KTH ROYAL INSTITUTE
OF TECHNOLOGY

DEGREE PROJECT IN URBAN PLANNING

SECOND CYCLE, 30 CREDITS

The Untold Story of Baba Island

Sustainable Livelihood: The Revival of Fishing Community and Ecology of Baba Island, Karachi

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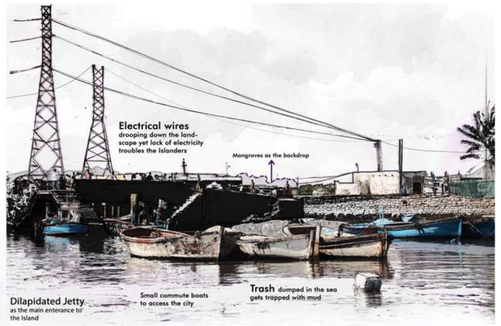
Baba Island | The Untold Story

25-30,000 inhabitants, Baba Island is one of the fishing communities faced with both social and economic challenges. Once part of the mangroves, the inhabited Baba Island is using the neighbouring mangroves for grazing their livestock and for firewood, contributing to the cutting down and shrinking of the very resource it depends on.

Among many factors, climate change and the removal of the mangroves have seriously threatened the livelihood of this fishing community. Once located in the city of Karachi, and then forcibly relocated to Baba Island, these fishermen have always been dependent on the city for their economic well being.



Site Analysis

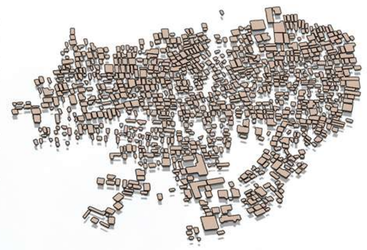
Streets

Narrow Streets with overlapping volumes The narrowest streets are usually 1.2 to 1.5m wide

Housing

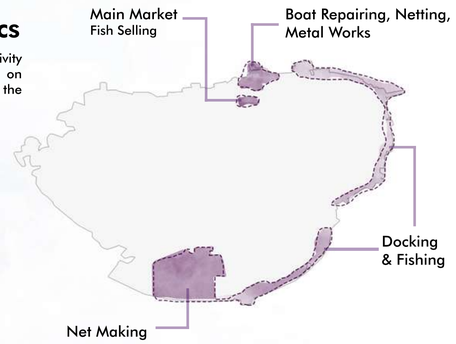
Approximately 1,500 to 2,000 houses with two or three stories. One family generally consists of 5 to 7 people.

Usually a big family is divided into two to three living on different floors due to lack of space and expenses.



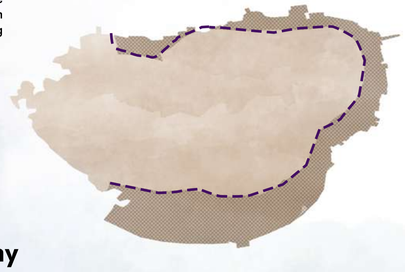
Economics

The economic activity happens mostly on the periphery of the Island.



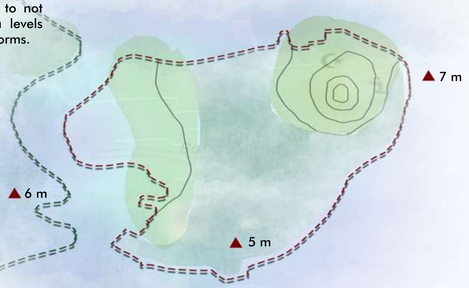
Land

The land of the Island has over the time been claimed from the sea by adding sand and waste.



Topography

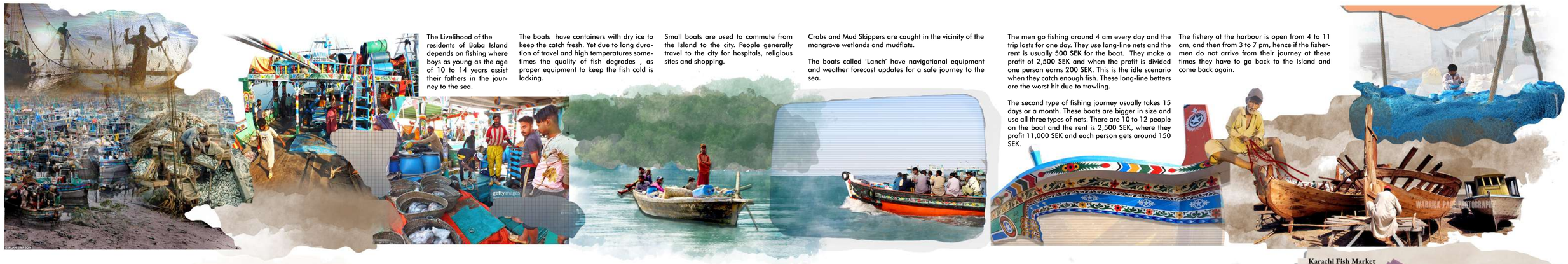
The Island is 5 to 7m above sea level which puts it at risk to not just rising sea levels but also sea storms.



Current Situation of the Island

Section 1 : 250

Fishing Community In Crisis



The Livelihood of the residents of Baba Island depends on fishing where boys as young as the age of 10 to 14 years assist their fathers in the journey to the sea.

The boats have containers with dry ice to keep the catch fresh. Yet due to long duration of travel and high temperatures sometimes the quality of fish degrades , as proper equipment to keep the fish cold is lacking.

Small boats are used to commute from the Island to the city. People generally travel to the city for hospitals, religious sites and shopping.

Crabs and Mud Skippers are caught in the vicinity of the mangrove wetlands and mudflats.

The boats called 'Lanch' have navigational equipment and weather forecast updates for a safe journey to the sea.

The men go fishing around 4 am every day and the trip lasts for one day. They use long-line nets and the rent is usually 500 SEK for the boat. They make a profit of 2,500 SEK and when the profit is divided one person earns 200 SEK. This is the idle scenario when they catch enough fish. These long-line betters are the worst hit due to trawling.

The second type of fishing journey usually takes 15 days or a month. These boats are bigger in size and use all three types of nets. There are 10 to 12 people on the boat and the rent is 2,500 SEK, where they profit 11,000 SEK and each person gets around 150 SEK.

The fishery at the harbour is open from 4 to 11 am, and then from 3 to 7 pm, hence if the fishermen do not arrive from their journey at these times they have to go back to the Island and come back again.

Inhabited Sea | The Harrowing realities of fishermen

Iran

Pakistan

India

Karachi

0 - 12 nm

12 - 20 nm

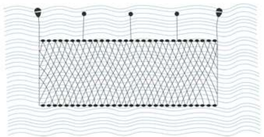
EEZ 240,000 km2

Extended Continental Shelf 50,000km2 -EEZ

In Pakistan Gill-Netting is the most common technique being used by the fishermen for catching fish in coastal waters as well as offshore waters. Gill-nets are like a wall of netting that hangs in the water column. They are used for catching sardines and small fishes along the coastline. Large meshed gill-nets are used in offshore waters for catching tuna and marlins.

Long Line & Gill-Netting

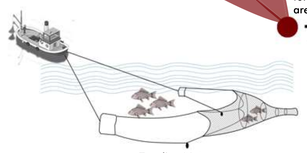
Long-line Net



Gill Net

Shrimp and bottom dwelling fish are caught through Trawling which involves pulling a bag like net behind a fishing boat. The trawl nets (locally known as Gujja) are operated in shallow waters for catching shrimp whereas in the offshore waters fish, such as snapper, croakers and catfish, are caught using trawl nets. For catching sardine, a seine net (locally known as katra) is used. This net is hanged vertically around a fish school and its bottom line is towed to form a pouch to trap fish, which are heaved in to the boat.

Trawling



Trawling Net

Island's Dependency on the City & movement to the Sea

Karachi Fisheries Harbour Authority

Ocean Gold Fisheries
Taj Fisheries

Karachi Fish Market
Fisheries Parking
Fisheries Weighbridge

Commute to City

Karachi Fish Harbour

Maritime Fisheries
Sindbad Fisheries
A.U. Fisheries
Noor's Fisheries
Chauhan Fisheries

Fish Market

Boat Repairing and Renting

MW Fisheries

Karachi Fish Market
International Fisheries
Pak (Pvt) Ltd.

