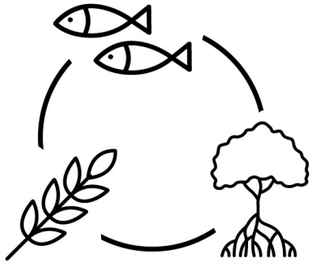
RECREATION

Reconnecting mangroves with urban life.

PRESERVATION

Restoring natural flows and sedimentation processes.

PRODUCTION



Creating adaptive livelihoods through agricultural gradients.

4.2.1 Existing Condition

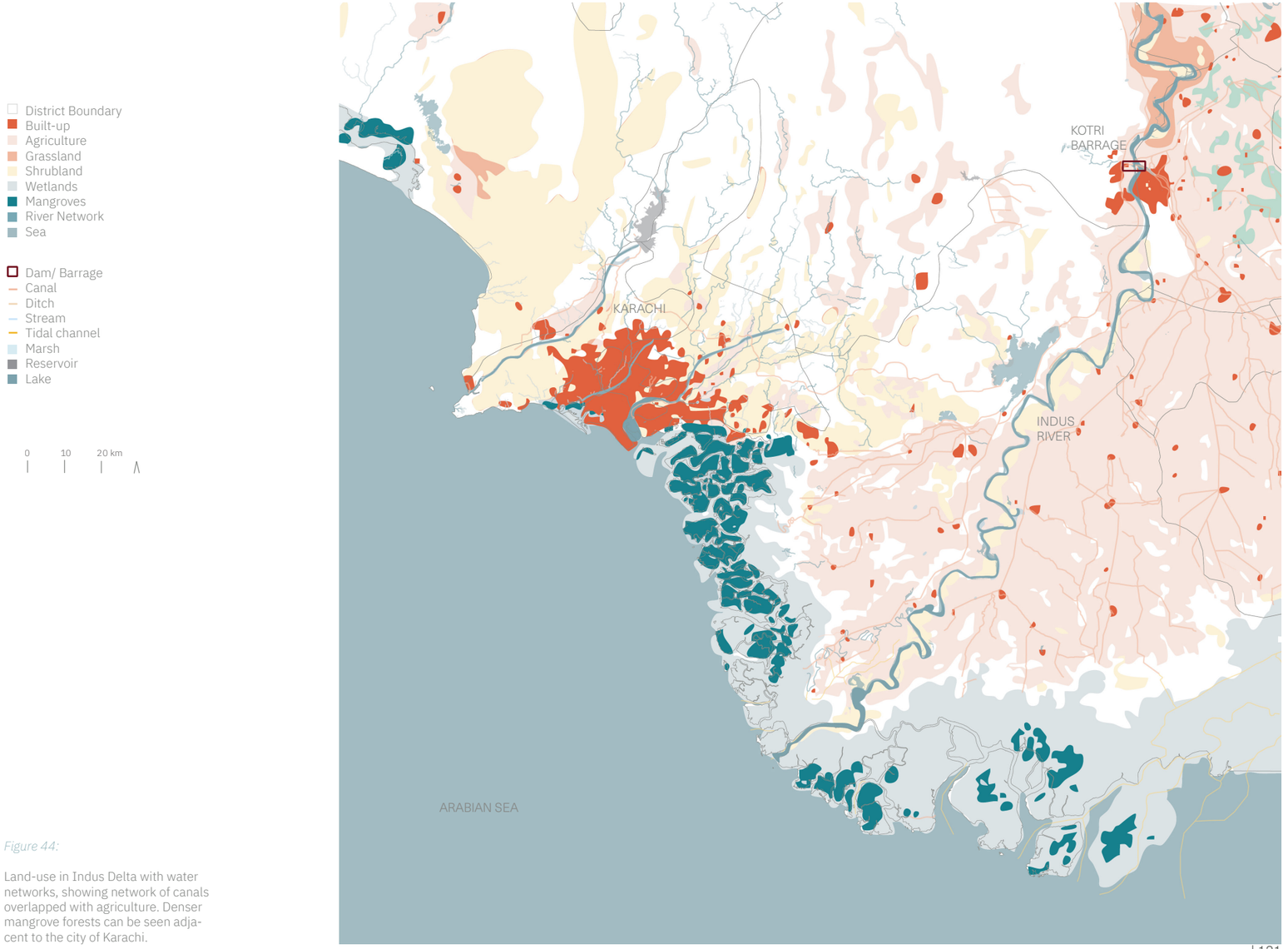


Figure 44:

Land-use in Indus Delta with water networks, showing network of canals overlapped with agriculture. Denser mangrove forests can be seen adjacent to the city of Karachi.

4.2.2 Network of Recreation
Strategic Delta Plan

In this network, the role of mangroves as urban parks is explored by integrating mangroves more with the existing stormwater drains and the Malir River. This leads to a shift in coastal development, attracting more towards the periphery. The existing streams from Malir river that drain into the Delta are widenend to allow more room for water to flow, and their embankments are made more permeable with vegetation. Not only does this serve as a recreational space but also mitigates floods by increasing the permeability of the city. The waste from the city is separated and water is treated before flowing into the delta. This waste management, along with boosting eco-tourism, creates new potential for local economy to flourish.

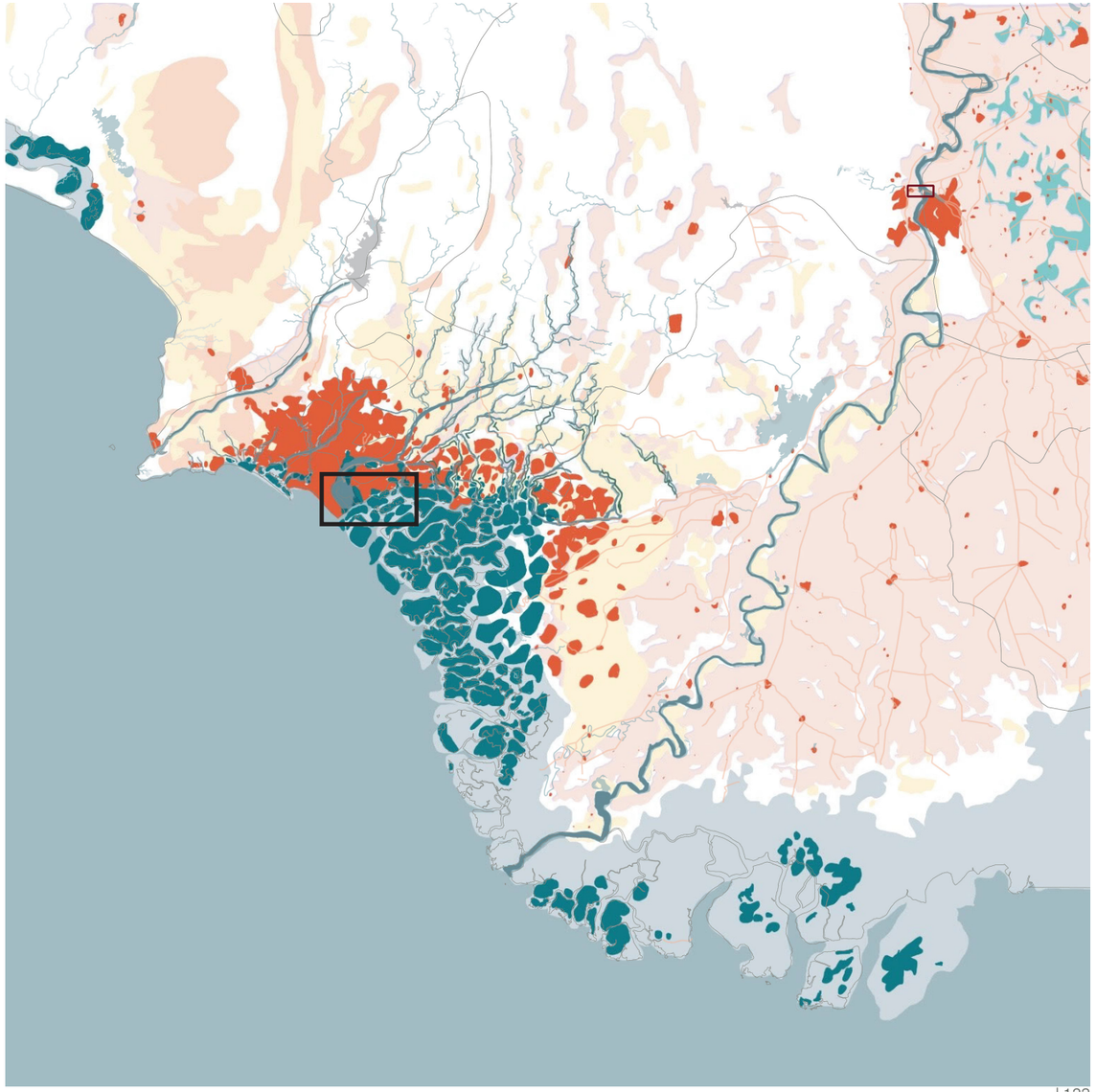


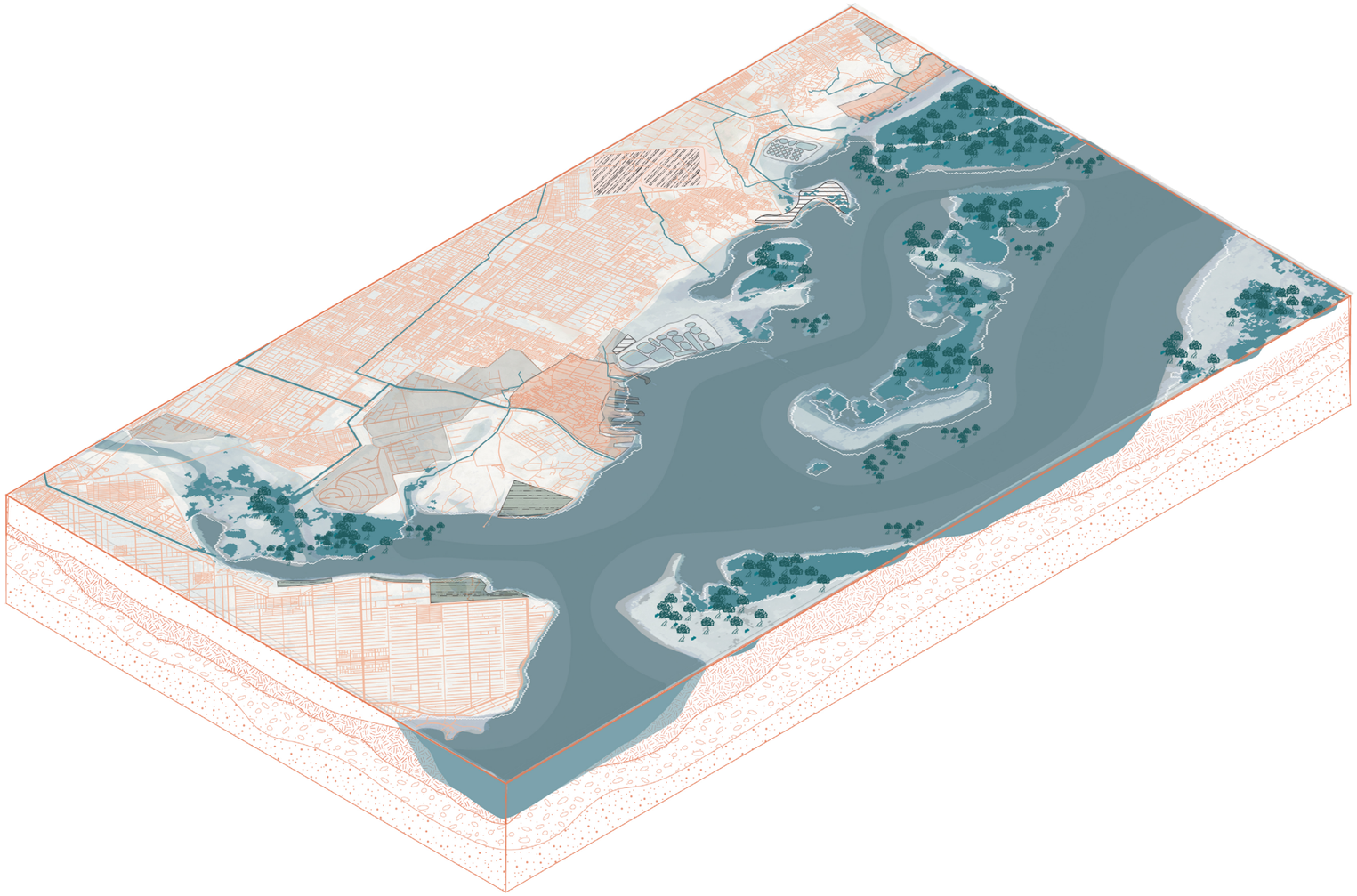
Figure 45:

Delta Strategy for Recreation Scenario.

4.2.2 Network of Recreation

Zoom-in Area 1: Karachi Coast and Delta - Existing

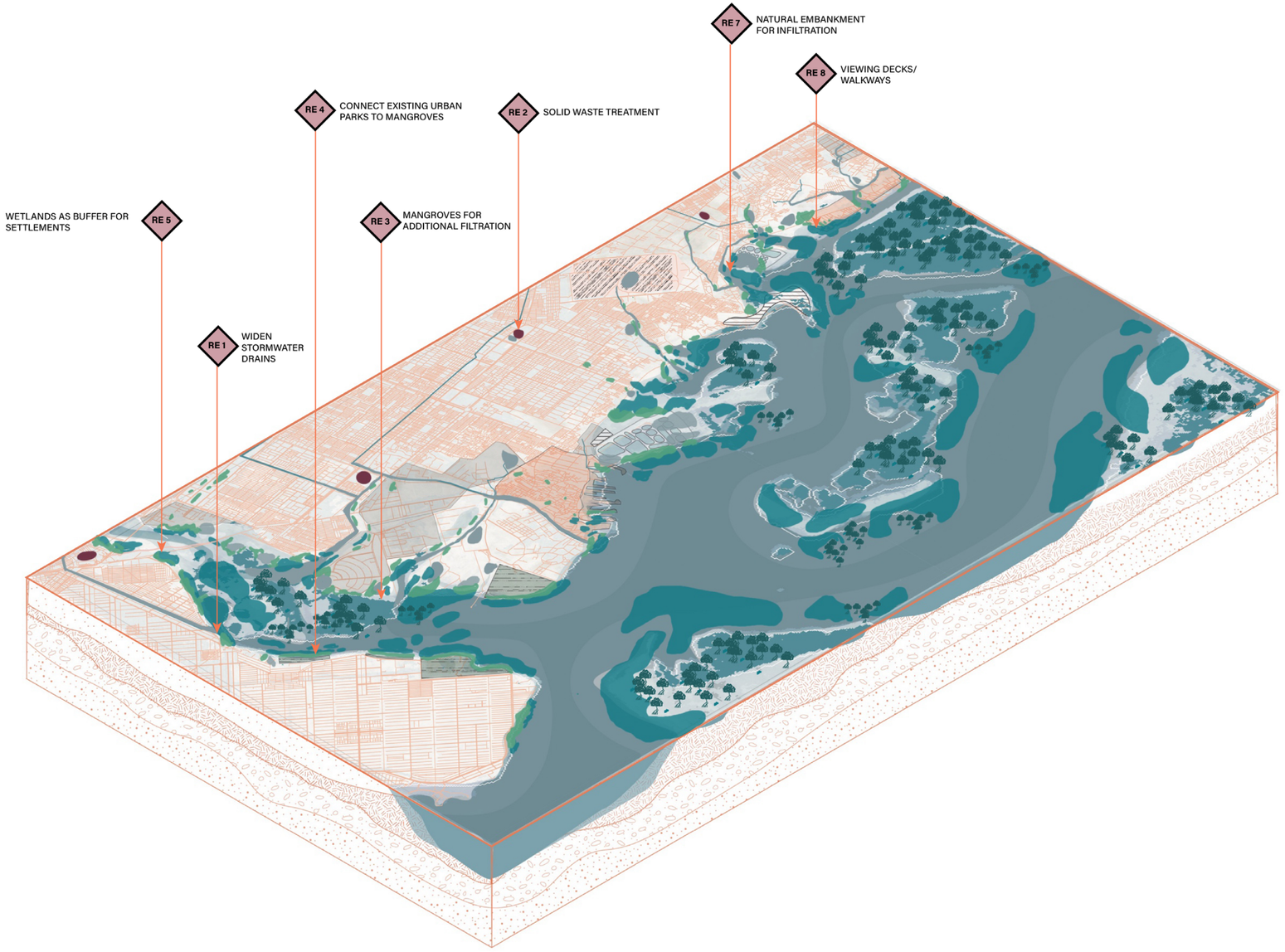
The focus area is the dense edge of Karachi with its residential and industrial hubs and the Malir River that drains from Karachi into the Indus Delta. This is to explore the potential of widening stormwater drains and integrating mangroves more with the urban fabric as essential public spaces. These not only improve access to green and blue areas but also cool down the city's rising heat island effect.