Marine Fisheries Department

Sell the Fish

Fisherman cooperative society

If the seafarers return late from the sea and the market is closed they have to store the fish in the boats before off-loading it to the Fishery. This leads to degrading quality of fish ending up in less money earned by the fishermen

West Wharf

China Creek

East Wharf

Baba Island

Sandspit Mangroves

Kemari

Commute to City

Bhit Island

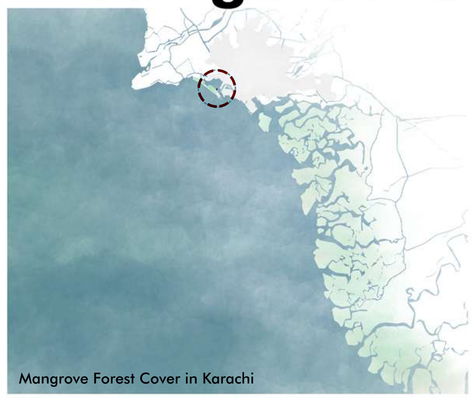
Medical/ Shopping/ Recreation

Mamora Island

Gill-Netters
Long-Line
12 - 20 nm

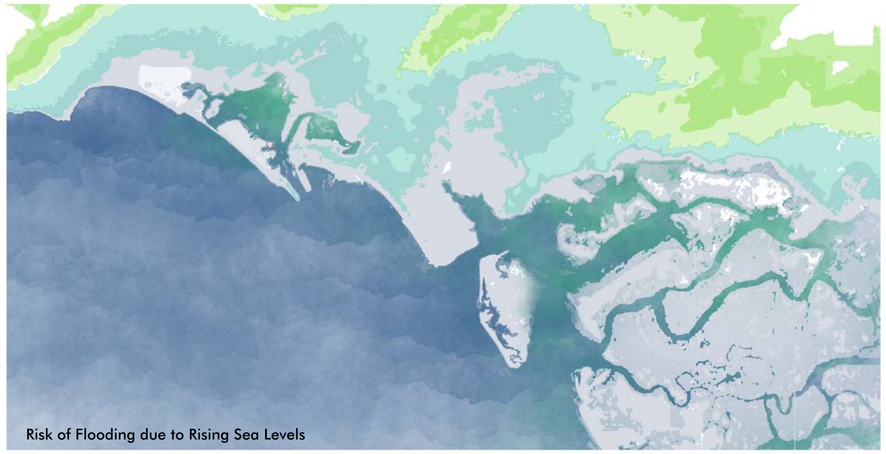
1 km

Endangered Coastal Ecology


Mangrove Forest Cover in Karachi

Continuous rise in sea levels could lead to Karachi being submerged - 2060

- 50 - 60 m
- 30 - 40 m
- 20 - 25 m
- 15 m
- 5 -10 m


Risk of Flooding due to Rising Sea Levels

Mangrove vegetation is characteristically present in river estuaries and along the coast where the land meets the sea. It proliferates in most of the places to stabilize some of the land which otherwise would be eroded every year due to wave action. The major components of the mangrove swamps are salt

Shoreline Stabilization

Climate Regulation

Timber & Forest Products

Fisheries

Water quality Maintenance

Coastal Protection

60 Species of birds belonging to 6 orders and 14 families are found in the Karachi's coastal waters. Some of these birds are resident and others are migratory in nature.

Carbon Sink

Mangroves store 60% more carbon than other trees - 1,083.000 kg/Ha

- 20% Living Biomass
- 78% Soil

14 Species of sea snakes use these mangroves as a breeding ground

UP TO 80%

fish caught in coastal waters spend at least part of their life cycle as in the mangrove creeks, or depend on the food web within the mangrove ecosystem. 200 species of fishes have been reported near the Island.

Lizards

High Tide

Low Tide

Wave Attenuation

High Tide

Low Tide

Pleuronectiforme

Mud Skipper

Crabs

Lobsters

Shrimps

Sardine

Roots support the growth of phytoplankton which serve as the food for zoo-plankton as well as larval stages and juveniles of fish and crustaceans, they also serve as food for filter feeders and benthic marine invertebrate

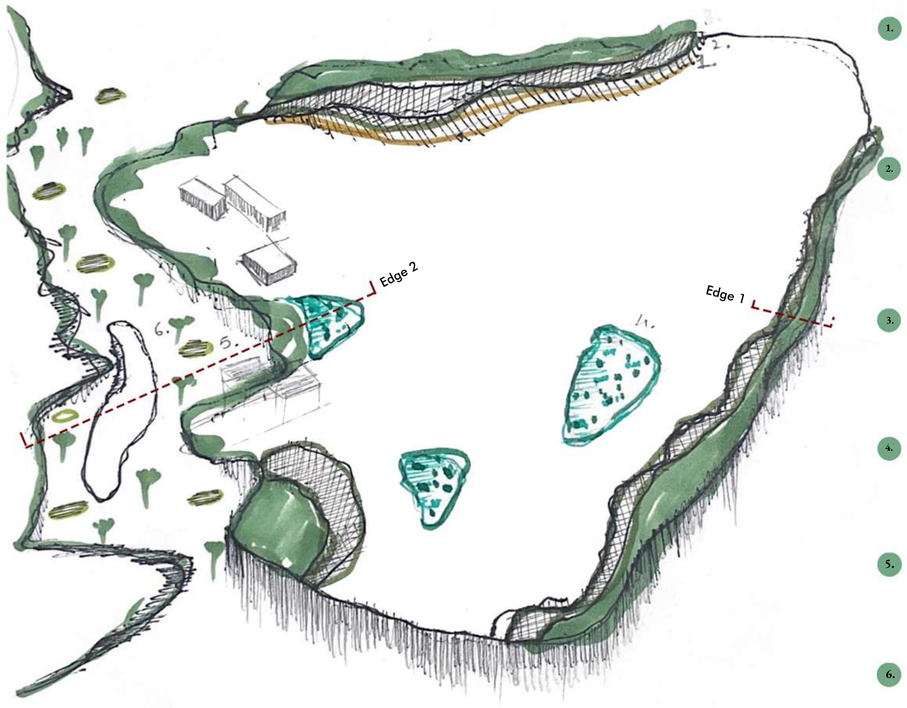
The soil of mangrove islands is alluvium with plenty of clay derived from land drainage and river discharge. It is rich in salts, like sodium chloride, sodium carbonate and nitrate, with some calcium which comes from shell fragments

NO_3 Nutrient

PO_4^{3-} Nutrient

NH_3 Nutrient

Ecology Regenerated



1. **Claiming Space for Mangroves**
Forestation in phases of mangrove Samplings. The community is educated on the significance and preserving the ecology.

2. **Connection between the forests**
The ecological imbalance of the remaining mangrove trees to be re-stored through connection between the forests. Floating mangrove pods and oyster pods as strategies are used.