- River steam and tidal creeks
- Mangroves
- Wetland
- Bareland
- Agriculture
- Existing Park/ Golf Course
- Roads
- Stormwater Drains
- Industries
- Fishing Villages
- Fisheries
- Salt farms

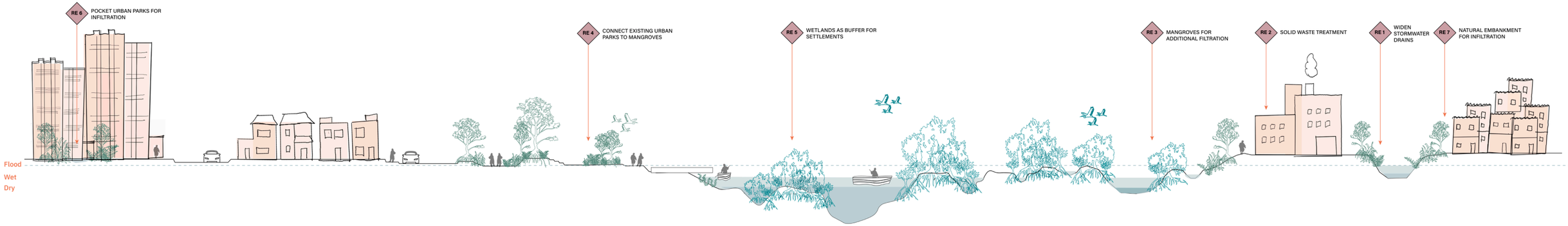
4.2.2 Network of Recreation

Zoom-in Area 1: Karachi Coast and Delta - Proposal

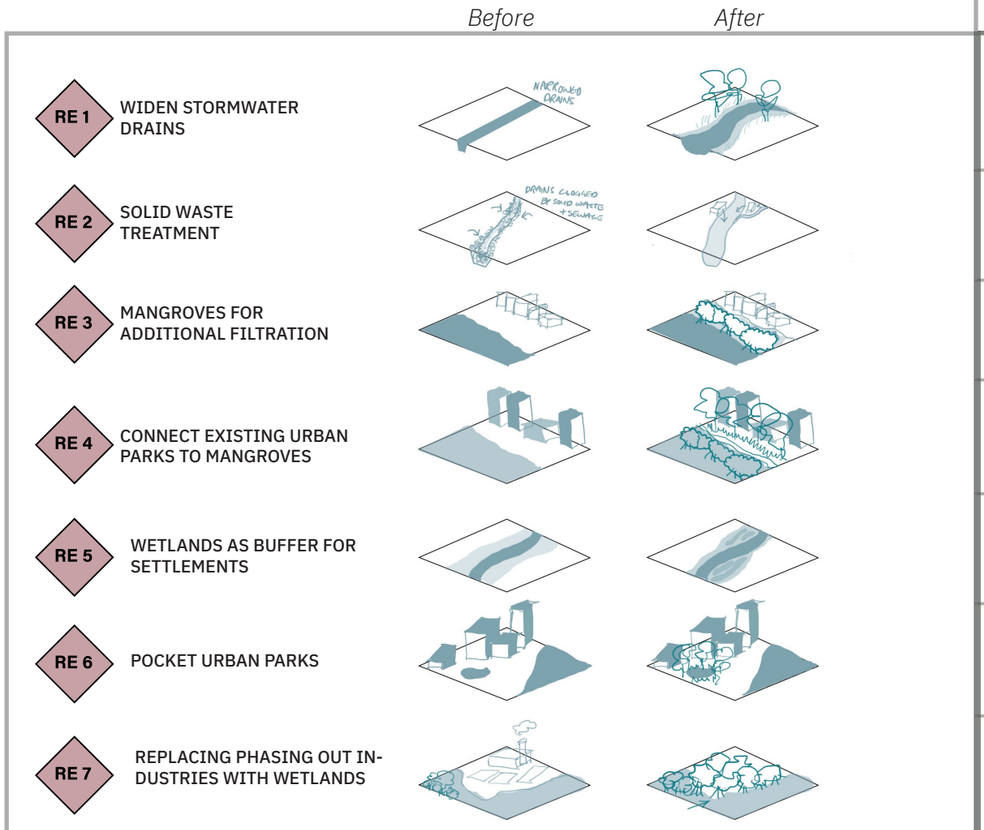


- River steam and tidal creeks
- Mangroves
- Wetland
- Bareland
- Agriculture
- Existing Park/ Golf Course
- Roads
- Stormwater Drains
- Industries
- Fishing Villages
- Fisheries
- Salt farms

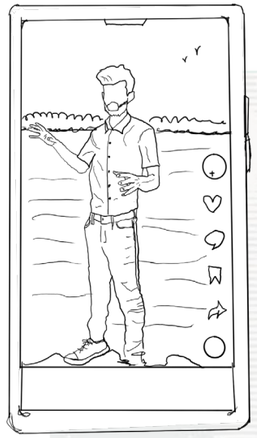
4.2.2 Network of Recreation
Typology Section



4.2.2 Network of Recreation
Toolkit of Strategies - Evaluation



	Ecological					Social					Economic				
	INCREASED BIODIVERSITY	IMPROVED SOIL HEALTH	IMPROVED WATER RETENTION / INFILTRATION	PROPER WASTE MANAGEMENT	INCREASED MANGROVE GROWTH	ACCESS TO CLEAN WATER	FOOD SECURITY	ACCESS TO GREEN-BLUE SPACES	FLOOD MITIGATION	INCREASE AWARENESS OF MANGROVES	INCREASED EMPLOYMENT OPPORTUNITY	IMPROVED LOCAL ECONOMY	INCREASED USE OF RENEWABLE ENERGY	REDUCED FLOOD-RELIEF EXPENSES	INCREASED ECO-TOURISM
RE 1	●	●	●	○	○	○	○	●	●	○	○	○	○	●	○
RE 2	○	●	●	●	●	●	○	○	●	○	●	●	○	●	○
RE 3	●	○	●	○	○	●	●	●	●	●	●	○	○	●	●
RE 4	●	●	●	○	○	●	○	●	●	●	●	○	○	●	●
RE 5	●	●	●	○	●	○	○	●	●	●	○	○	○	●	○
RE 6	●	●	●	●	○	●	○	●	●	○	○	●	○	●	○
RE 7	●	○	●	○	●	○	●	●	●	●	○	○	●	●	○



I have observed a greater variety in bird species near the city than before.

My kids and I now have access to cleaner public spaces that also keep our neighbourhood cool and shaded.

I can now enjoy my breaks in the mangrove park next to the creek.

Due to proper waste management, I can breathe and flourish in a cleaner environment.

Mangroves have grown denser around the city, increasing our catch.

I can play with my friends safely in cleaner water.

4.2.3 Network of Preservation

In this network, the role of mangroves as facilitators in expanding the footprint of the delta is explored, as they trap sediments. The Kotri barrage is demolished and water is allowed to flow naturally to the delta, keeping its path before the barrage's construction in mind. Emphasis is laid on conservation and expansion of mangrove forests and agricultural production is reduced. Floodplains provie water in dry season to the remaining agricultural land. The city grows even more as the delta experiences a further migration from rural to urban areas, expanding inland. This is deemed necessary for mangrove rehabilitation and fishing is also allowed only in designated zones.

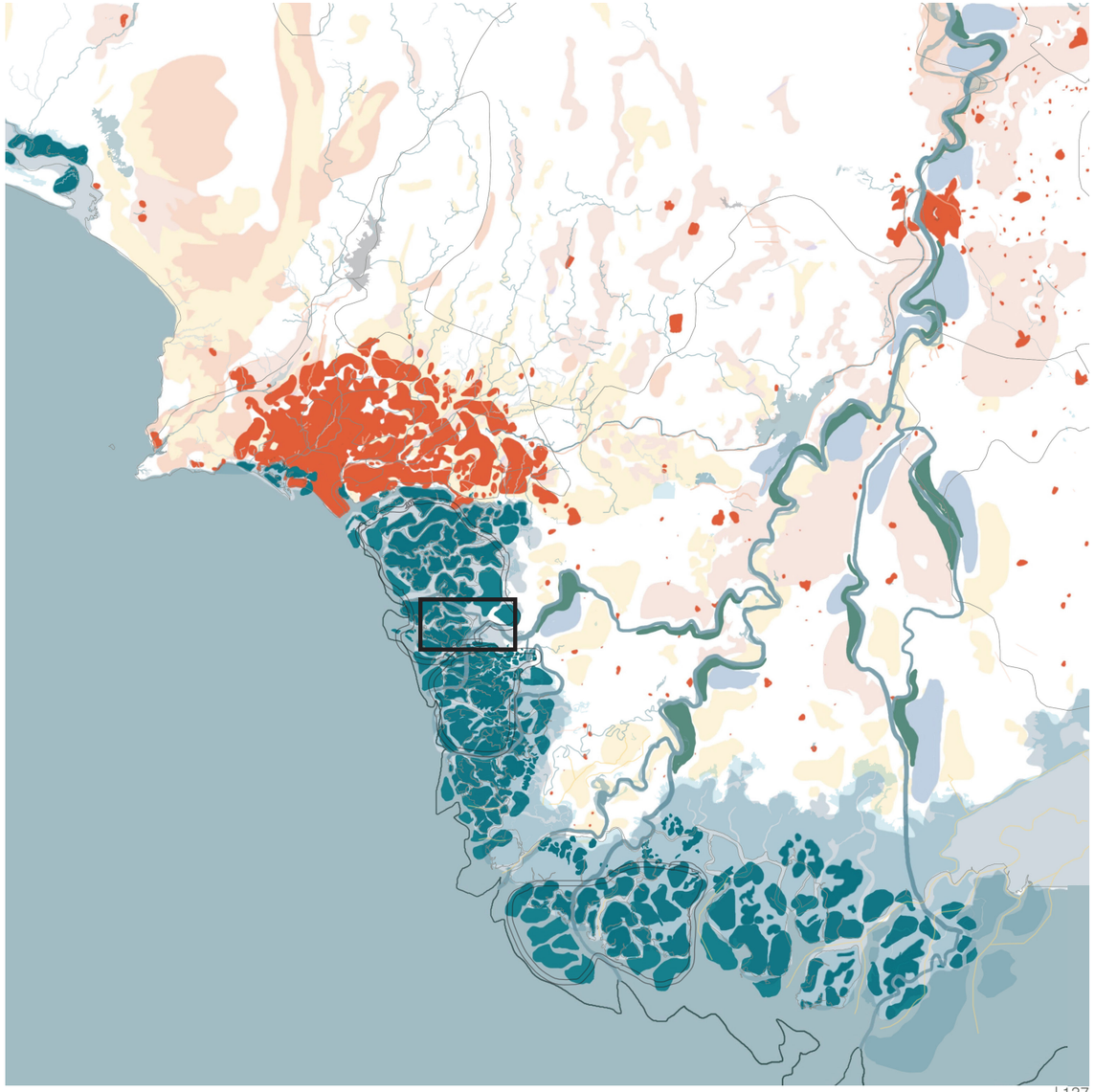


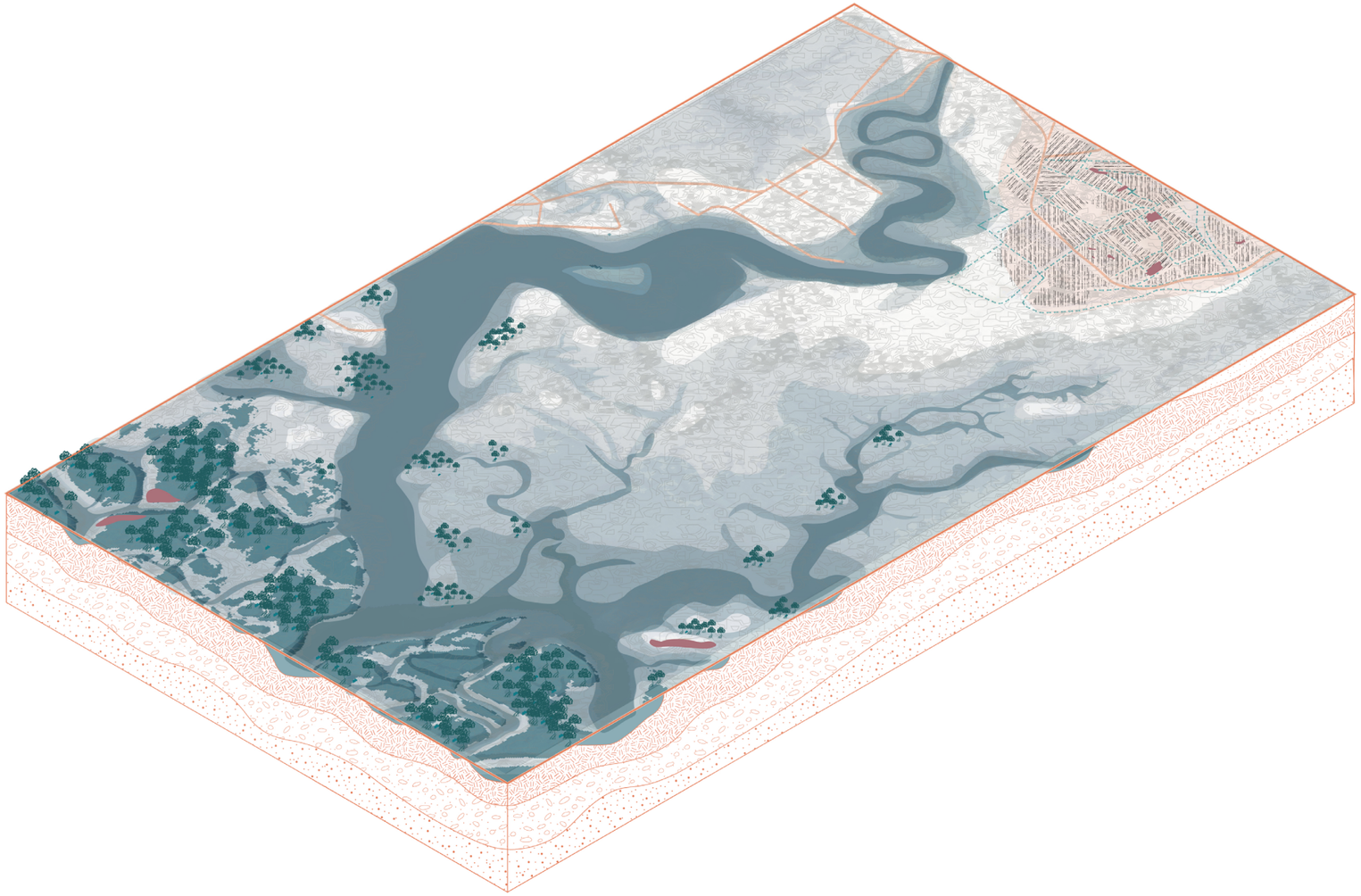
Figure 46:

Delta Strategy for Preservation Scenario.

4.2.3 Network of Preservation

Zoom-in Area 2: Remote Settlements - Existing

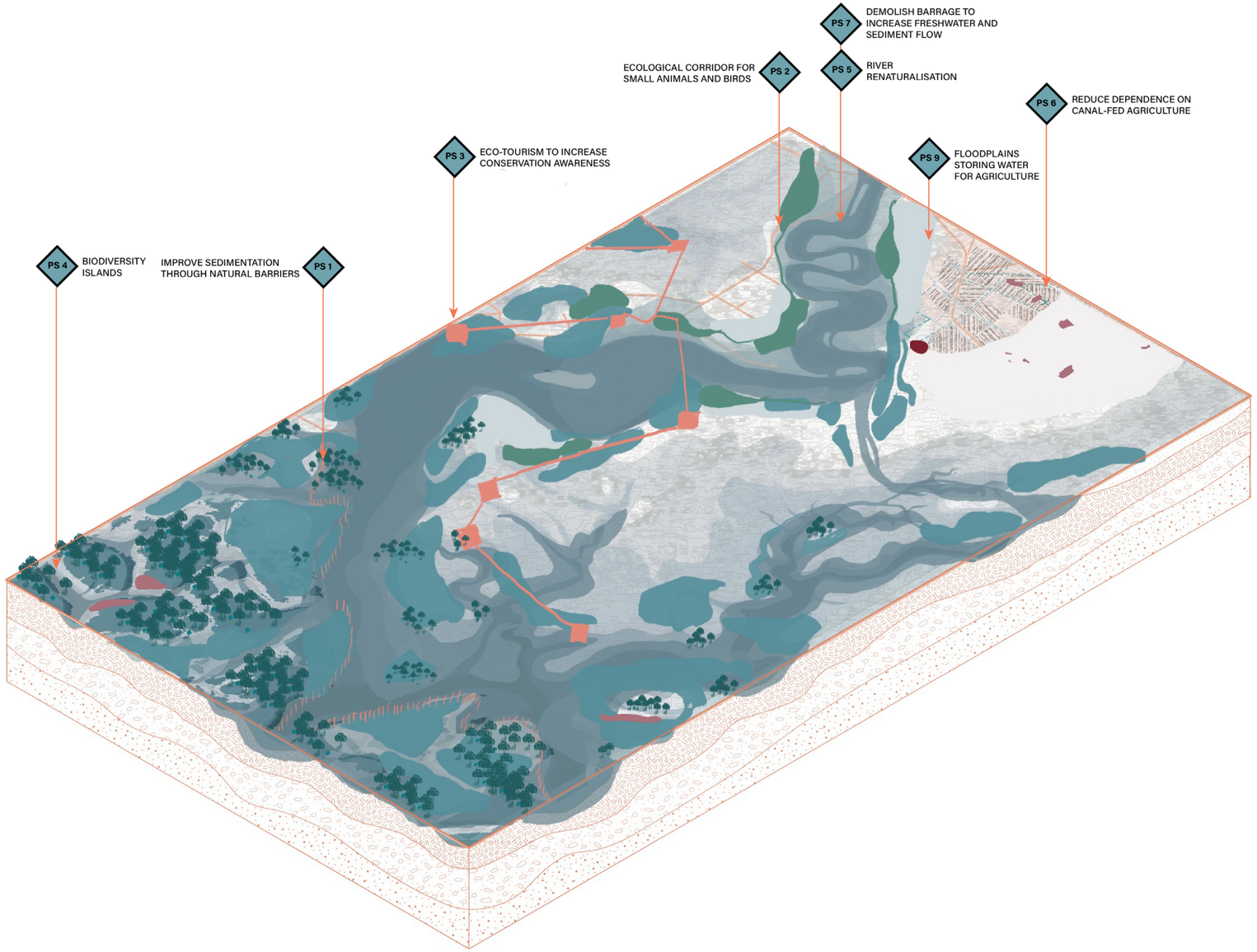
The zoom-in focus of this scenario is on an additional branch of the Indus River, formed after the barrage was demolished and based on how it used to exist in 1950 in the same region. This is also an area which was prone to flooding, with minimal agricultural settlements.



River steam and tidal creeks
Mangroves
Wetland
Bareland
Agriculture
Settlements
Roads
Canals

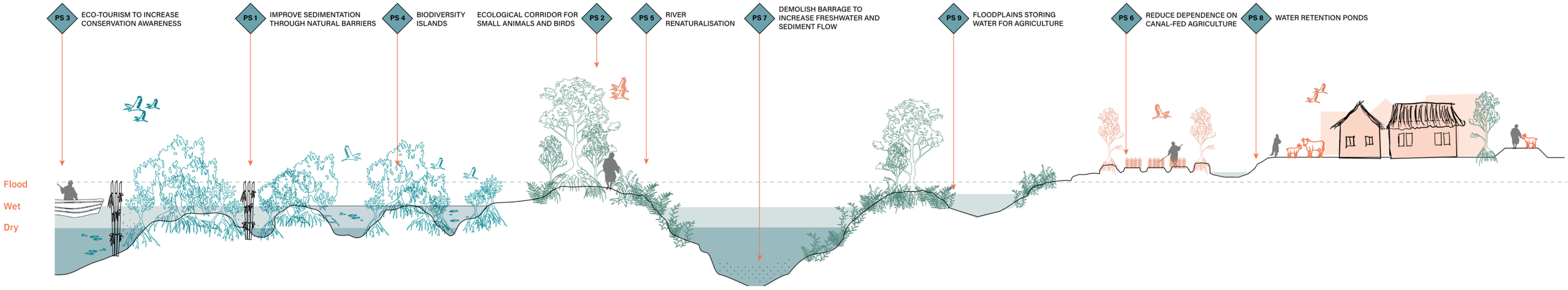
4.2.3 Network of Preservation

Zoom-in Area 2: Remote Settlements - Proposal

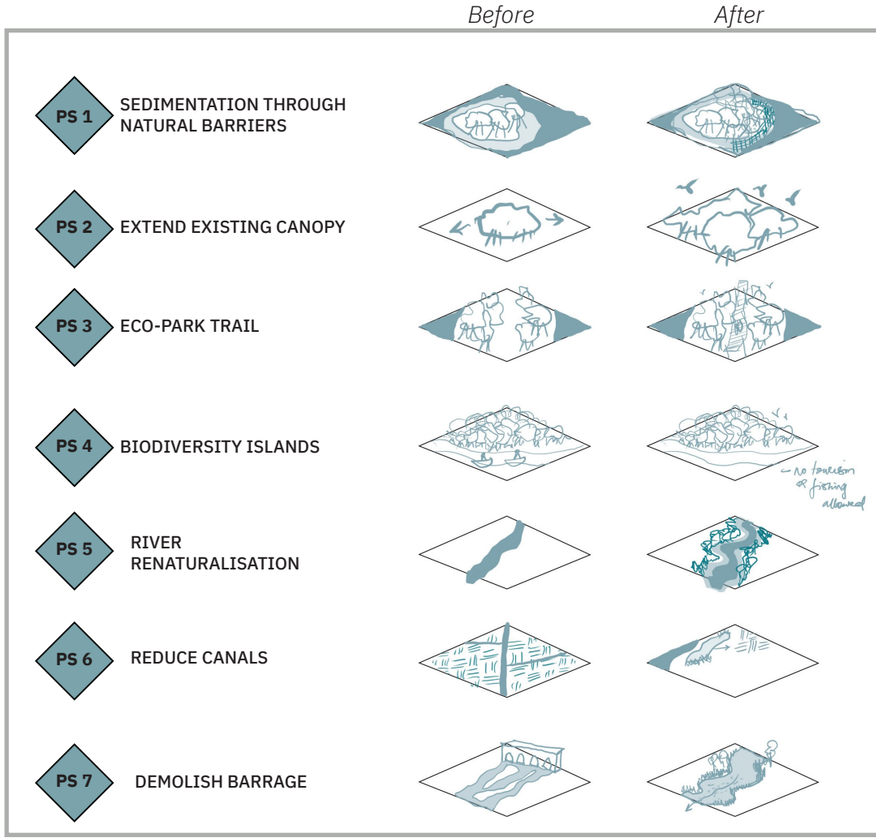


- River steam and tidal creeks
- Mangroves
- Wetland
- Bareland
- Agriculture
- Settlements
- Roads
- Canals

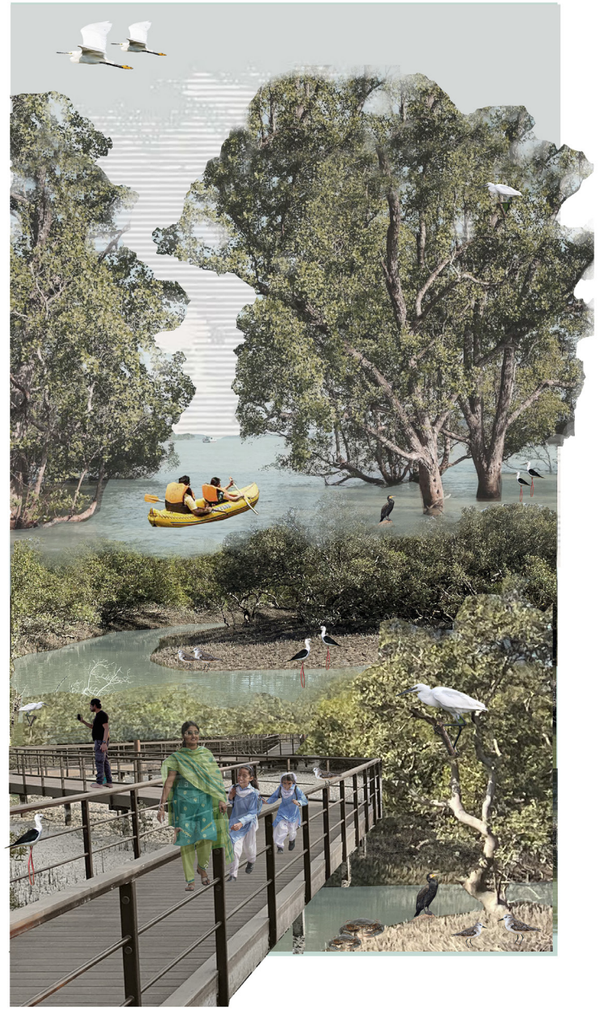
4.2.3 Network of Preservation
Typology Section



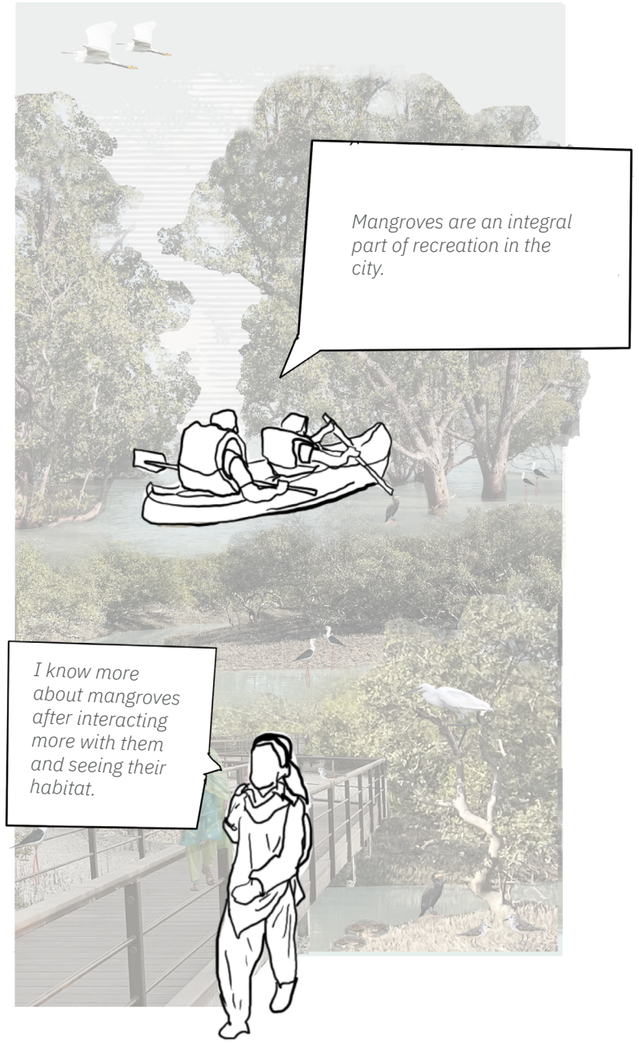
4.2.3 Network of Preservation
Toolkit of Strategies - Evaluation



	Ecological					Social					Economic				
	INCREASED BIODIVERSITY	IMPROVED SOIL HEALTH	IMPROVED WATER RETENTION / INFILTRATION	PROPER WASTE MANAGEMENT	INCREASED MANGROVE GROWTH	ACCESS TO CLEAN WATER	FOOD SECURITY	ACCESS TO GREEN-BLUE SPACES	FLOOD MITIGATION	INCREASE AWARENESS OF MANGROVES	INCREASED EMPLOYMENT OPPORTUNITY	IMPROVED LOCAL ECONOMY	INCREASED USE OF RENEWABLE ENERGY	REDUCED FLOOD-RELIEF EXPENSES	INCREASED ECO-TOURISM
PS 1	●	●	●	○	●	○	●	○	●	○	●	●	○	●	○
PS 2	●	●	○	○	●	○	●	○	●	○	○	●	○	●	●
PS 3	○	○	○	○	●	○	○	●	○	●	●	●	○	○	●
PS 4	●	●	○	○	●	○	○	○	○	●	●	○	○	●	●
PS 5	●	●	●	●	●	○	○	●	●	○	○	○	○	●	○
PS 6	○	●	●	●	●	○	○	○	●	●	○	○	○	●	○
PS 7	●	●	●	○	●	●	○	○	●	●	○	○	○	●	●



4.2.3 Network of Preservation | *Stakeholder Impact*



4.2.4 Network of Production

In this network, the role of mangroves in agricultural production is explored. A gradient from saline to brackish to freshwater determines type of crop. This integration helps increase the value of mangroves with multiple stakeholders, ensuring a shared responsibility for their well-being.

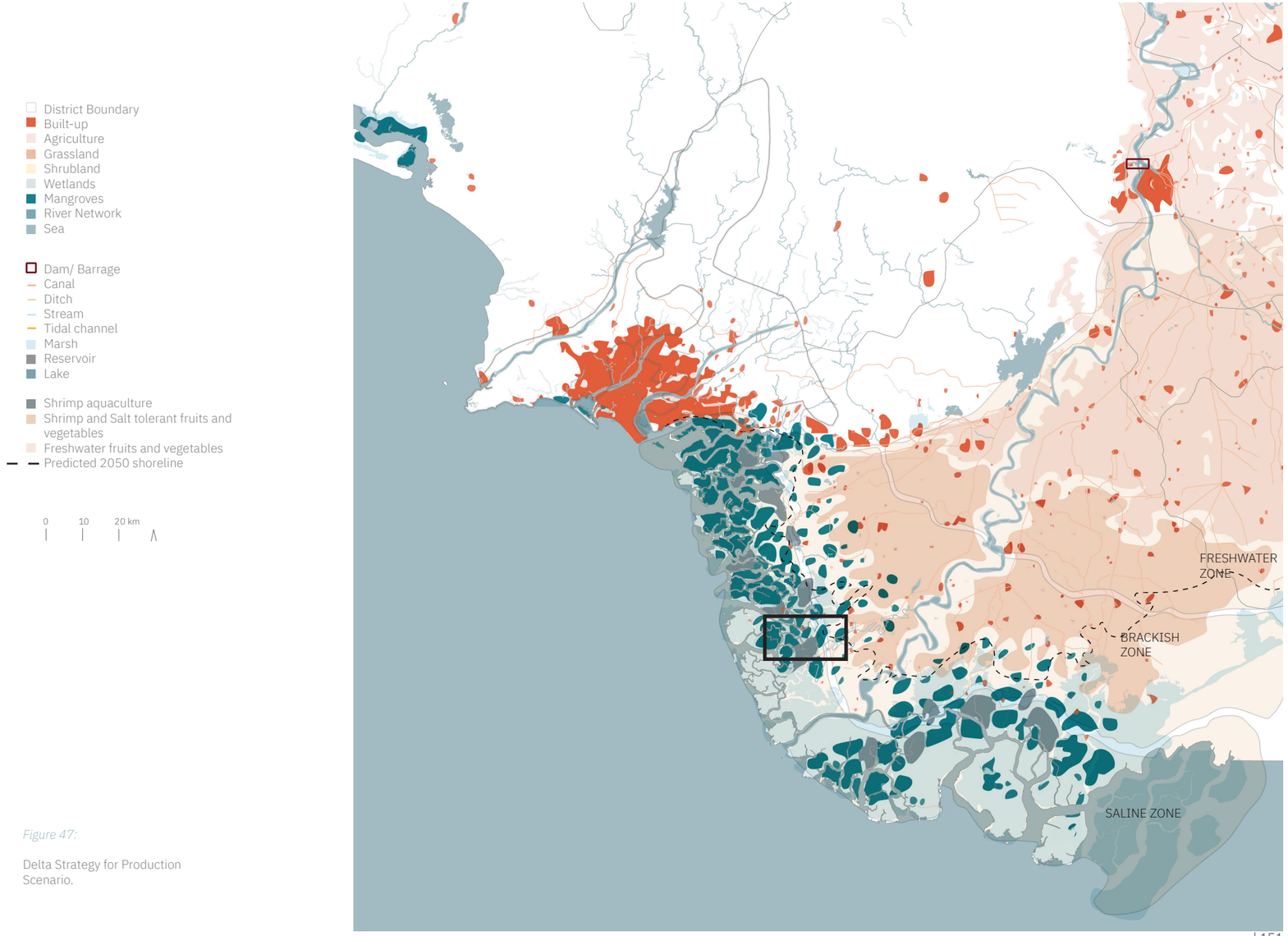


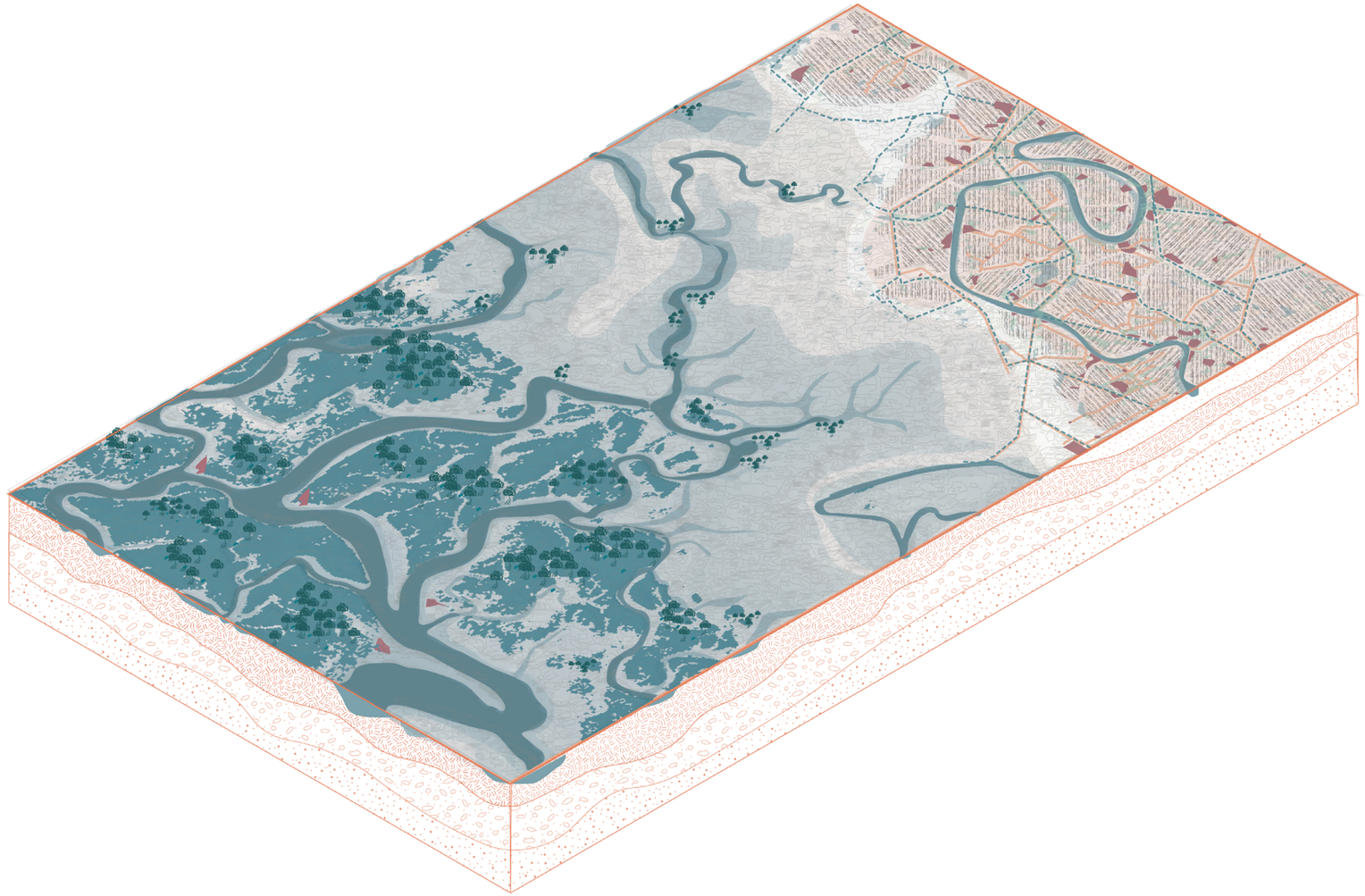
Figure 47:

Delta Strategy for Production Scenario.