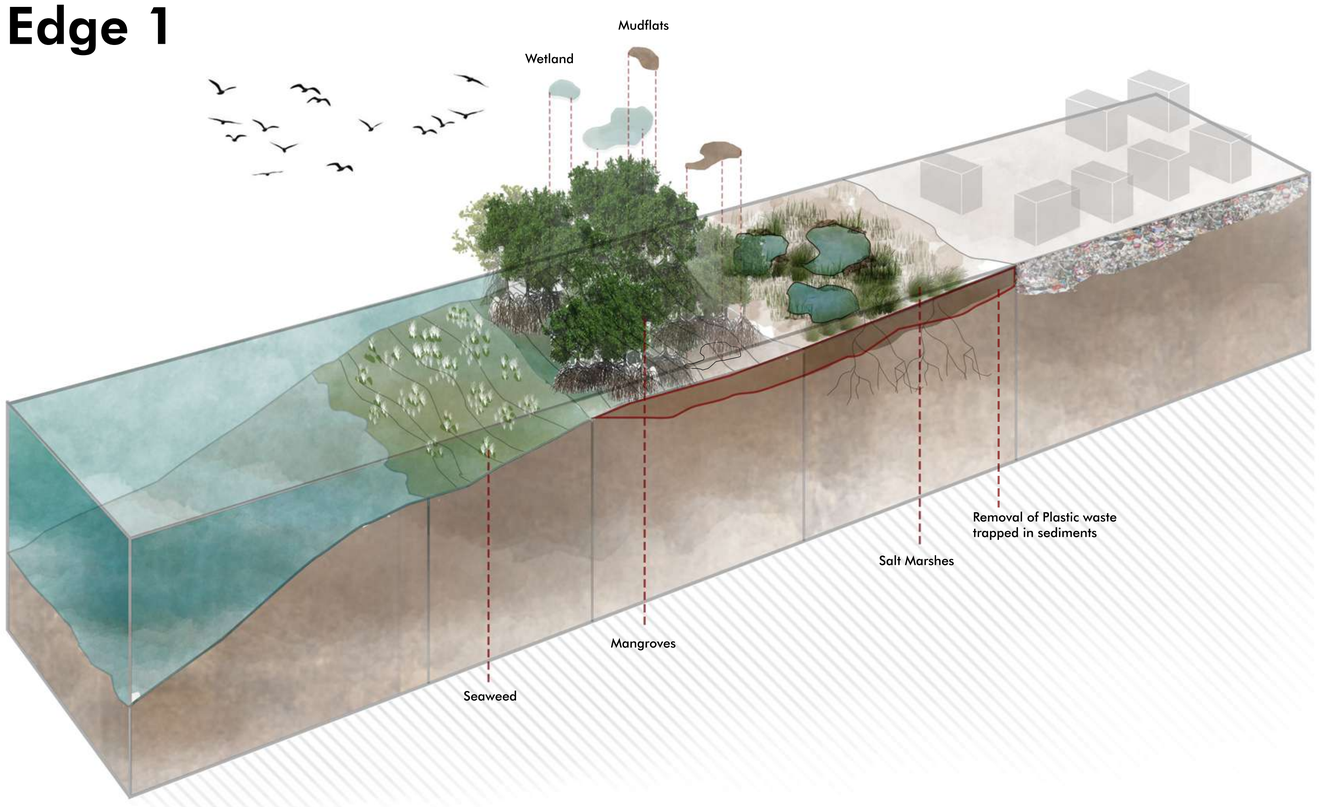
3. **3 Tier Ecology Layers**
The ecological imbalance of the remaining mangrove trees to be re-stored through connection between the forests. Floating mangrove pods and oyster pods as strategies are used.

4. **Porous Periphery**
The hard periphery of the Island is made pervious to break the intensity of water as mangrove plantations anchor the soil and prevent from sea storms.

5. **Community Garden**
Local food production on small scale to help the Island residents survive through the seasonal unemployment phase.

6. **Housing Proposal**
New typology in respect to rising sea levels and ecological regeneration

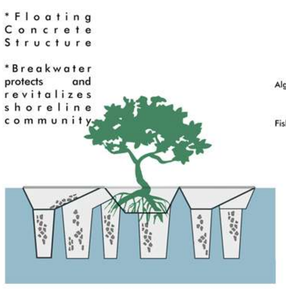
Edge 1



Edge 2

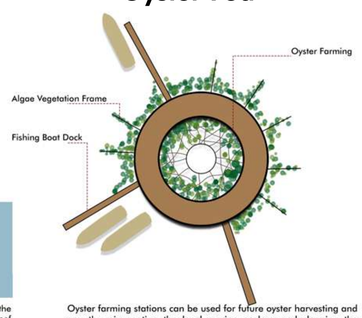
Strategies:

Mangrove Pod



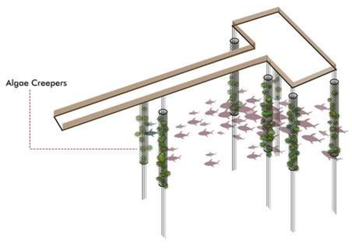
It ensures mangrove seedlings stay above water as roots grow to the seabed. The calcium from the concrete helps nourish the coral reef below the mangrove forest and stabilize the seabed.

Oyster Pod

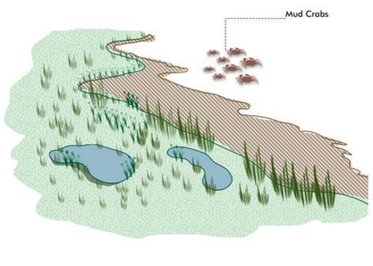


Oyster farming stations can be used for future oyster harvesting and growth, rejuvenating the local marine ecology and cleaning the harbor for future recreational use and experiences.

Jetty Pier



Mudflats & Salt Marshes Wetlands

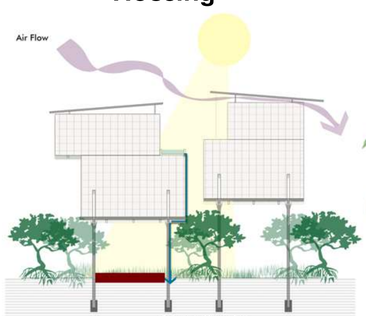


Mud crabs revival in the mangrove forests and the mudflats which are beneficial for the fishing community as they can earn 50 to 100 SEK per day.

Mangrove Plantation

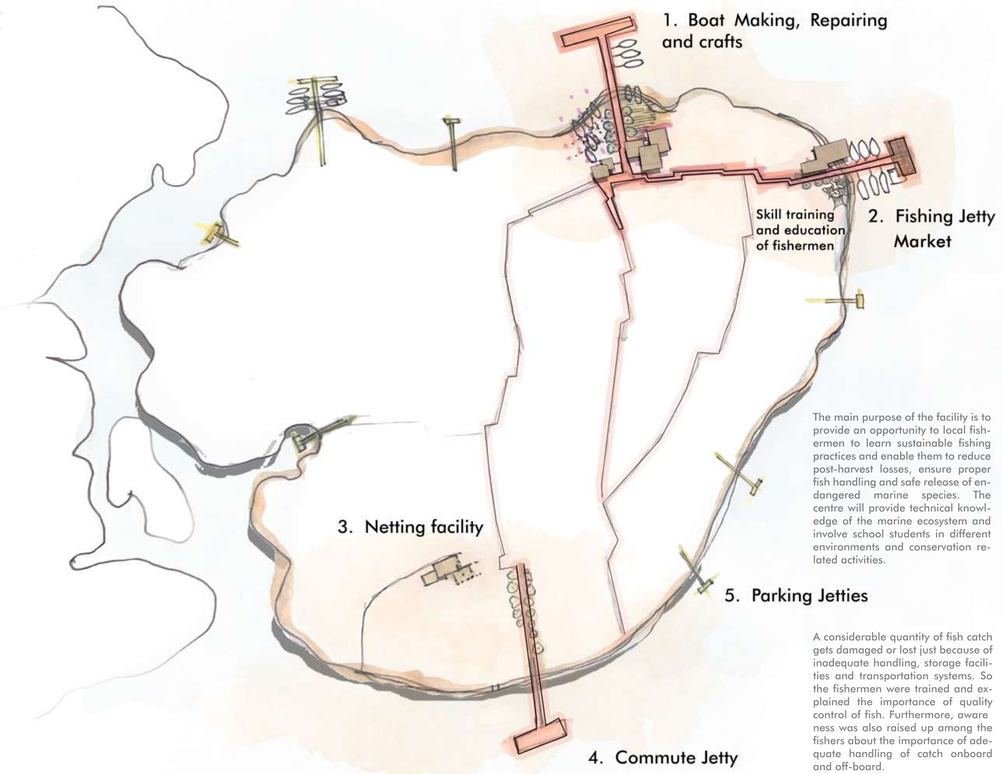
It takes five to eight years to beneift from the mangrove plantations with the fish and crabs thriving again and the Island being saved from salt water intrusion.