4.2.4 Network of Production

Zoom-in Area 3: Dense Agriculture and Mangrove Islands - Existing

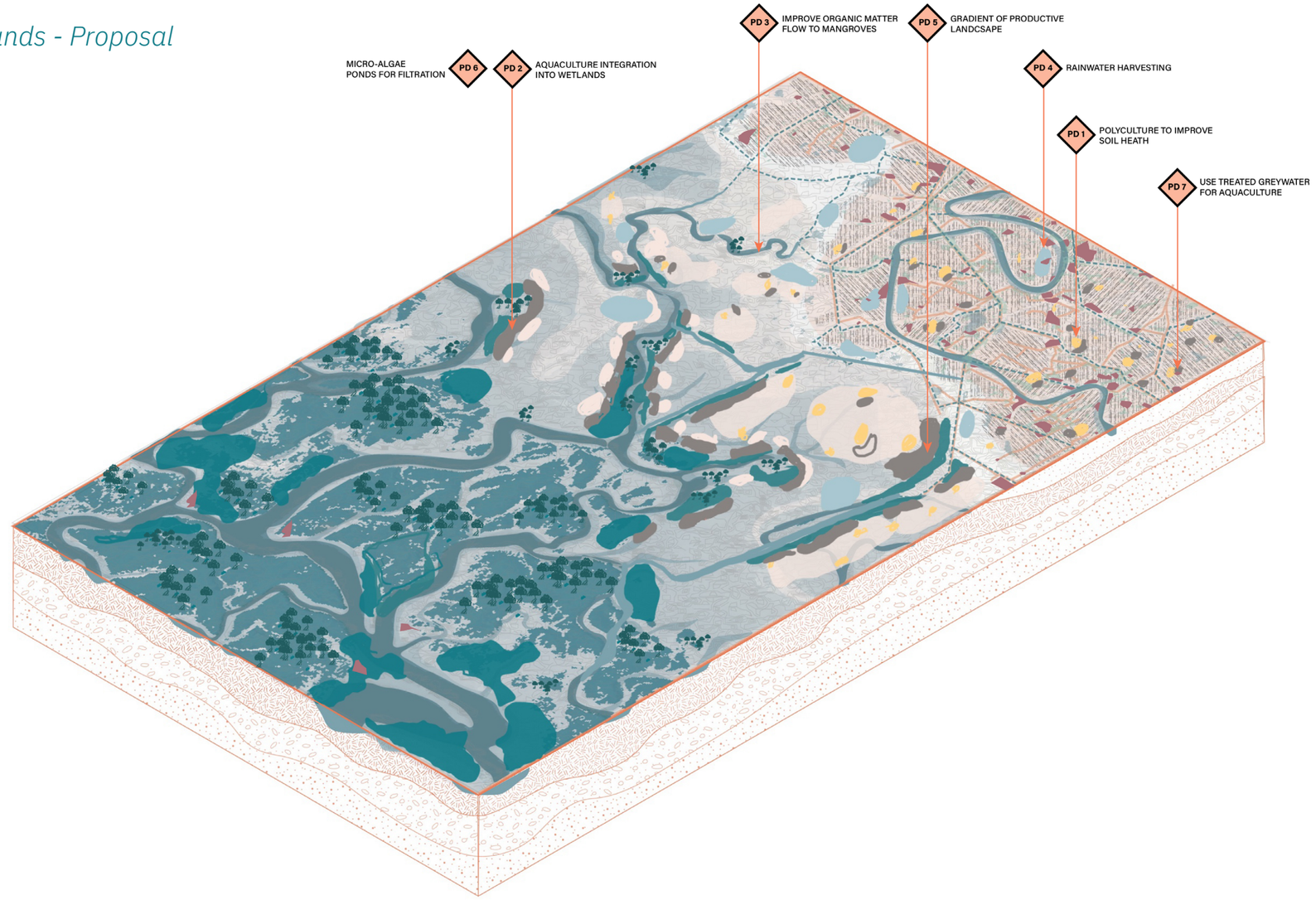
In this network, the zoom-in focus area is where agriculture meets the mangroves, but also where the saline zone meets the brackish zone. This creates an opportunity for integration of wetlands with agricultural production.



River steam and tidal creeks
Mangroves
Wetland
Bareland
Agriculture
Settlements
Roads
Canals

4.2.4 Network of Production

Zoom-in Area 3: Dense Agriculture and Mangrove Islands - Proposal



River steam and tidal creeks

Mangroves

Wetland

Bareland

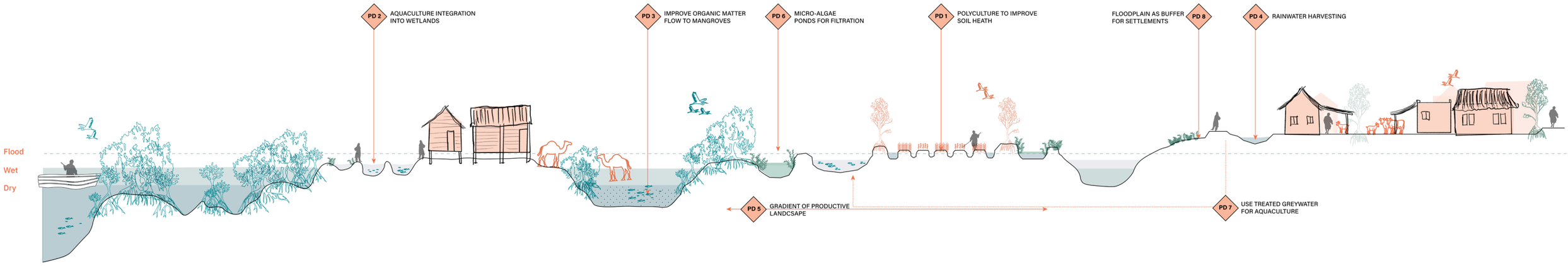
Agriculture

Settlements

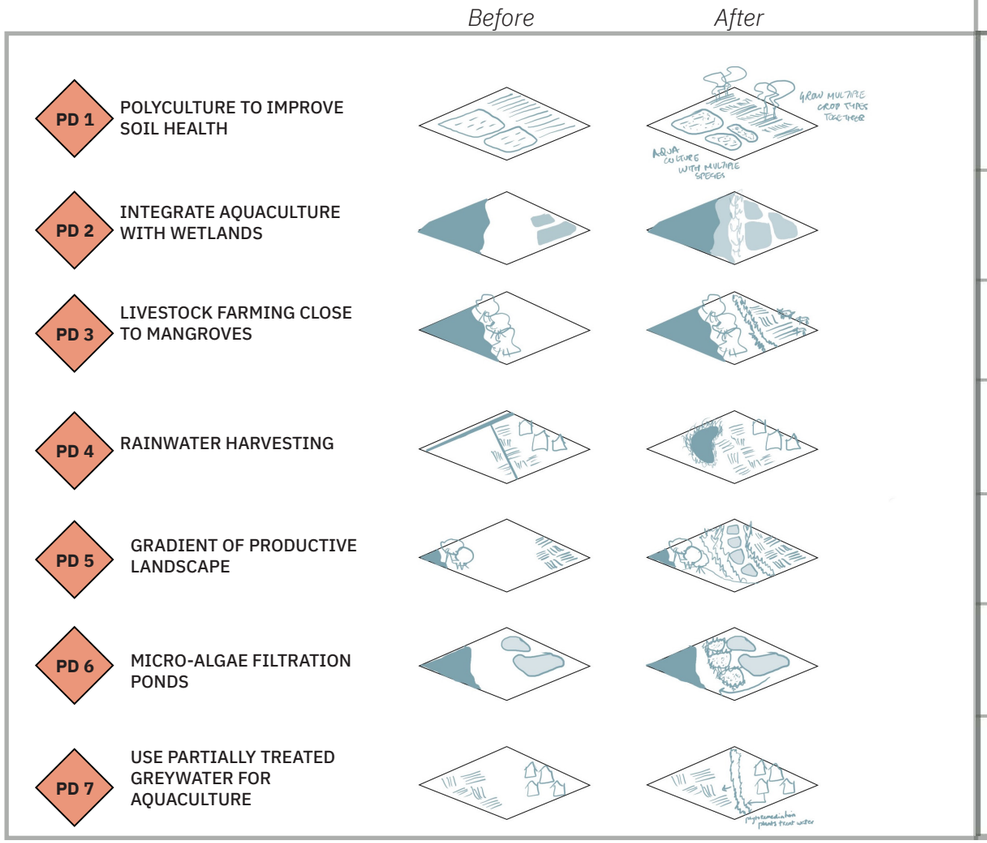
Roads

Canals

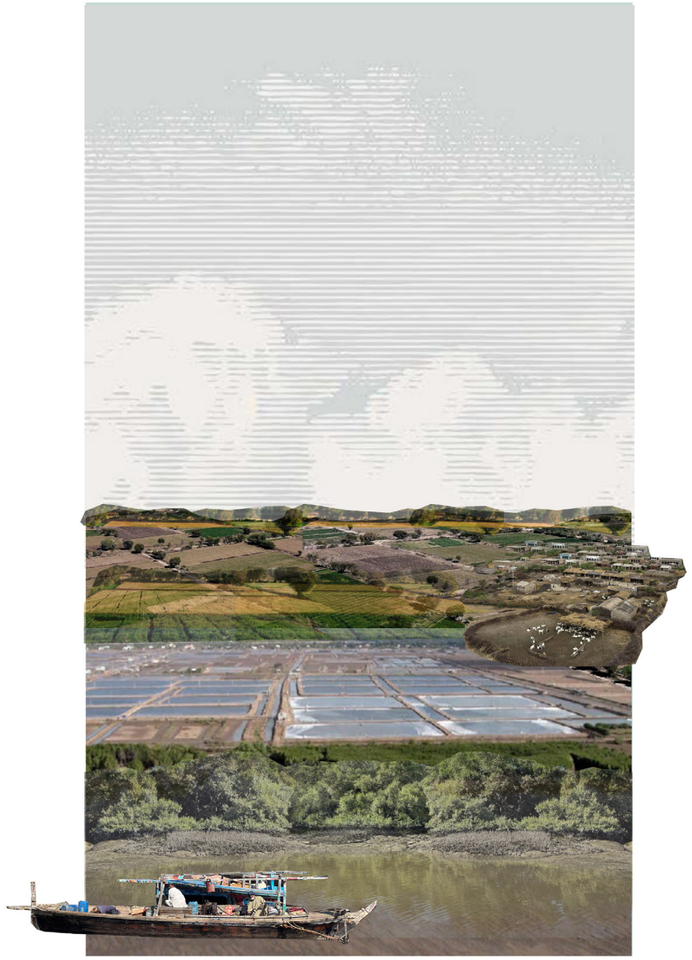
4.2.4 Network of Production
Typology Section

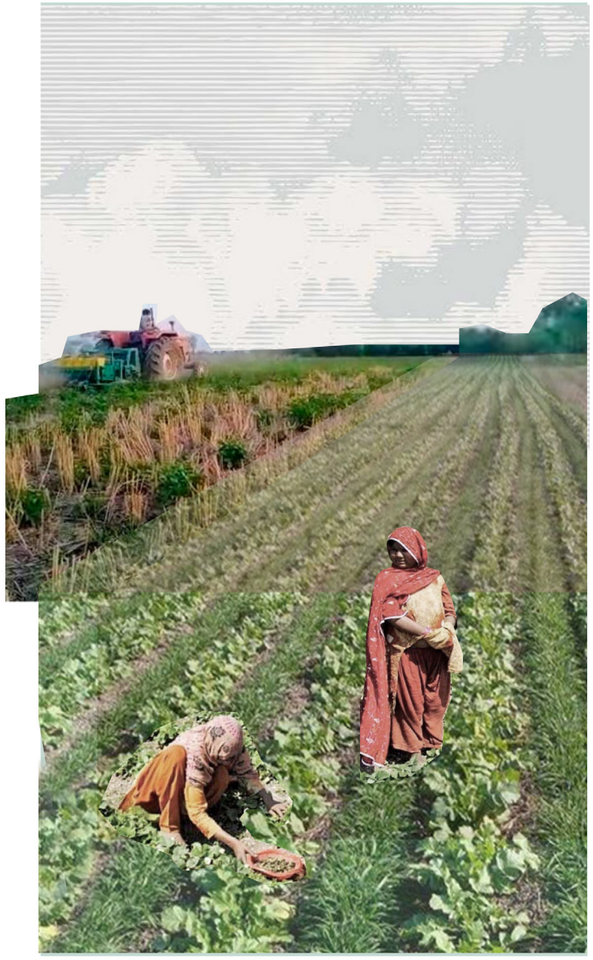


4.2.4 Network of Production
Toolkit of Strategies - Evaluation



	Ecological					Social					Economic				
	INCREASED BIODIVERSITY	IMPROVED SOIL HEALTH	IMPROVED WATER RETENTION / INFILTRATION	PROPER WASTE MANAGEMENT	INCREASED MANGROVE GROWTH	ACCESS TO CLEAN WATER	FOOD SECURITY	ACCESS TO GREEN-BLUE SPACES	FLOOD MITIGATION	INCREASE AWARENESS OF MANGROVES	INCREASED EMPLOYMENT OPPORTUNITY	IMPROVED LOCAL ECONOMY	INCREASED USE OF RENEWABLE ENERGY	REDUCED FLOOD-RELIEF EXPENSES	INCREASED ECO-TOURISM
PD 1	●	●	○	○	○	○	●	○	○	○	●	●	○	○	○
PD 2	○	○	●	○	●	○	●	●	●	○	●	●	○	●	●
PD 3	●	●	○	●	●	○	●	○	○	●	○	●	●	○	○
PD 4	●	●	●	○	●	●	●	●	●	○	○	○	○	●	○
PD 5	○	●	○	○	●	○	●	○	●	●	●	●	○	●	○
PD 6	○	●	○	●	○	●	●	○	○	○	●	●	○	○	○
PD 7	○	●	●	●	○	○	○	○	○	○	○	○	○	○	○





4.2.4 Network of Production | *Stakeholder Impact*

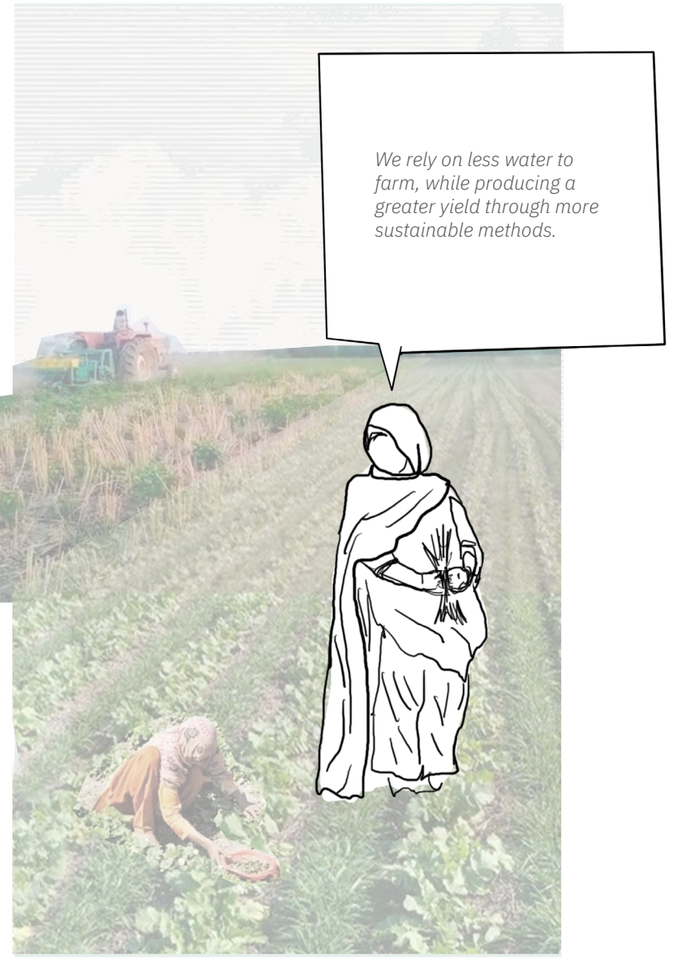


Figure 48: View of floating jetty at Keti Bandar from the 15 feet high embankment that surrounds the Fishing Vilage.

5.1 Re-evaluation of Toolkit Strategies

By designing the three scenarios of recreation, preservation and production, some insight was gained on which strategies from the toolkits were effective in improving stakeholders' socio-economic vulnerability while also regenerating the delta's more-than-human ecosystem.

This learning is taken further by now exploring combinations between different strategies, for example, how does recreation also become a form of production by combining strategies of preservation and recreation. That is, can combining natural barriers for sedimentation and eco-tourism paths create a network of recreation that also keeps fishing boats out of vital regeneration areas?

By experimenting with various new combinations of toolkit strategies, one possible delta vision is proposed. It should be noted that there can be many more ways of combining these toolkits and more possible visions. However, this research demonstrates one possible way forward as an example of the flexibility of the research by design methodology used.

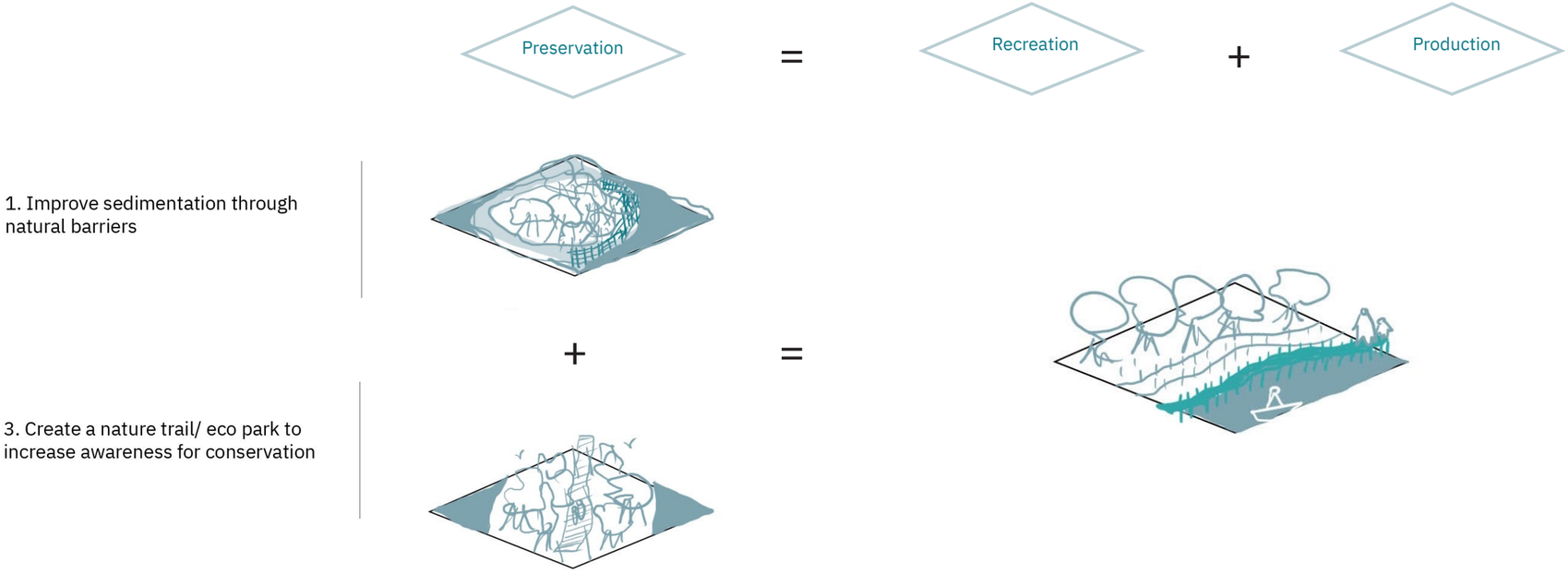


Figure 49:

An example of combining different toolkit strategy types to create new typologies and interpretations.