Housing



Community Garden

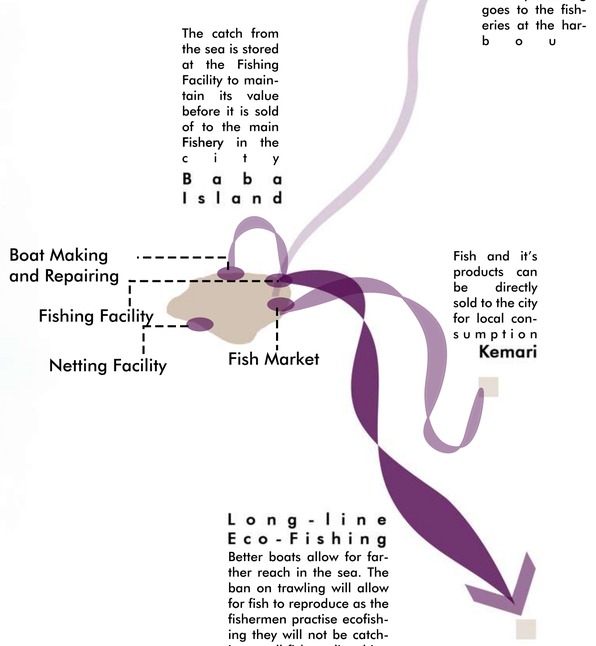
Eco-Fishing



The main purpose of the facility is to provide an opportunity to local fishermen to learn sustainable fishing practices and enable them to reduce post-harvest losses, ensure proper fish handling and safe release of endangered marine species. The centre will provide technical knowledge of the marine ecosystem and involve school students in different environments and conservation related activities.

A considerable quantity of fish catch gets damaged or lost just because of inadequate handling, storage facilities and transportation systems. So the fishermen were trained and explained the importance of quality control of fish. Furthermore, awareness was also raised up among the fishers about the importance of adequate handling of catch onboard and off-board.

Movement to Sea



The catch from the sea is stored at the Fishing Facility to maintain its value before it is sold of to the main Fishery in the city

Baba Island

Karachi Fish Harbour

Catch of Imported Quality and for processing goes to the fisheries at the harbou

Fish and it's products can be directly sold to the city for local consumption

Kemari

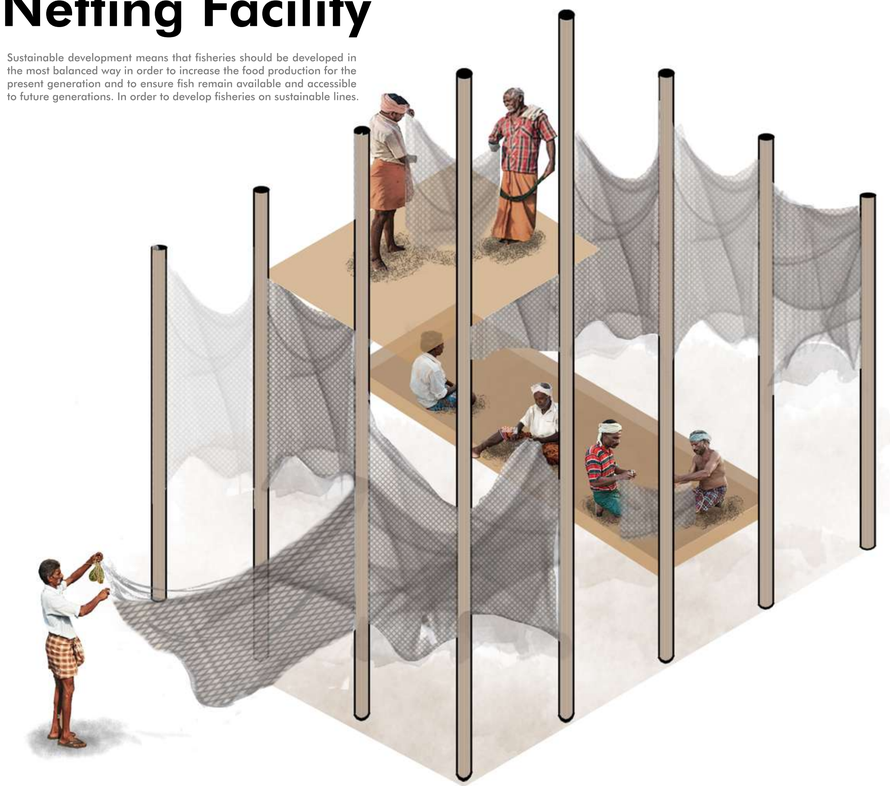
Long-line Eco-Fishing

Better boats allow for farther reach in the sea. The ban on trawling will allow for fish to reproduce as the fishermen practise ecofishing they will not be catching small fish or disturbing the seabed ecosystem.