5.2 Delta - Existing Condition

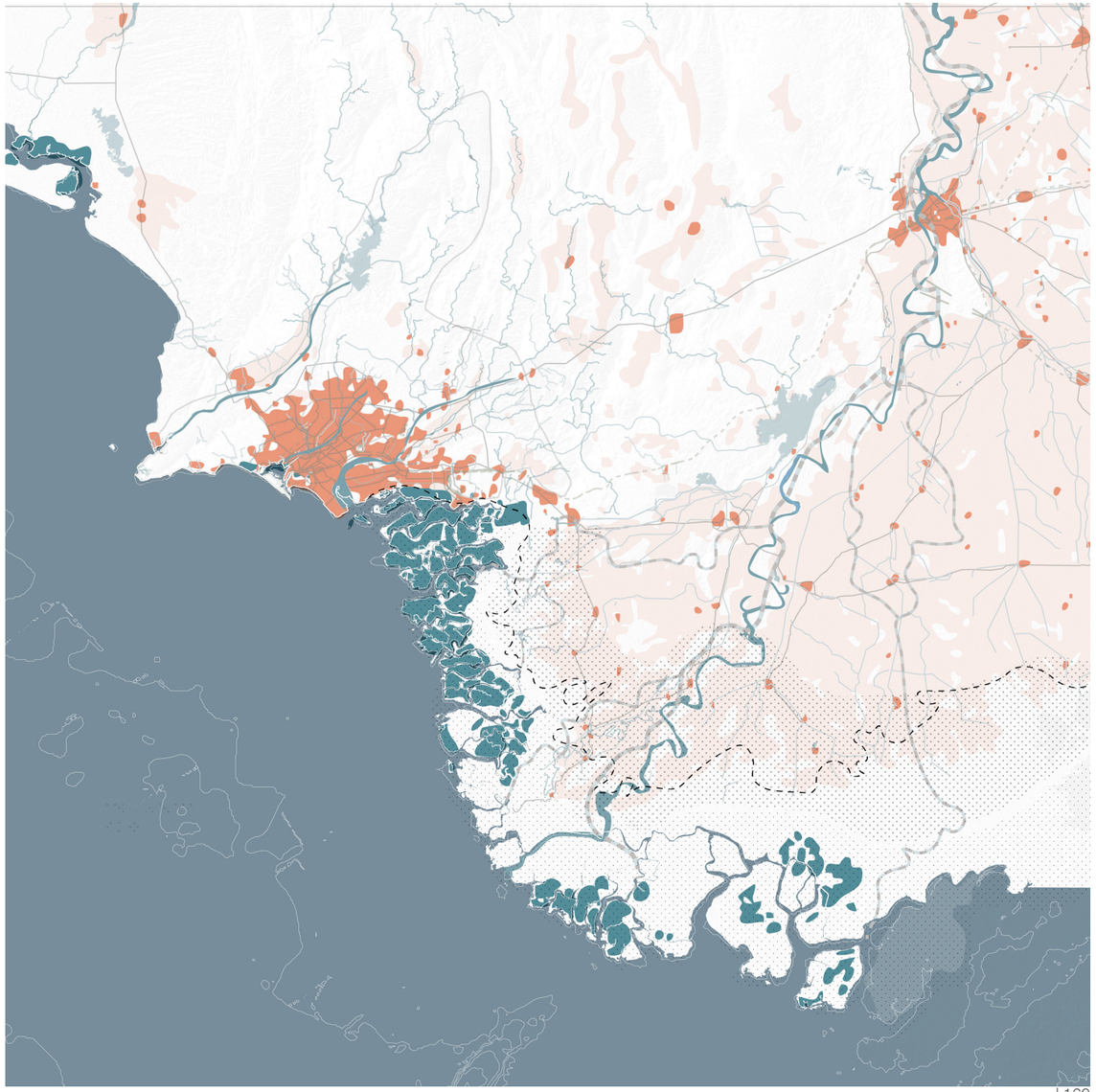


Figure 50:

Existing Delta Land-Use and 2050 Shoreline Prediction.

5.3.1 Delta Vision - Green-Blue Network
Recreation and Preservation

Taking the idea of demolishing the Kotri Barrage forward, this vision tries to create a green-blue network that integrates with and enriches the mangrove forests of the Indus Delta. This network also extends into the stormwater drains of Karachi and the Malir River that drains into the delta. This not only allows freshwater and sediment flow to the mangrove forests but also gives more room to the river through wetlands and floodplains, protecting settlements from flood and drought vulnerability while improving soil health.

Figure 51:

The Vision for the delta starts with the green-blue network, that brings back floodplains, integrating them in the urban and rural fabric.

5.3.2 Delta Vision - Agricultural Gradient
Production and Preservation

Mangroves are also further integrated functionally into the delta by creating a gradient from mangrove forests to aquaculture to agriculture. Another gradient establish is from the Indus river to canal fed-agriculture to rain-fed agriculture. The latter reduces dependence on canals that divert water away from the river, while transitioning to rain-fed and more sustainable forms of farming can still sustain deltaic livelihoods. Aquaculture also creates new employment opportunities, facilitated by training from government agencies.

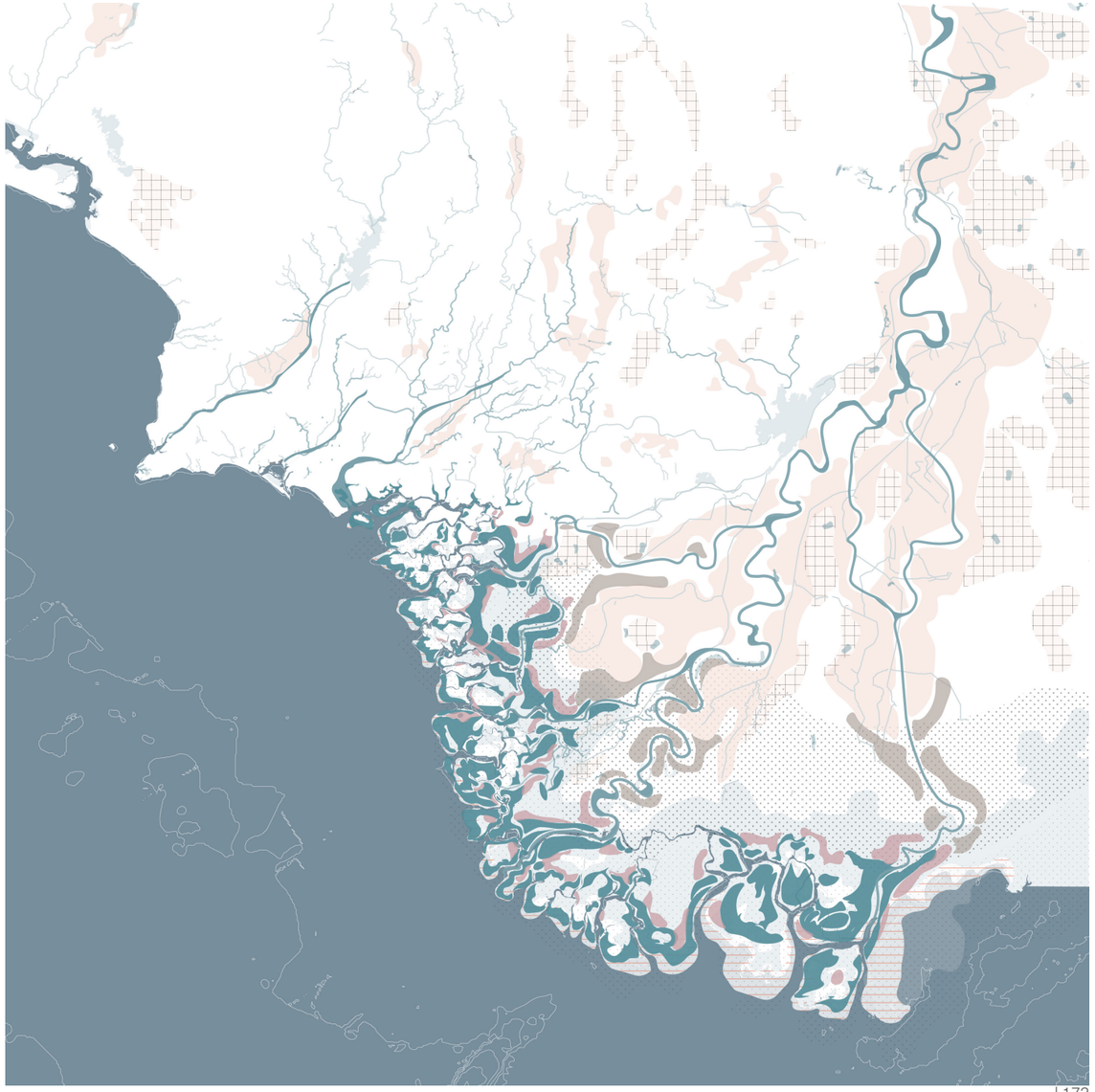


Figure 52:

Agriculture is also less dependent on canals, leaving more flow of fresh-water towards the delta.

5.3.3 Delta Vision - Urban to Rural Migration
Recreation and Production

However, the creation of a green-blue network, reduced canal-fed agriculture and new public parks has little effect if there is no investment on a proper waste management infrastructure. This would require a high investment from the government but would be necessary and rewarding in terms of long-term better livability of the human and more-than-human inhabitants of the delta. As mangroves are regenerated, there would also be less investment needed in flood-relief efforts and reconstruction of submerged settlements and infrastructure.

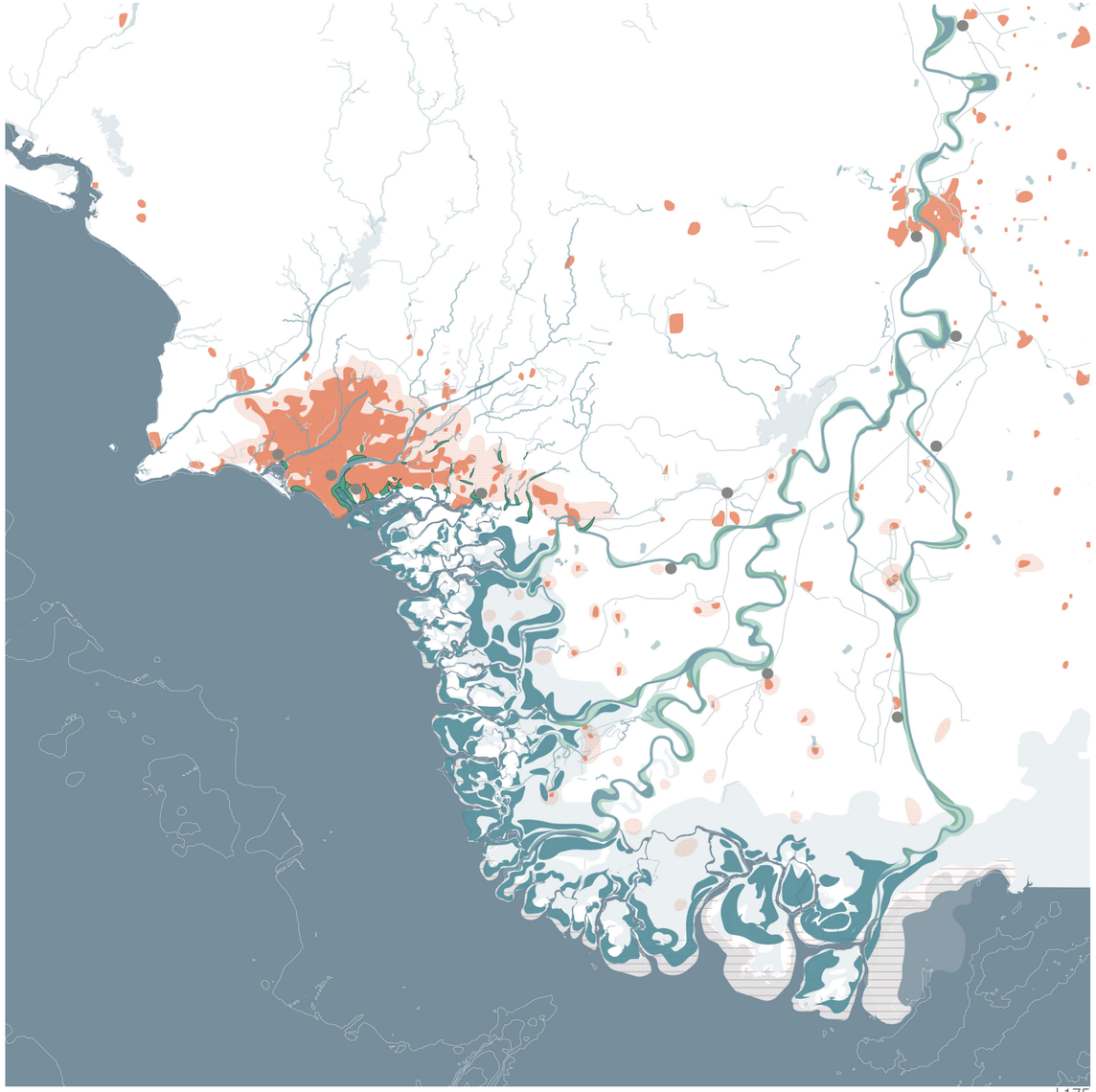


Figure 53:

Urban densification is then expected to increase inland while smaller villages and towns in the delta will expand due to additional livelihood opportunities.

5.3.4 Combined Delta Vision 2050

By combining strategies from the toolkits of recreation, production and preservation, one possible vision for the delta can be as shown. In this proposal, preservation strategies used include the removal of the Kotri barrage and river/ stream renaturalisation. Dependence on canals is reduced and biodiversity islands are designated for conservation, where no fishing is allowed. Sedimentation is encouraged around mangroves and this is combined with an eco-park trail to create recreation and thus another kind of production.

The production toolkit strategy of creating a gradient of agriculture from mangroves to aquaculture to agriculture, is now applied with another additonal gradient. This spans from the river to canal-fed agriculture to rain-fed agriculture, resulting in more sensitive water-consumption patterns. By integrating aquaculture with wetlands, all settlements from urban to rural are safer.

While floodplains can be seasonal agriculture zones but also public spaces for nearby settlements, they also provide a buffer to create more space for water infiltraton and retention. Recreation toolkit's solid waste management thus becomes an important way to create public spaces that are usable, while ensuring that drainage from the delta as well as the city, is not interrupted. The city of Karachi is also expected to expand to 31 million by 2050 (City Population 2050, n.d.), which is why the darker red shows that the city will not reclaim more land towards the delta or sea but expand inland, and also within different existing patches in the delta. There can thus be a gradual shift away from the centralised hierarchy of karachi as the place to live, since additional livelihoods are created through mangrove restoration, aquaculture and even solid waste management.

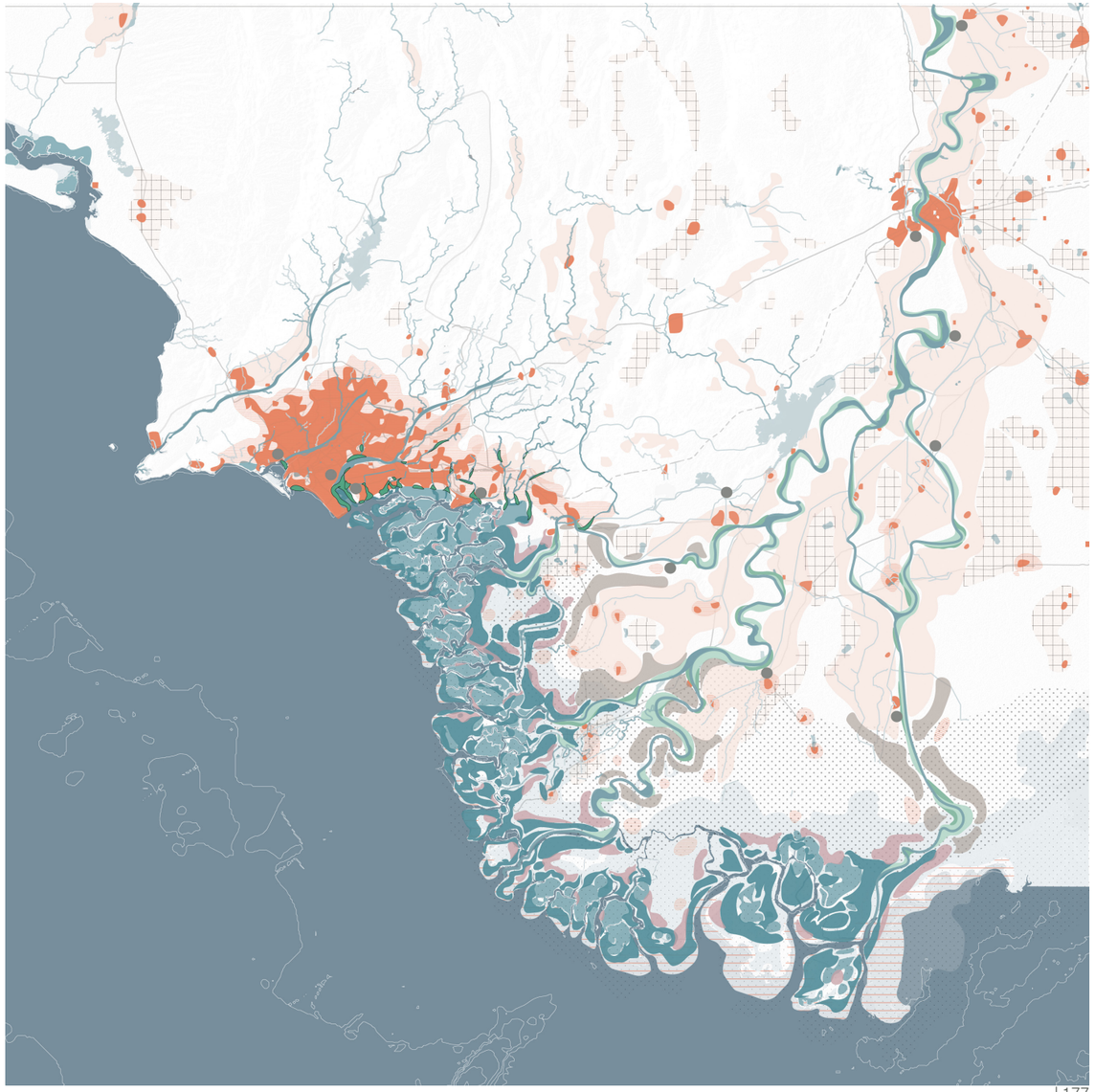


Figure 54:

The Vision for the delta, where the kotri barrage is removed, river banks and stormwater drains are renaturalised, floodplains and wetlands protect settlements, while agricultural production becomes more varied in terms of water-consumption.

5.4 Delta Vision 2050 - Zoom-In Locations

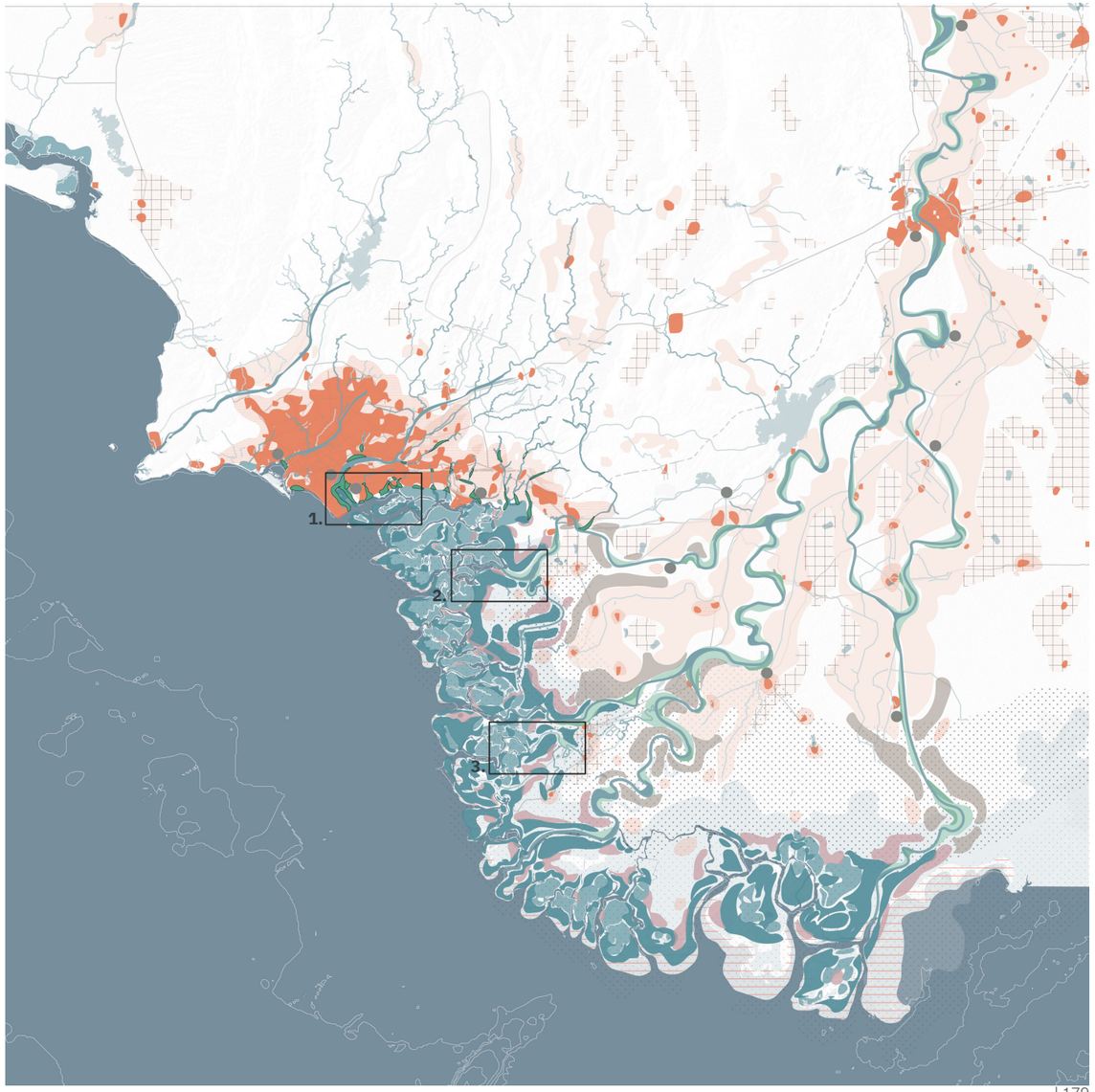
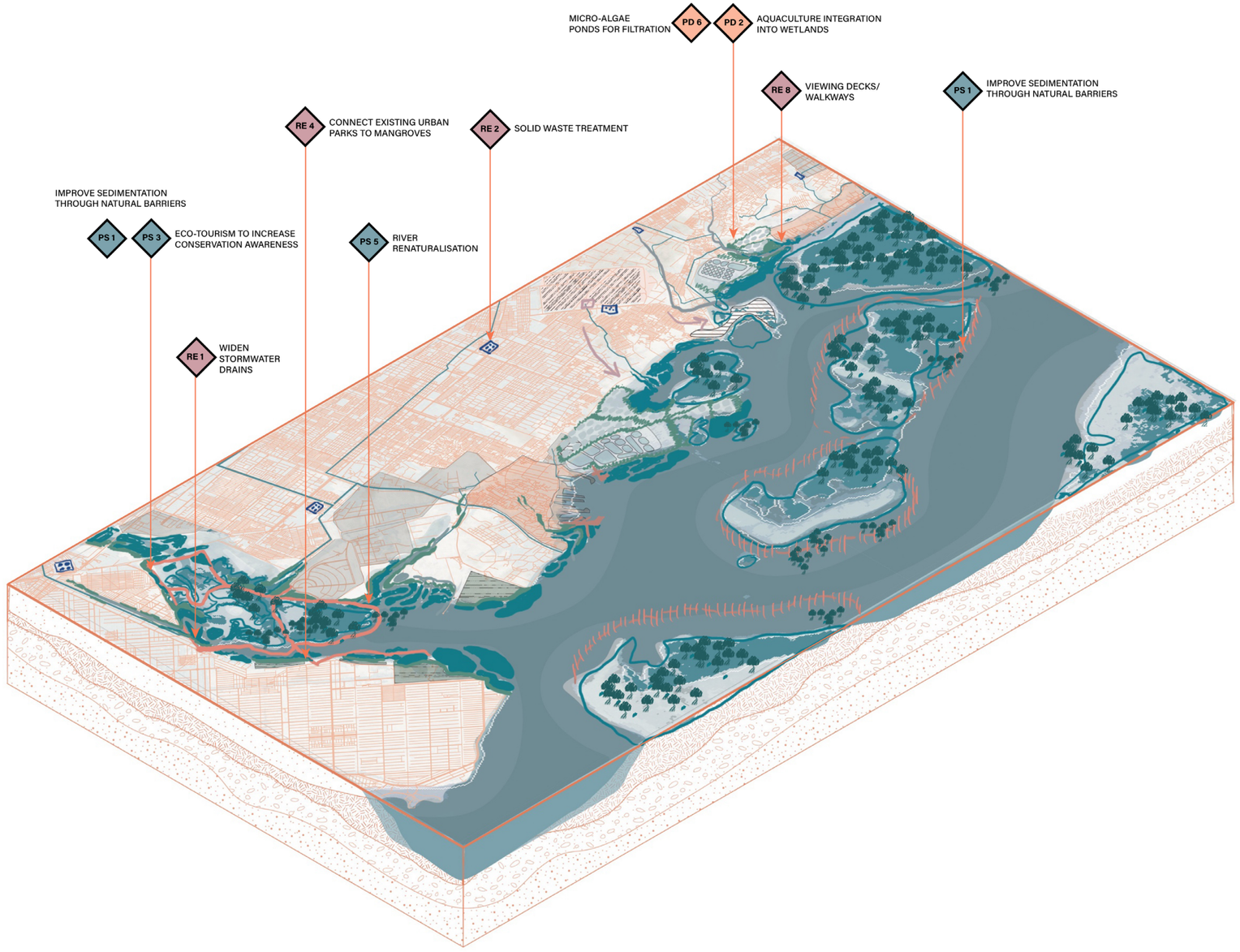


Figure 55:

The Vision for the delta, with the 3 zoom-in locations.

5.4.1 Zoom-in Area 1: Karachi Coast and Delta

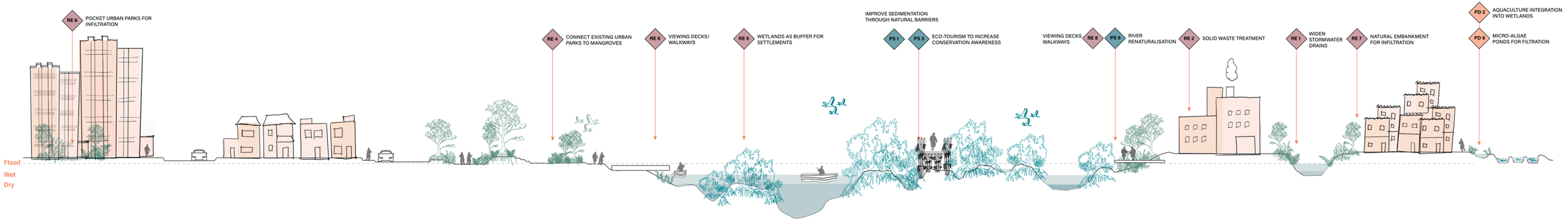
The following shows ways in which different strategies from the recreation, preservation and production toolkits can be combined to create a new perception of the three ideas of care. This combination varies for the different zoom-in sites based on their stakeholders and typologies present.



- River steam and tidal creeks
- Mangroves
- Wetland
- Bareland
- Agriculture
- Existing Park/ Golf Course
- Roads
- Stormwater Drains
- Industries
- Fishing Villages
- Fisheries
- Salt farms

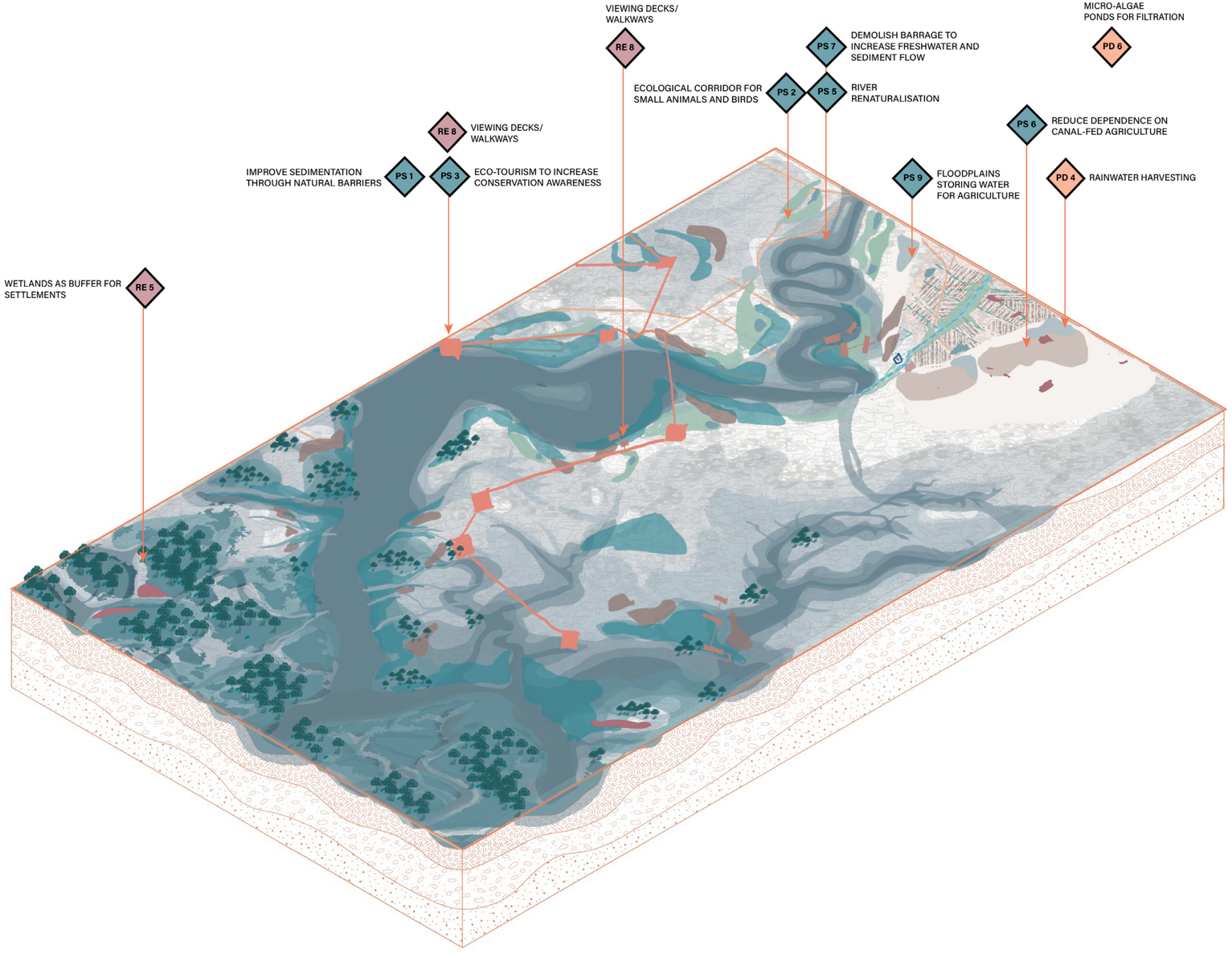
5.4.1 Zoom-in Area 1: Karachi Coast and Delta

Typology Section



5.4.2 Zoom-in Area 2: Remote Settlements

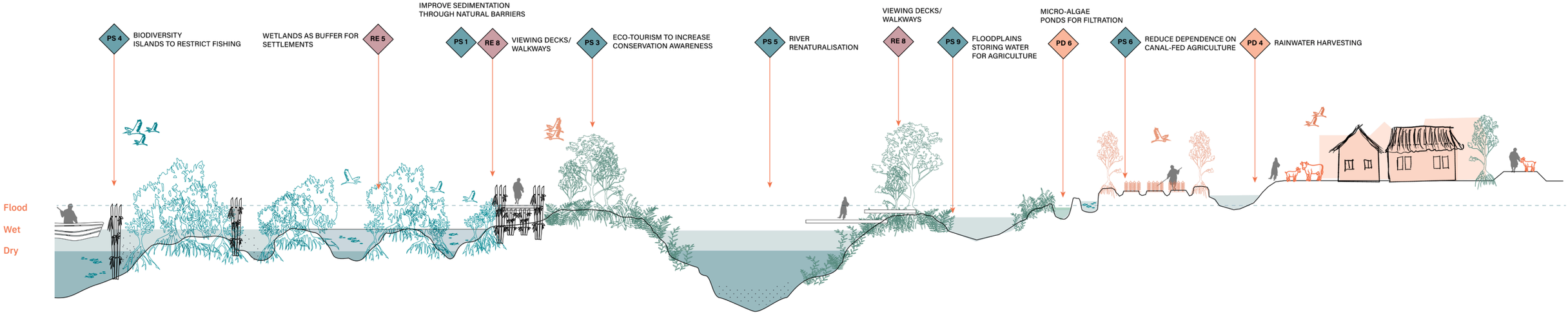
The following shows ways in which different strategies from the recreation, preservation and production toolkits can be combined to create a new perception of the three ideas of care. This combination varies for the different zoom-in sites based on their stakeholders and typologies present.



River steam and tidal creeks
Mangroves
Wetland
Bareland
Agriculture
Settlements
Roads
Canals

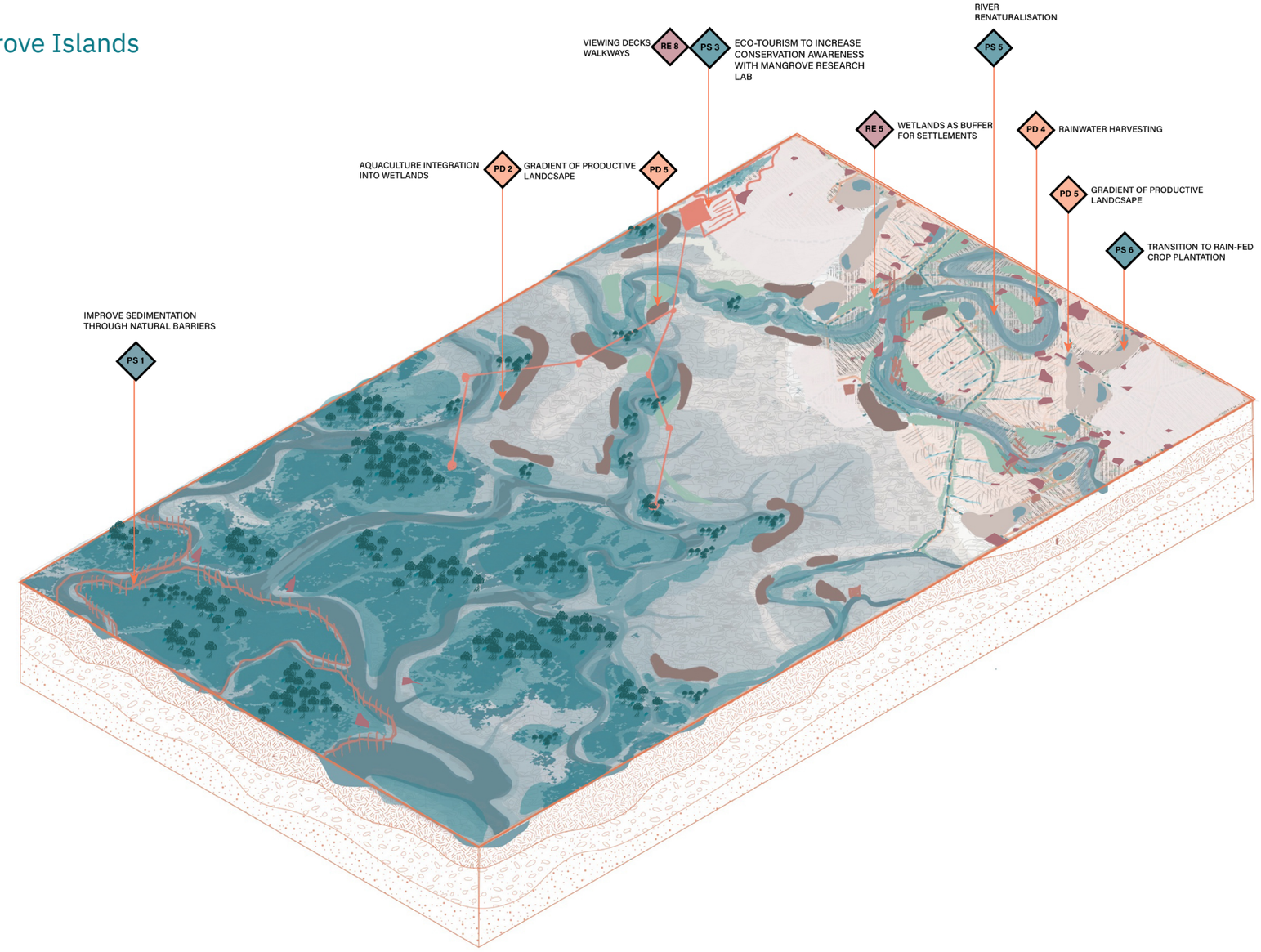
5.4.2 Zoom-in Area 2: Remote Settlements

Typology Section



5.4.3 Zoom-in Area 3: Dense Agriculture and Mangrove Islands

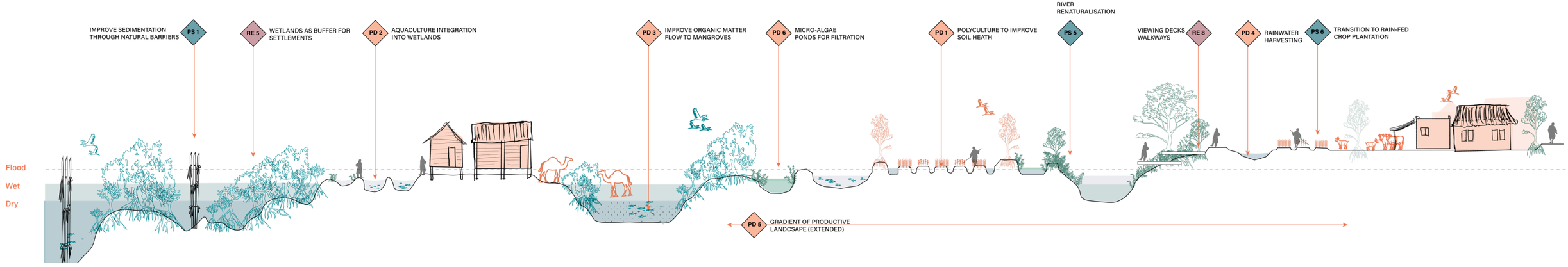
The following shows ways in which different strategies from the recreation, preservation and production toolkits can be combined to create a new perception of the three ideas of care. This combination varies for the different zoom-in sites based on their stakeholders and typologies present.