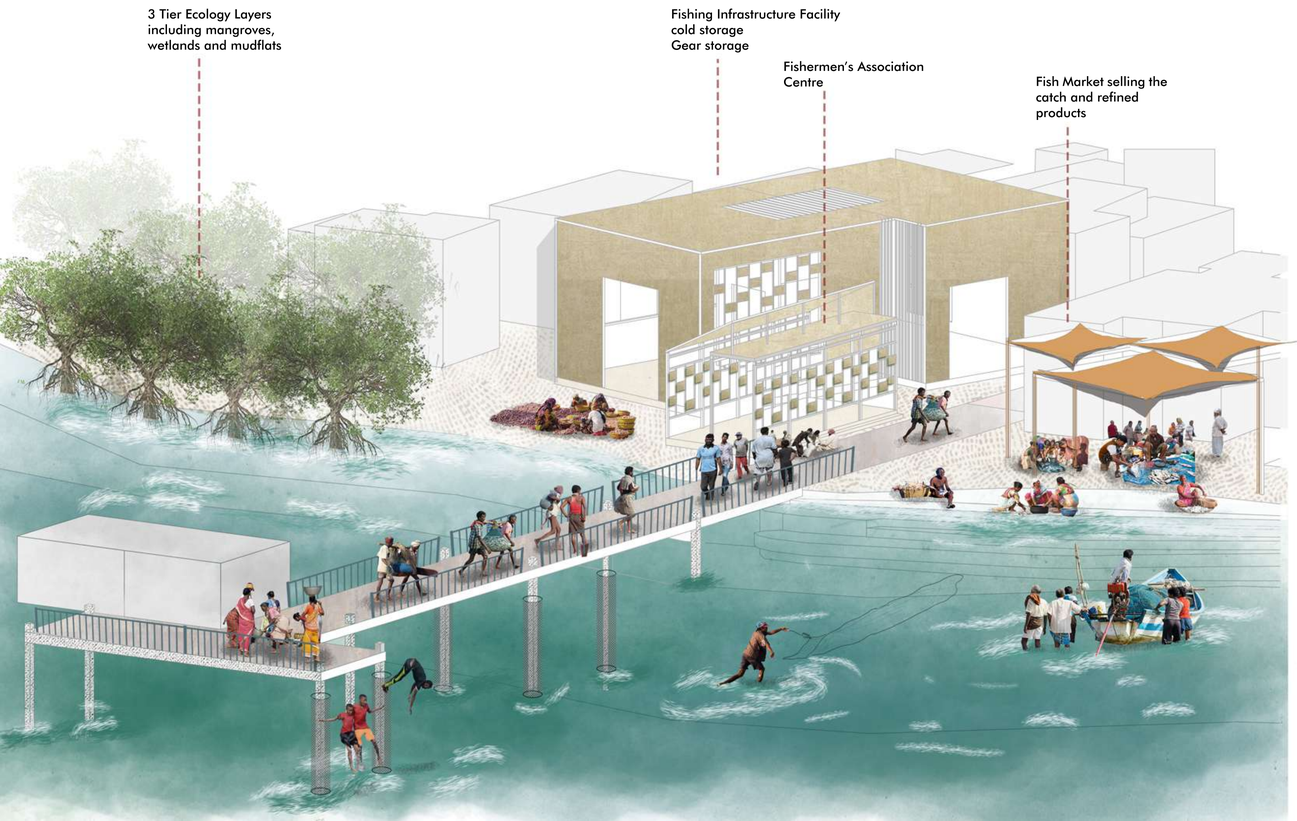
EEZ 240,000 km2

Netting Facility

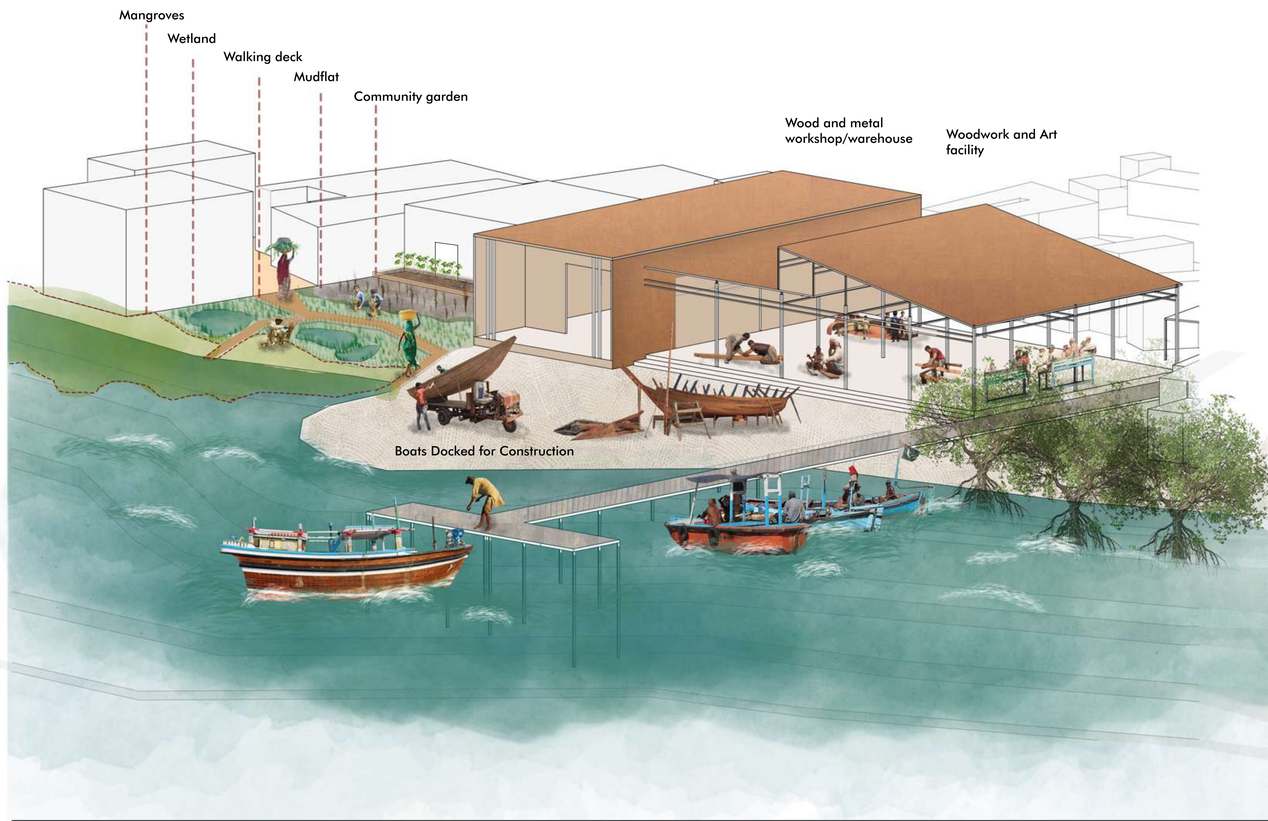
Sustainable development means that fisheries should be developed in the most balanced way in order to increase the food production for the present generation and to ensure fish remain available and accessible to future generations. In order to develop fisheries on sustainable lines.



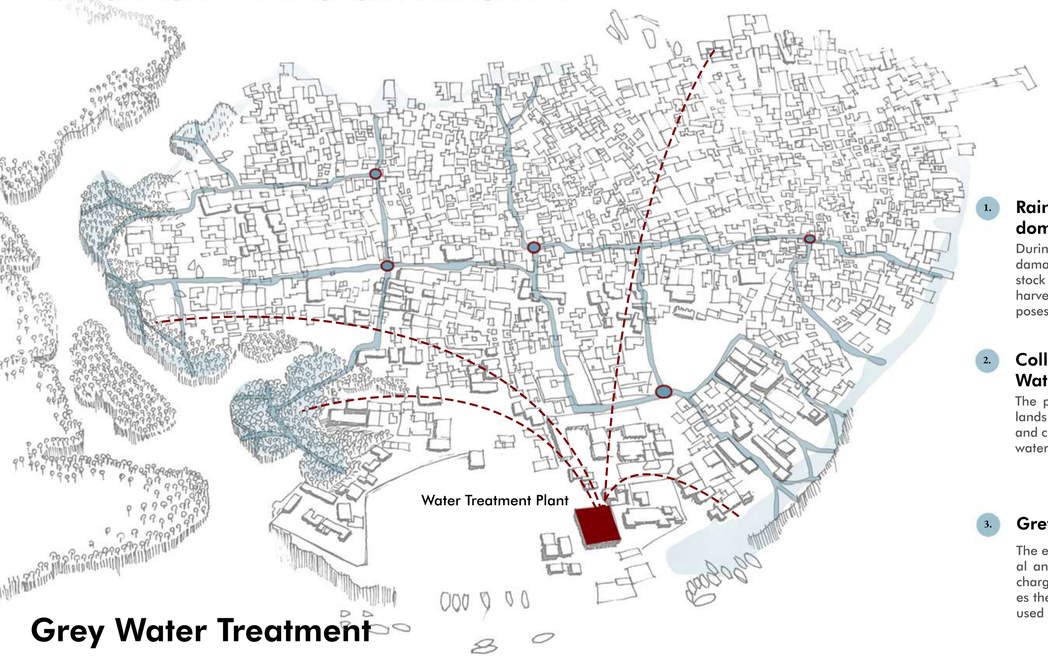
Fishing Facility



Boat Making Facility



Water Treatment



1. Rain Water Harvesting for domestic use and Plantaions

During the rain seasons urban flooding damages houses and troubles the livestock to tackle these issues the water harvested can be used for various purposes.

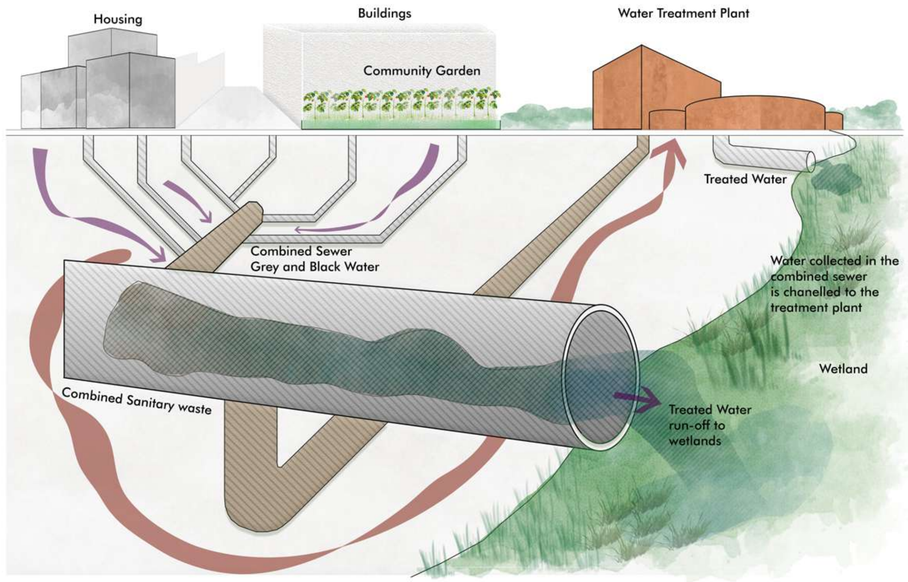
2. Collection Points for Storm Water

The points are water basins and wetlands that retain water for vegetation and channel it to the periphery for fresh water to the mangroves.

3. Grey Water Treatment

The existing water plant is not functional and untreated water is directly discharged to the sea. This project proposes the treatment of water which can be used for the plantation.