- River steam and tidal creeks
- Mangroves
- Wetland
- Bareland
- Agriculture
- Settlements
- Roads
- Canals

5.4.3 Zoom-in Area 3: Dense Agriculture and Mangrove Islands

Typology Section



5.5 Synergy Between Humans and More-than-Humans

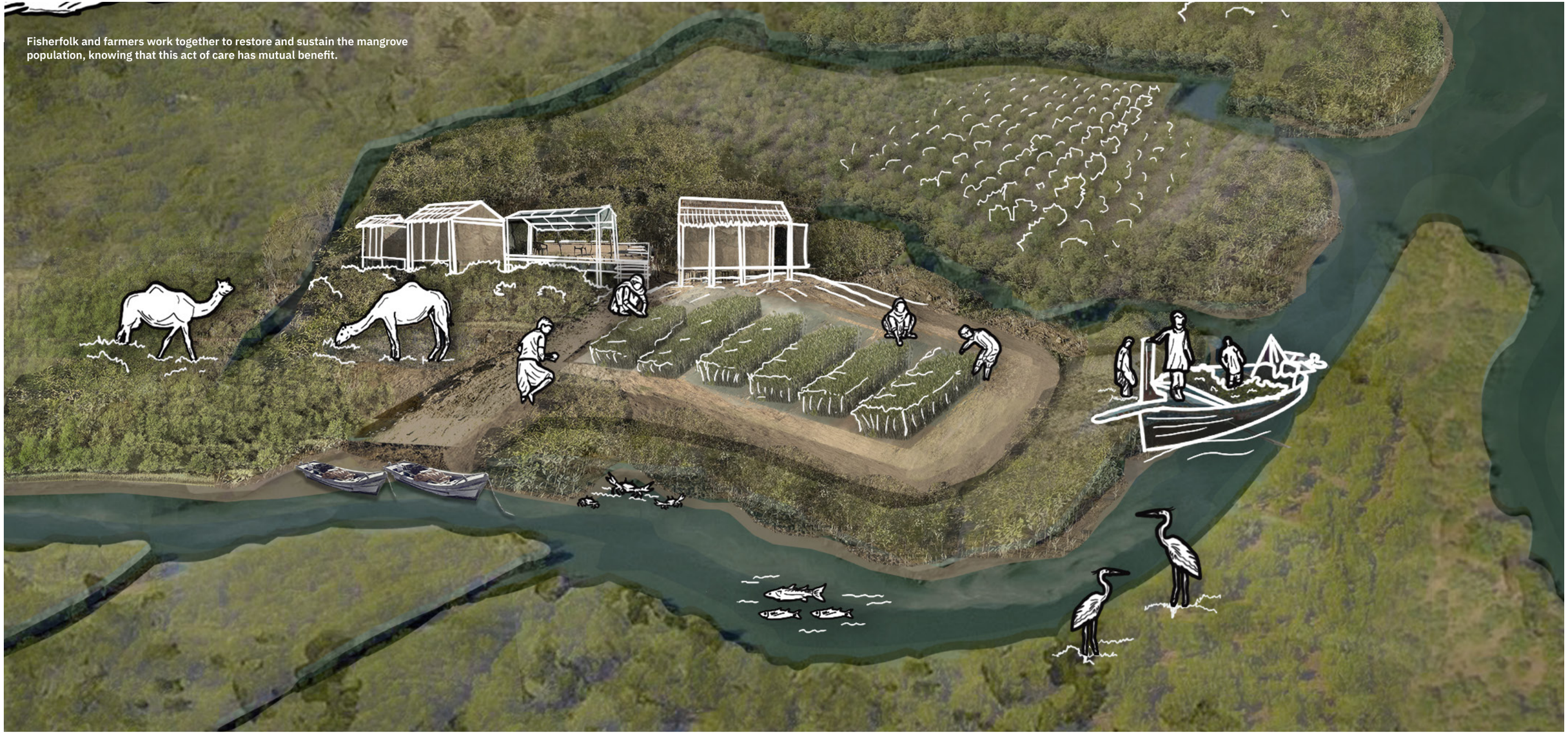
The combined vision for the Indus Delta imagines an evolving landscape sustained through shared care between humans and more-than-human life. It brings together ecological restoration, adaptive livelihoods, and public stewardship into a framework where mangroves are not just preserved but actively woven into the rhythms of everyday life. Communities - particularly fisherfolk and farmers - engage in practices like integrated aquaculture, mangrove replanting, and wetland management, not only to restore lost ecologies but also to secure their own futures.

This is a model of interdependence where care is reciprocal: people tend to the mangroves knowing they, in turn, protect coastlines, support livelihoods, and anchor cultural memory. Rather than positioning nature as separate or passive, the vision reframes the delta as a shared space of co-existence, responsibility, and regeneration.

Eco-park network extends from the city of Karachi into the Indus Delta, while keeping humans away from certain conservation areas.

Farmers work together to integrate mangroves and sustainable aquaculture into the existing productive landscape.

Fisherfolk also practice sustainable aquaculture, filtering water through micro-algae ponds before it flows into the delta. This reduces dependence on marine fishing.


Fisherfolk and farmers work together to restore and sustain the mangrove population, knowing that this act of care has mutual benefit.

5.6 Phasing and Implementation

Phase	Priotity Actions	Focus Areas	Stakeholders Engaged
1. Urgent (Years 2-5)	• Ensure clean water reaches the delta (e.g. treated wastewater, improved storm drains) • Set aside and protect mangrove zones along coast and creek edges • Launch low-cost production pilots (e.g. community aquaculture, polyculture, etc.)	Karachi Coast and Tidal Creeks	Local fisherfolk, Local farmers, NGOs like Pakistan Fisherfolk Forum (PFF), Sindh Building Control Authority (SBCA), Karachi Development Authority (KDA), Defence Housing Authority (DHA) Karachi Water & Sewerage Corporation (KWSC), Sindh Solid Waste Management Board (SSWMB)
2. Short-Mid Term (Years 5-10)	• Restore degraded wetlands and convert flood-prone farmland into buffers • Support livelihood diversification (shrimp ponds, salt-tolerant crops, eco-tourism pilots) • Enforce no-fishing zones in key regeneration sites	Remote delta villages & saline agriculture zones	Farmers, Fisherfolk, Sindh Environmental Protection Agency (SEPA), Ministry of Climate Change Pakistan, Provincial Disaster Management Authority (PDMA Sindh) WWF-Pakistan and IUCN Pakistan
3. Long Term (Years 10-25)	• Formalize recreation networks (urban mangrove parks, eco-trails) • Build governance partnerships (water-sharing, zoning, community monitoring) • Scale up productive mosaics based on ecological performance	Across entire delta gradient (inland to sea)	Government of Sindh (Planning & Development Department), Sindh Coastal Development Authority (SCDA), Sindh Forest Department, Indus River System Authority (IRSA), Water and Power Development Authority (WAPDA), WWF-Pakistan and IUCN Pakistan

Chapter 6 |

Conclusion and Reflection

Figure 56: View of Avicenia Marina Mangroves in Indus Delta.

6.1 Conclusion

This thesis started with a simple but important question: What do the mangroves need? That question slowly reshaped the way I approached the Indus Delta - not just as a landscape to be restored, but as a living and vulnerable system where people, ecologies, and politics are deeply entangled. What began as a project about ecological restoration turned into something much more systemic - one that tries to acknowledge how water flows, waste systems, land use, and livelihoods are all connected, and how regeneration can only happen when we address those interdependencies together.

Using the lens of care, I developed the three Networks of Care - preservation, production, and recreation - to explore how design can support both ecological and social needs at the same time. These networks aren't separate solutions but overlapping layers that work together: protecting core mangrove habitats, creating safer and more diverse livelihood options like aquaculture and waste processing, and reconnecting the city's residents to these often invisible ecosystems through recreation and education. The inland-to-sea gradient helped me translate these ideas spatially, showing how different zones of the delta could support each other depending on their specific conditions.

But throughout this process, I've also been confronted with the limits of what design can do. Putting ideas on paper often felt abstract, knowing that real change depends on complicated negotiations - and that any proposal inevitably benefits some while challenging others. There's no perfect solution that works for everyone. What design can do, however, is make these trade-offs visible and create space for more honest conversations about who is involved, who carries the risks, and how decisions get made. In that sense, care is not a fixed solution, but an ongoing and shared responsibility - one that depends on cooperation, governance, and long-term commitment.

If anything, this thesis has taught me that some of the most meaningful work is already happening at the grassroots - local communities planting mangroves, youth groups raising awareness on social media, and people adapting their daily lives to a changing environment. My project doesn't replace those efforts - it tries to learn from them, support them, and offer a design framework that can help these actions grow stronger, more visible, and more connected. In a fragile landscape like the Indus Delta, it's these small but powerful forms of care that hold the most potential for a more resilient future.

6.2 Reflection

1. What is the relation between your graduation project topic, your master track (A, U, BT, LA, MBE), and your master programme (MSc AUBS)?

'Reviving a Dying Delta' grew from both personal proximity and distant unawareness. Growing up in Karachi, I lived next to the Indus Delta without truly seeing it. It was only later that I recognized this landscape not just as a place of fading beauty, but as a fragile convergence of livelihoods, ecologies, and systemic neglect. The delta's invisibility - politically, socially, ecologically - became the very reason to engage with it through urban design.

This thesis reflects the essence of the Urbanism track and the MSc AUBS programme: working across scales where global flows, national water politics, urban expansion, and local resource use collide. The delta is not only an ecological system but also a socio-political one - shaped by upstream diversions, Karachi's pollution, land reclamation, and precarious rural economies. My design aims to hold these interwoven forces together, using spatial tools to imagine how more-than-human coexistence might emerge through negotiated care.

Rather than design as solution-making, this project views design as a way to surface relationships - between people, mangroves, and the uncertain waters they share. It embodies the MSc AUBS programme's attention to systemic thinking, spatial justice, and design research as a form of situated accountability, where neither the human nor more-than-human can be considered in isolation.

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

This thesis has been a deeply iterative process, with constant negotiation between research and design. Initially, my focus was more thematic - on how to support the livelihoods of remote delta communities. But as I dug deeper, I realized that the degradation of the mangroves wasn't only a local issue; it was connected to far-reaching systemic flows - of water, waste, politics, and capital.

The shift began with a reorientation of the central question: instead of asking what people in the delta need, I asked what the mangroves need - and what kind of socio-economic structures could support that need in a lasting way. This led to the concept of Networks of Care, which explore mangrove regeneration through three interwoven lenses: production, preservation, and recreation. Each network became a way to visualize how ecological goals could align with human aspirations.

Fieldwork played a major role in this transition. I encountered both lived knowledge and contradictions. Conversations with fisherfolk showed me that locals often see mangroves as essential to their livelihoods but also rely on practices that unintentionally harm them. This duality made me rethink my assumptions: who are the victims, who are the enablers, and how do we mediate between long-term ecological health and immediate human needs?

This back-and-forth process was also reflected in my methodology. At first, I was interested in the maximization method, testing three possible systems - social, economic, and ecological. However, I soon realized that these systems are so intertwined that separating them in design would be counterproductive. Instead, I focused on studying their influence on one another. I then began developing scenario-building methods, exploring how three proposals with a single thematic focus could address the complex dependencies between social, ecological, and economic factors. As I progressed with the 3 'Networks of Care' (recreation, production and preservation), I again reached a standstill when trying to extract definitive conclusions from the scenarios. Eventually, I understood that the key learning from these three scenarios lay in the strategies I had tested within them. This realization led to the creation of a strategy toolkit, which I evaluated and combined to generate one possible vision for the delta. Through this process, I also reinterpreted the toolkits themselves and recognized how deeply interlinked the three networks were.

Design helped me test these scenarios: Could fishponds work as buffers between farming and the sea? Could mangroves become public space assets? Could informal waste systems in Karachi be redirected to avoid harming the delta? These tests also sharpened my research - grounding it more firmly in spatial logic and focusing it on implementation. The back-and-forth between drawing, analysis and methodology, became one of the most educational aspects of my process.

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

In the early stages, my approach was optimistic but overly hypothetical. With guidance, I gradually shifted towards a more grounded research-by-design method, centering the mangrove ecologies while staying attentive to social realities. System mapping, stakeholder conversations, and iterative design became my primary tools.

The key shift came in treating care not only as an ethical stance, but as a design method. Care demanded that I map vulnerabilities, not just potentials; that I consider whose well-being is prioritized, whose burdens are intensified, and whose voices are missing. It guided me to propose interventions that could nurture both ecological and social resilience: regulating waste flows, diversifying livelihoods, or using recreation to reconnect urban residents with distant ecosystems.

Rather than resisting change - which deltas cannot afford - my methodology embraces adaptation. The delta has long adapted to shifting waters; my strategies aim to support that adaptability by offering flexible, site-responsive scenarios that remain provisional as conditions evolve.

Crucially, visualizing these interconnections became central to my process. Diagrams allowed me to translate complexity into legible spatial narratives - not to simplify, but to make visible how water, livelihoods, governance, and nonhuman life intersect. In that sense, my methodology values design less as a tool of authority and more as a means to hold space for diverse, and at times conflicting, realities to surface and interact.

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

Academically, my thesis contributes to current discussions on how urban design can engage with fragile and contested deltaic landscapes, especially in the Global South, where data scarcity, fragmented governance, and overlapping social and ecological vulnerabilities create complex design conditions. Throughout my research, I struggled to find work that addressed these complexities holistically. Much of the existing literature was highly fragmented - either highly technical (focused on hydrology or engineering), narrowly social (focused on community vulnerability), or limited to documenting mangrove loss without offering integrated ways forward. There was often little discussion on how to spatially and systemically reconnect the multiple processes contributing to the delta's ongoing degradation.

In response to this gap, my work proposes an integrative framework that does not view mangrove regeneration as an isolated act of tree planting, but as inseparable from broader system management - improving how we govern waste, water, and soil flows, and how these intersect with human livelihoods. The Networks of Care framework introduces care not only as a normative value but as an active design lens - recognizing humans and more-than-human ecosystems as interdependent co-inhabitants rather than separate categories. In doing so, it challenges the conventional binary between development and conservation, proposing instead that ecological restoration and human well-being must be pursued as mutually dependent, negotiated processes. In this way, the thesis contributes to broader academic discussions on how to design within uncertainty, embrace adaptive climate resilience, and approach design research as a relational, situated, and evolving process - rather than as a fixed or prescriptive solution.

Societally, the project makes visible the lived realities of delta communities who navigate ongoing environmental precarity, while simultaneously drawing attention to the systemic forces - urban expansion, waste mismanagement, upstream diversions - that shape the delta's vulnerabilities. Each monsoon season, these communities are exposed to stagnant, polluted, and disease-infected waters, as recurrent floods overwhelm fragile infrastructures. Often, government response remains limited or delayed, leaving already vulnerable populations to survive on their own under increasingly hazardous conditions.

This proposal seeks not only to regenerate ecosystems but to reduce this chronic vulnerability. By addressing the systemic roots of degradation - including waste flows, water management, and soil salinization - it aims to create spaces where both ecological and human well-being can stabilize and adapt. Through diversifying livelihoods, whether via aquaculture, mangrove nurseries, or community-based waste processing - this project offers ways for local residents to build greater economic security while contributing directly to the delta's ecological resilience.

At the same time, the thesis recognizes that the delta's future is not shaped solely by top-down interventions. Grassroots practices already exist, often emerging without formal support - fisherfolk replanting mangroves, youth groups raising awareness, and local communities informally adapting to environmental change. These small but powerful acts of care demonstrate that local agency is already active, and that design must not replace such capacities, but learn from, support, and amplify them. Strengthening these bottom-up efforts offers a more durable, adaptive, and context-sensitive pathway for long-term regeneration.

In terms of scope and implications, my project does not attempt to offer definitive solutions to deeply entangled political, economic, or environmental conflicts. Rather, it offers a way of thinking and designing that remains open, adaptive, and responsive to future uncertainties. The Networks of Care are not static proposals but speculative frameworks that invite ongoing negotiation between social needs, ecological thresholds, and climate pressures. In highly dynamic delta systems, where resisting change is often neither possible nor desirable, the project embraces adaptation as an approach that can slow degradation while creating more equitable, resilient futures.