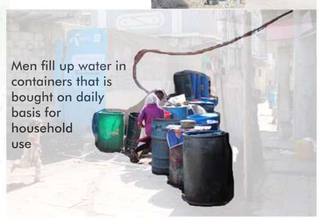
Grey Water Treatment



Existing Water Supply

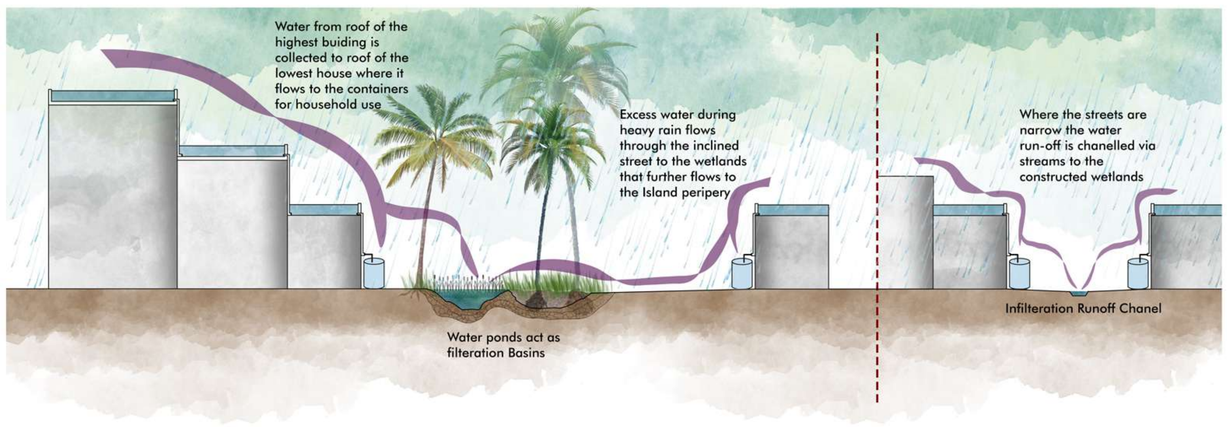
Water Storage Containers that are used for water brought through boats.

The existing water treatment plant doesn't function

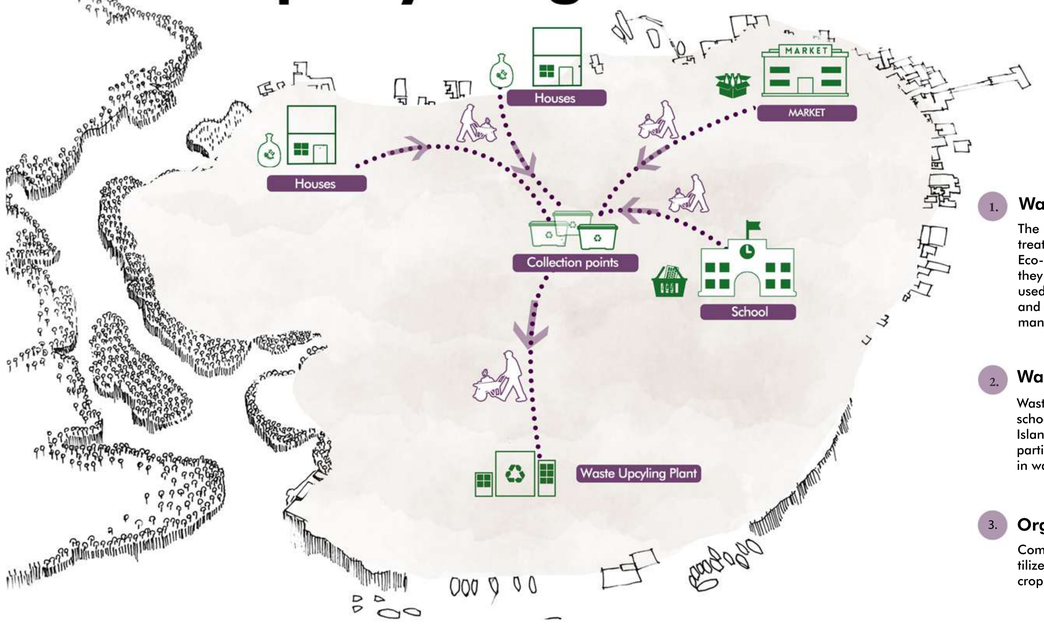


Men fill up water in containers that is bought on daily basis for household use

Rain Water Harvesting



Waste Up-Cycling



1. Waste Up-cycling Plant

The Plant will collect Plastic waste and treat it for construction purposes. The Eco-bricks will also generate revenue as they can be sold. The bricks will also be used for renovation of existing streets and can be used for the construction of mangrove pods.

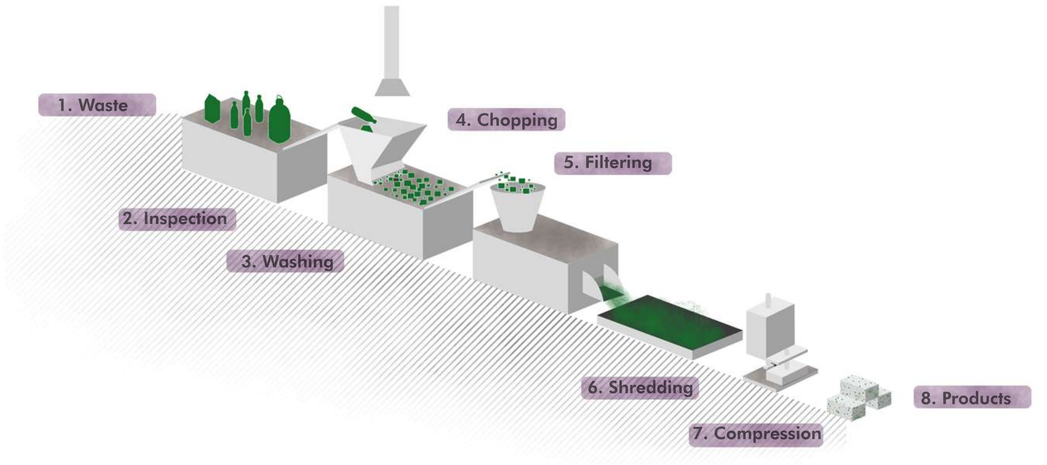
2. Waste Segregation Points

Waste will be segregated at household, school and market areas. People of the Island will be trained including school participation to allow for better results in waste segregation.

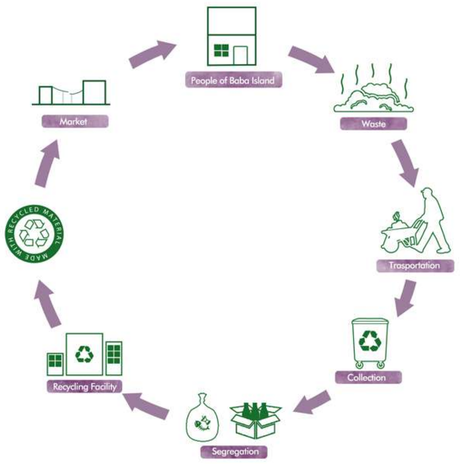
3. Organic Waste

Composting method will be used to fertilize the community gardens for better crop yield as the soil is silty.