Through this process, I also came to realize that contributing to awareness itself is already a critical role for an urban designer. Many interdisciplinary efforts - from social media activism and grassroots protests, to documentaries and exhibitions - are already amplifying these issues and fostering important public dialogue. These conversations exist and are growing. What this project offers is a spatial complement to those dialogues: a way to translate these conversations into tangible spatial proposals, scenarios, and strategies that allow those complex negotiations to unfold in space, rather than remain only in discourse. In that sense, the project acts as both a design inquiry and a spatial platform for continuing collective engagement.

Ethically, the project continually challenged my own position as a designer working within a landscape I am personally connected to. My proximity to Karachi gave me both empathy and responsibility but also demanded careful reflection on how my design choices might unintentionally reinforce existing vulnerabilities. I witnessed how rural communities, already facing poverty and displacement, are often forced to engage in extractive practices that harm the very ecosystems they rely upon for survival. Simultaneously, the more-than-human systems - the mangroves, estuaries, tidal flows - remain entirely voiceless within institutional decision-making. The absence of coherent governance leaves both human and more-than-human communities exposed to ongoing harm.

Throughout this process, I also struggled to understand my own role as an urban designer. Designing on paper often felt inherently top-down, and I became increasingly aware that no proposal - however well-intentioned - can ever fully avoid producing winners and losers. There is no neutral design; every intervention inevitably privileges certain actors while challenging others. This constant negotiation between competing needs, interests, and vulnerabilities became, for me, the central ethical responsibility of the urbanist. Learning to hold space for these contradictions, rather than seeking to resolve them entirely, became a difficult but necessary part of my process.

Working at the territorial scale made these tensions even more pronounced. I often questioned how to imagine a vision that would be more bottom-up, rather than imposed from above. Over time, I came to realize that any meaningful vision for the delta's regeneration cannot emerge from a single perspective - instead, it requires cooperation between multiple actors across levels of governance, communities, and ecologies. Stakeholder collaboration - from local fisherfolk to urban policymakers - is essential for translating any design vision into lived reality. In this, I came to see design not as offering solutions, but as making space for shared, situated conversations about responsibility, care, and adaptation.

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

While deeply rooted in the specific socio-political and ecological context of the Indus Delta, the questions this thesis engages with - coastal degradation, biodiversity collapse, urban pollution, fragmented governance, and climate-induced displacement - are shared by many fragile delta regions globally. What makes this project transferable is not the specific design outcomes, but rather the approach: an iterative, care-based design process that integrates spatial, ecological, and social systems, while staying responsive to uncertainty.

Throughout my research, I often encountered fragmented studies - some narrowly technical, others purely social - but few that brought together these entangled systems into actionable spatial strategies. My thesis aims to fill that gap by showing how ecological regeneration cannot be addressed in isolation, but must be embedded within improved governance of waste, water, soil, and livelihoods. This integrative approach can be adapted to other vulnerable coastal territories, whether in the Mekong, or Sundarbans, where similar pressures exist and where urban growth, upstream interventions, and climate threats

intersect.

Importantly, I have also come to understand that transferability lies not in replicating design solutions, but in replicating the process of collective engagement. Any meaningful response must emerge from listening to local actors, translating complexity into shared understanding, and creating flexible spatial frameworks that remain open to adaptation as conditions evolve. Urban design here becomes a tool to make visible these interdependencies, to open up space for dialogue among stakeholders, and to frame the often-invisible care work that already exists at the grassroots level.

In that sense, this project does not offer ready-made answers but proposes a way to engage with systemic vulnerability while amplifying existing local agency. Even modest design interventions, when positioned alongside grassroots initiatives and interdisciplinary collaborations, can become catalysts for larger conversations - and that, I believe, is where much of this project's transferability lies.

6. How did my personal connection to the Indus Delta shape — and sometimes complicate — my design decisions?

Working on this project challenged me not only as a designer, but as someone personally tied to the delta and its people. Having grown up in Karachi, I was geographically close to the delta, yet like many in the city, I was largely disconnected from its daily realities until this thesis. That distance, and eventual reconnection, became central to how I approached the work.

As I began to understand the multiple layers of degradation - from upstream diversions and collapsing mangrove ecologies to informal waste dumping and unchecked urban expansion - I also saw how governance failures repeatedly leave both people and ecosystems exposed, especially during floods. I witnessed how, each monsoon season, floodwaters turn into stagnant, polluted pools that communities are left to navigate on their own, often for months. Seeing this firsthand sharpened my awareness that any design for the delta must not only restore ecological functions but directly address the lived vulnerabilities that define daily survival here.

At the same time, working at the territorial scale often felt abstract. When building the Networks of Care - through recreation, preservation, and production lenses - I constantly questioned whether I was simply mapping idealized interventions onto a fragile landscape without fully accounting for the deep political, institutional, and social complexities that make implementation so difficult. Every scenario I developed - whether proposing aquaculture ponds, mangrove nurseries, or waste management infrastructures - involved difficult trade-offs. There is no intervention that benefits everyone equally; design inevitably privileges certain actors while placing new demands on others. A proposal that may regenerate mangroves could also risk displacing informal settlements or altering existing livelihoods. Navigating these realities made clear to me that design is never neutral.

This tension led me to rethink my role as a designer. Rather than presenting definitive solutions, I began to see my work as opening up conversations - making visible how waste flows impact fisheries and demonstrating how ecological regeneration and livelihood diversification must operate together. Throughout the process, I came to recognize that much of what I was proposing already builds on forms of care that exist locally: from local replantation efforts and aquaculture pilots to existing eco-tourism, mangrove awareness exhibitions and social media activism. My work ultimately became less about prescribing outcomes, and more about building frameworks that acknowledge these existing capacities while proposing spatial tools to strengthen and upscale them - with the understanding that real transformation requires cooperation across community, institutional, and governance levels.

7. How did my understanding of "care" evolve into an approach to urban design — and how did this help me navigate the limits of the discipline while still contributing meaningfully?

At first, care felt personal - a sense of responsibility for a place connected to my own home. But through this process, and inspired by Matters of Care, I came to see care not as something I could apply, but as an ongoing, fragile engagement with both human and more-than-human vulnerabilities. The delta is a landscape of entangled lives - fisherfolk, mangroves, tidal flows - all shaped by forces far beyond their control.

Rather than trying to resolve these tensions, care became a way to stay with them. My role shifted from proposing fixed solutions to holding open spaces where multiple needs could be acknowledged and negotiated. Design became less about offering answers and more about making visible the interdependencies - how Karachi's waste flows into the delta's creeks, how upstream water diversions affect coastal salinity, how local livelihoods depend on the same mangroves they sometimes harm.

This approach also humbled me. Urban design cannot reverse climate change or fix political failures. But it can help translate complexity into legible stories - offering speculative frameworks, like the Networks of Care, that remain provisional and open to adaptation. In this way, design becomes an act of attention and responsibility - not to control the delta's future, but to remain engaged as its uncertain futures unfold.

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Appendix

Figure 57: View of Avicenia Marina Mangroves in Indus Delta.

Fieldwork Pictures:

Figure 58:

Tidal creeks of the Indus Delta showing exposed mangrove roots.

Figure 59:

Sparse patches of mangroves in areas further away from the Karachi Coast.

Figure 60:

Pollution from the Bin Qasim Port and nearby industries has created a toxic environment for mangroves.

Figure 61:

Sewage pipes draining industrial wastewater into mangrove wetlands.

Figure 62:

Jetty at Rehri Goth, where wastewater from the village is also seen draining into the delta.

Figure 63:

A view of Rehri Goth (fishing village), with various fishing boats preparing to depart before the tide comes back.

Figure 64:

Camels on Bundal island, left alone to graze and grow. Once they are older, they are either sold or used for recreational rides at Karachi's beaches.

Figure 65:

A camel at Khuddi creek grazing on mangrove leaves.

Figure 66:

The home of one of the few resident families at Khuddi Creek.

Figure 67:

Use of solar power at a settlement at Khuddi Creek, to charge mobile phones. Fish can be seen laid out to dry at the back, to be later sold as poultry feed.

Figure 68:

Toxic waste and salinisation stunting mangrove growth at the Clifton Urban Forest, Karachi. This is one of the areas where wastewater from Karachi flows into the Arabian Sea.

Figure 69:

Plastic and other waste accumulated at the coast of Karachi near Sea View Beach. This becomes part of marine debris that is already endangering deltaic and marine ecosystems nearby.

Karachi’s Water Flows:

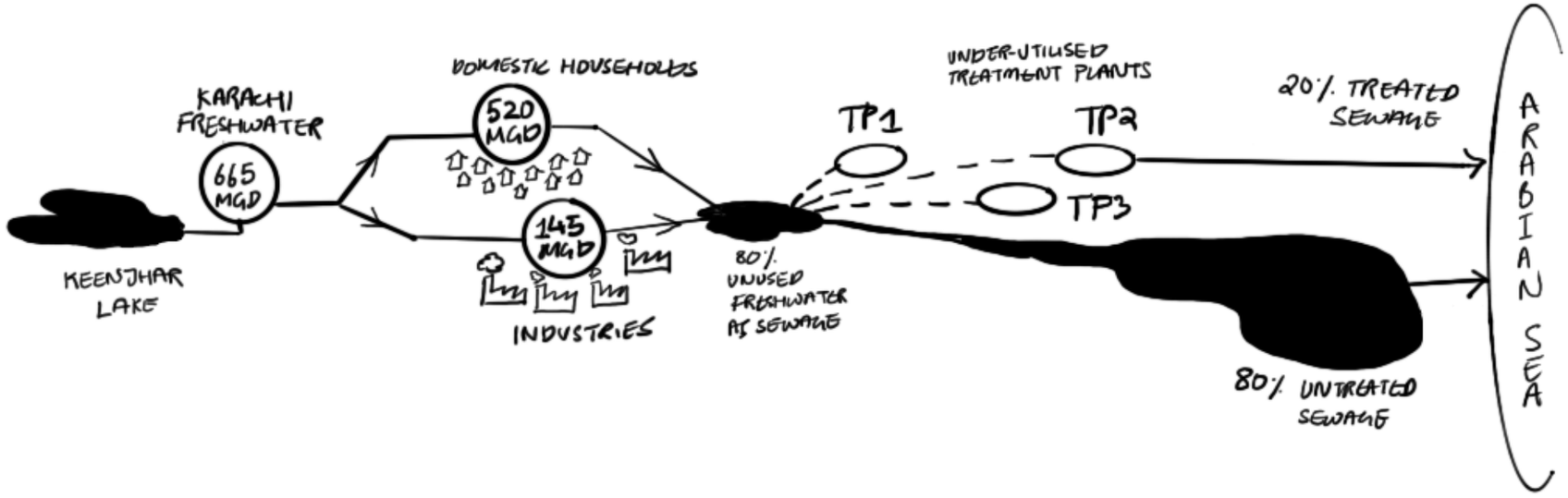
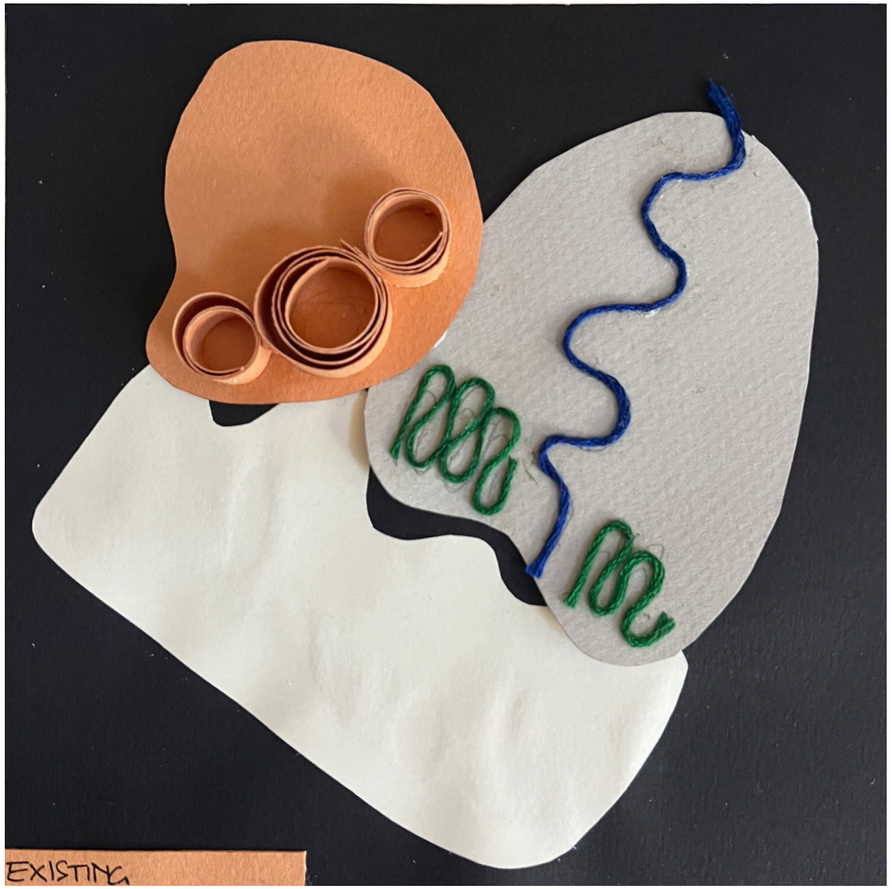


Figure 70:

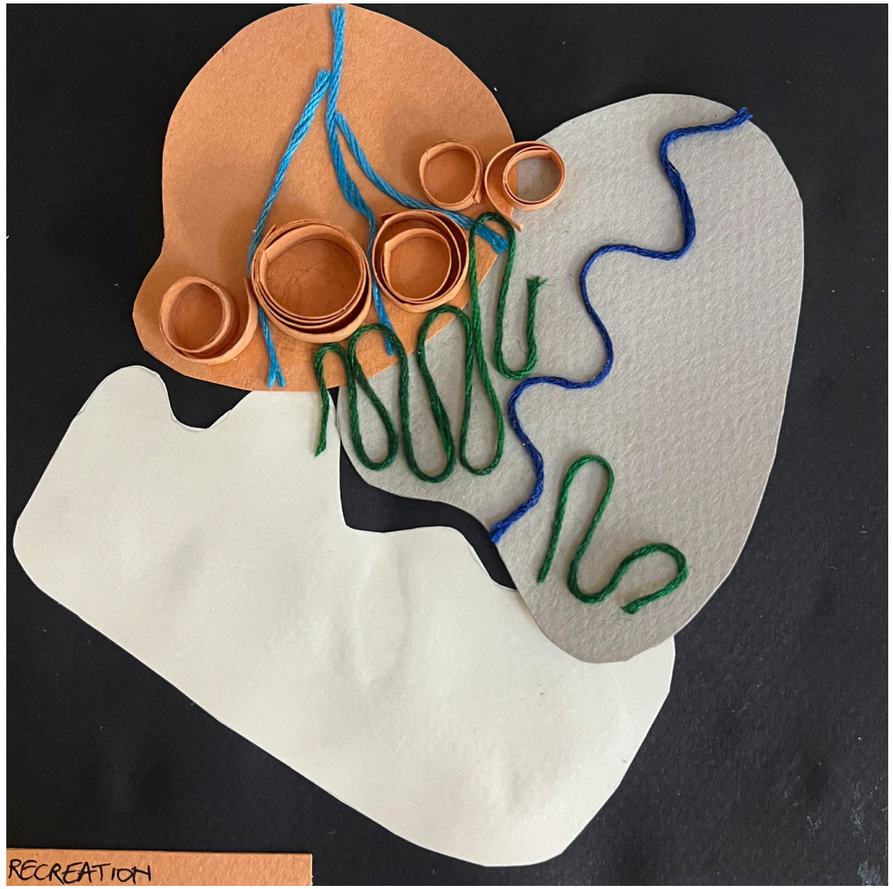
Freshwater distribution to and wastewater flow from Karachi in Mega Gallons per Day.

Source: (Situational Analysis of Water Resources of Karachi, 2019), (Mahera Omar, 2023)

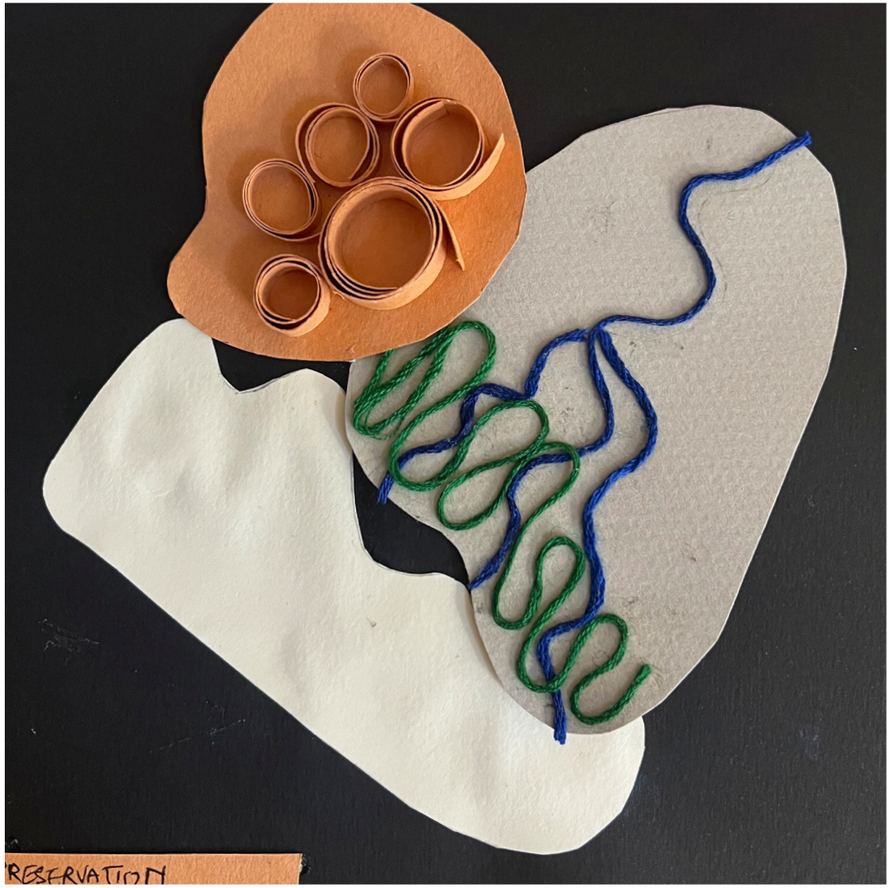
Delta: Existing Condition
Conceptual Model



Delta: Network of Recreation
Conceptual Model



Delta: Network of Preservation
Conceptual Model



Delta: Network of Production
Conceptual Model