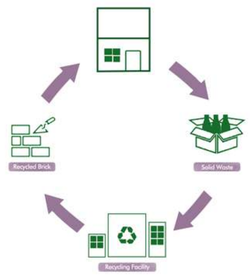
Circular Waste Cycle: Waste Treatment



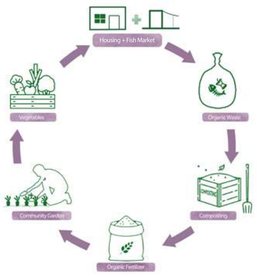
Waste Movement



Existing Linear Chain



Non-Organic Waste Cycle



Organic Waste Cycle

Baba Island Regenerated

Boat Making Facility

Fish Market

Eco-Fishing Facility

Fishing Jetty

Mangrove Pods

Community Garden

Proposed Housing

Existing Ground converted to Community Garden

Jetties for boat parking

School

Clinic

Mangrove Pods as protection from soil erosion

Netting Facility

Religious Site

Waste Treatment Plant

Water Treatment Plant

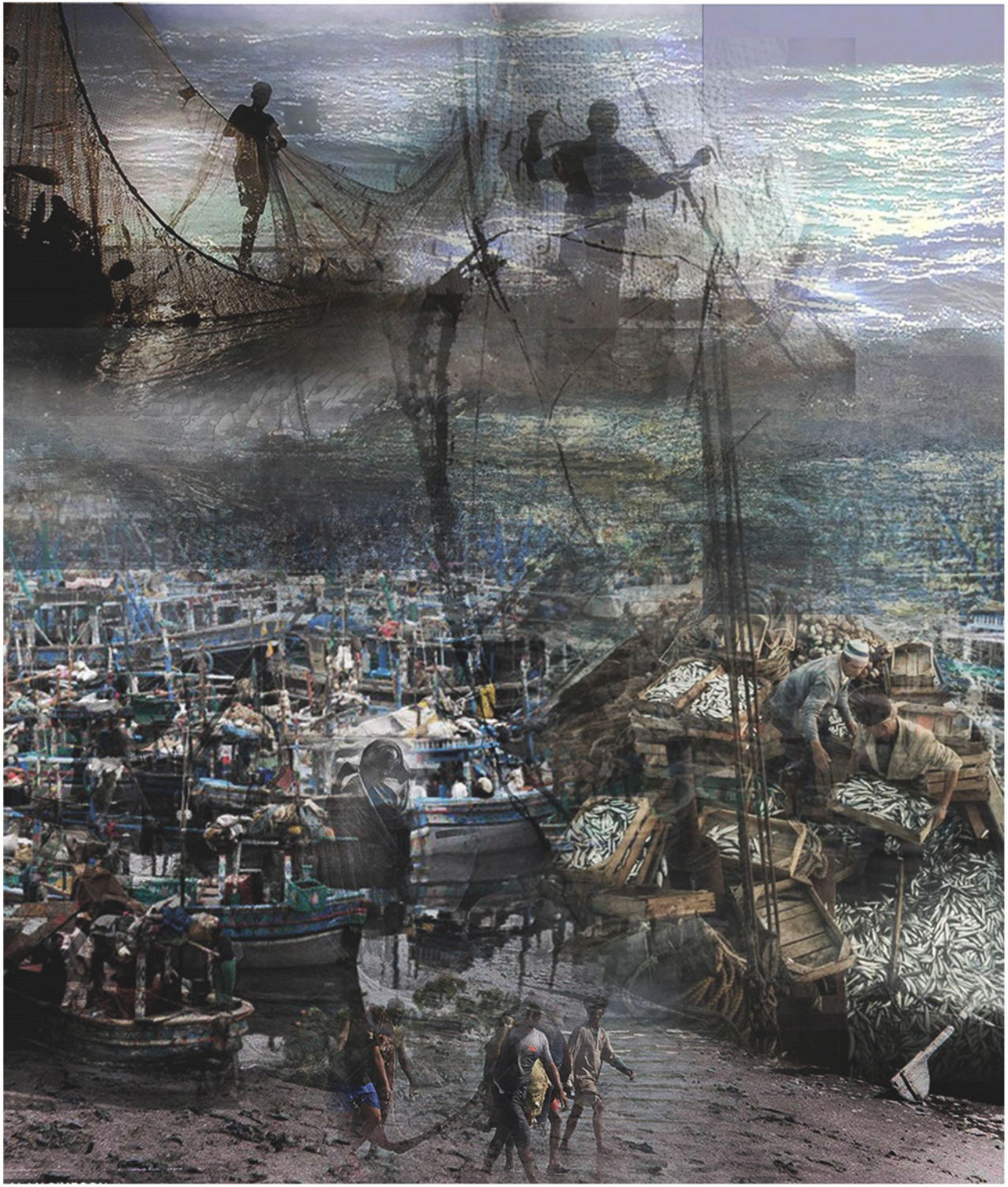
Oyster Pods

Porous Periphery is more resilient to high tides allows the waves to flow through the mangroves breaking its pressure

Entrance Jetty

Commute to the city

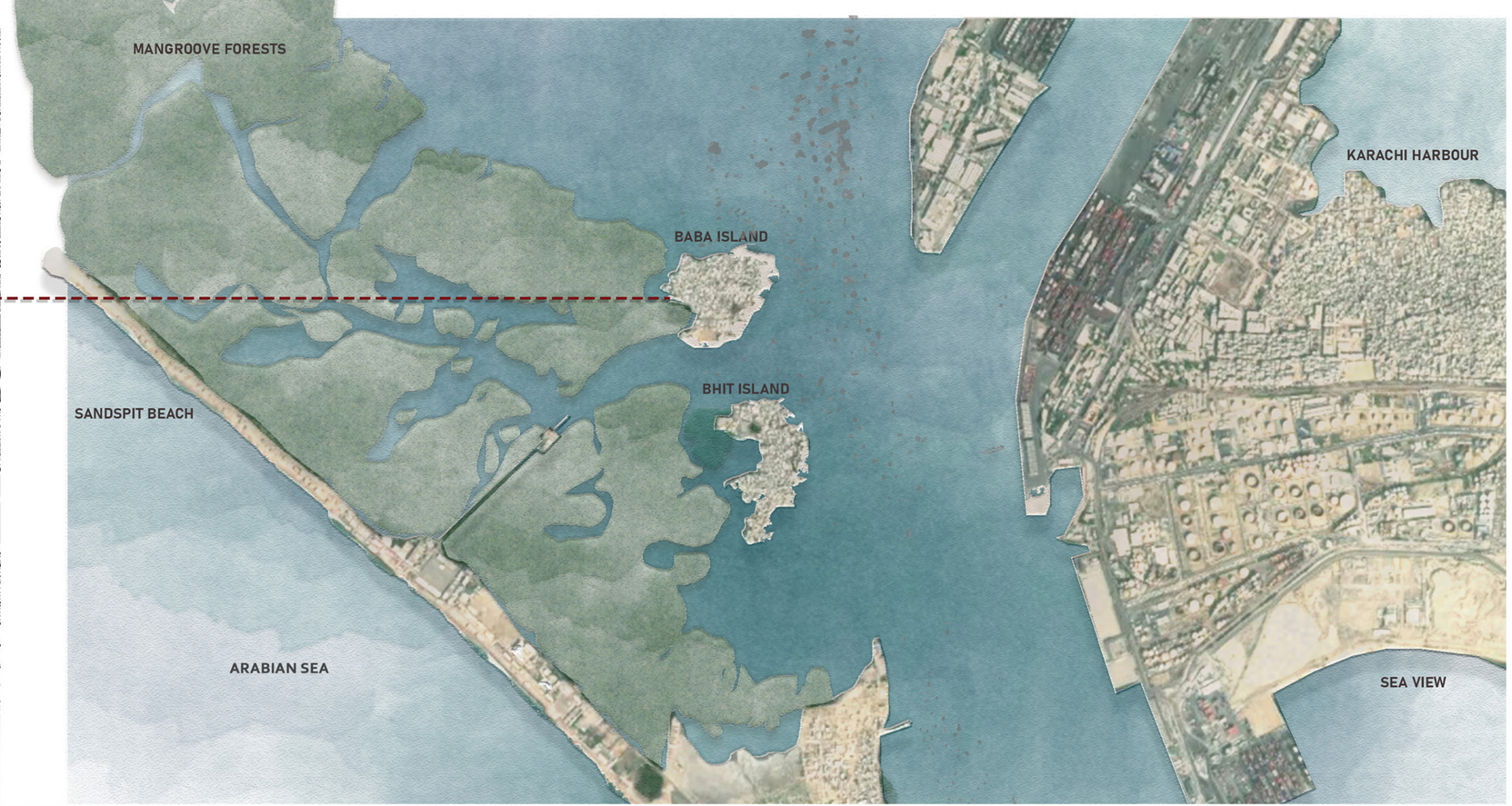
Scale - 1:600



MAHUM AHMAD

AD2EXU
THESIS
BOOKLET

SUSTAINABLE LIVILEHOOD



SITE LOCATION

KARACHI - PAKISTAN

BABA ISLAND

Karachi's port does not open directly to the Arabian Sea. Between the port and the ocean, a barrier Island runs northwest - southeast. East of this island and west of the port sits a large expanse of water and mangroves. Water in the Lyari River Delta must empty into the sea through the Baba Channel. Sediment colors the water flowing through that channel a lighte color than the surrounding ocean. Immediately east of the Port of Karachi lie two more mangroves forests, the larger of which is named China Creek.

BABA ISLAND

The metropolitan city of Karachi was once called Kolachi, comprising fishing villages including Baba Island. It became a local trading port in the 18th century, later developing into a port city during British rule. Baba Islandis a kilometre's proximity to the Kemari Jetty that provides the only access to the mainland. Baba and Bhit are twin Islands separated by 800 meters of water depth.It is a densely poplutated Island with 30,000 inhabitants. The approximate area of the Island is 4 km^2.

The fundamental source of income for the dwellers of this historical island is fishing. Without fear, armed with fishing nets and other gear, these locals venture into deep waters, hoping to bring home enough to make ends meet for the day (Sultan, 2019). Baba Island marginalized community faces resource depletion, degradation of once pristine water for fishing, pollution and bleak socioeconomic structure

SDG's

Life below water

Conserve and sustainably use the oceans, seas and marine resources for sustainable development.

Life on land

Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.

Climate Action

Offsetting the impact of climate change starts with you becoming aware and informed,

PROBLEM

Rising sea levels: In Karachi, the average mean sea level rose to 1.1 mm per year. Karachi is already on the verge of sea-level rise.
"If water intrudes, it would inundate the entire old Karachi area," said Dr Moazzam Ahmed, an environmentalist at the World Wildlife Fund (WWF) Pakistan. Experts have apprised that the coast of Karachi could be submerged by 2060 if the rising sea level current trajectory of s continues. In such a scenario, the fishing village becomes extremely vulnerable to climate escalations. The rehabilitation plan for future or resilience strategies have not even been thought of yet brought about in criticism by activists, or the government.

Most affected people by rising water levels

A rise sea level of a few mm per year, although not threatening but direct and indirect impact of this rise would have a profound Impact on the coastal resources for sustainable coastal zone management. Direct land loss of low - lying areas can rapidly damage or destroy coastal ecosystems. The loss of mangroves in coastal areas are resulting in:

1 Reduced reproduction & procurement of commercial fishing
2. loss of livelihood and declining health of communities, particularly women, children and elders dependent on fish-based products as a primary source of sustenance
3. Increased coastal erosion, damage to coastal villages and agricultural land through salt - water intrusion and contamination
4. Reduced availability of wood, loss of fauna and floral biodiversity, and the silting up of navigational channels and ports.

THESIS FRAMEWORK

Water Pollution **Land Reclamation**

Rising Sea Levels **Vanishing and Degrading Habitat** **Loss of Marine Life**

Mangrove Ecology

Research Topic

A resilient cohabitation of vulnerable community and ecology
Biodiverse coast - Sustainable Livelihood

Fishing Village

Risk of Flooding **Lack of Basic Amenities** **Unemployment**

Marginalised Community **Lack of Infrastructure**

Poor Sanitation **Healthcare problems**

MANGROVE HABITAT

THE VANISHING AND DEGRADATION OF MANGROVE HABITAT IN THE CONTEXT OF KARACHI

Pakistan is recognized to have the 7th largest mangrove forests in the world. These are one of the primary features of coastal ecosystems and are widely spread across the coast of Pakistan. The majority of mangroves forests are found in the Indus Delta, a region categorized as one of the most productive Global 200 Ecoregions of the world."The annual deforestation rate of Pakistan is 1.63%. In the early 1970s, when the port was being constructed, eight species of mangroves flourished. Today, only four remain.

Presently, mangroves face multiple threats such as environmental degradation, ruthless cutting, and dumping of sewage wastewater. The reduced freshwater flow in the Indus delta and other mangrove forest areas is leading to declining in productivity and nourishment of their habitats leading to the death of the plants. In recent years, toxic waste in the form of untreated sewage, industrial effluent, and bloodied water drained from the nearby cattle colony – in the case of Karachi Mangroves, has proved to be the biggest challenge to the survival of mangroves. On a daily basis, around 472 m gallons of waste are released into the sea; which poisons the surrounding vegetation and marine life.

A hatching ground for fish, and critical to sustaining the delicate ecological balance of the area, mangroves that fall under the authority of the Port Qasim Authority and the Karachi Port Trust are the most endangered. The major coal-handling operations approved this year will only add to the already considerable problems.

These are just some of the causes of the degradation of the mangrove habitat. The key role of this biodiverse coastal forest is to prevent tsunamis, cyclones, they provide nursing grounds for various fish and crab species, climate mitigation and more so are a source of livelihood of coastal communities. The significance of these forests are currently undermined in the context and even though the state has laws to protect these forests, little has been done in concrete actions for protection and rehabilitation of these habitats.

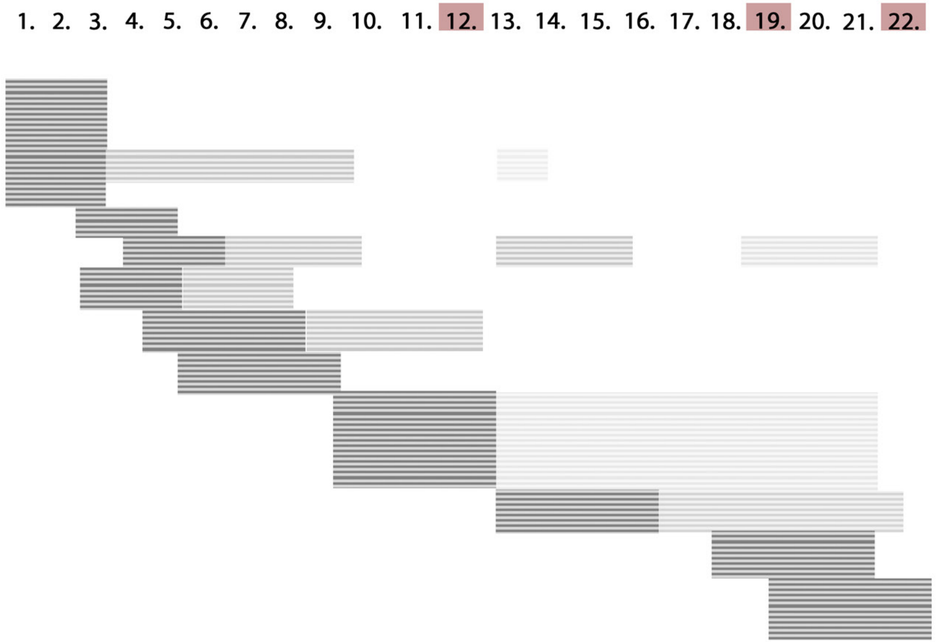
SANSPIT MANGROVES NEAR BABA ISLAND

Sandspit area is made up of tidal lagoons, inter-tidal mudflats and mangrove swamps. It is supported by various type of species namely migratory birds, marine dolphins, crabs, lobsters etc.

The sandy beach of Sandspit is the most important nesting habitat of marine turtles. About 20,000 migratory birds visit the area in winter. A total of 106 species of bird that include migratory and resident have been recorded from the area. Five villages surround the Sandspit area. Fishing is the main source of income of the community of these villages.There are 400 hectares of mangrove forests in the area. More than 70 % of the villagers depend on mangroves for fuel wood, constructing boats and houses. Besides using wood, leaves are also utilized as fodder for livestock.

TIMELINE

Site Visit + Interviews
Documentation
Site Analysis
Ecology Research References
Ecology Mapping
References
Literature Review
Documentation
Concept + Toolbox
Thesis Framework References
Ideation
Strategies
Design Ideas
Strategies
Design Development
Drawings Strategies
Models
Site Specifications References
Drawing Development
Final Drawings
Literature Review
Presentation



METHODOLOGY

RESEARCH

Literature Review
Ecology Dynamics
References
Site Visit
Interviews

ANALYSIS

Coastal Documentation
Ecology System
Actors Documentation
Sytems and Mapping
Site Analysis

IDEATION

Concept Development
Toolbox
Strategies
Iterations
Design Development

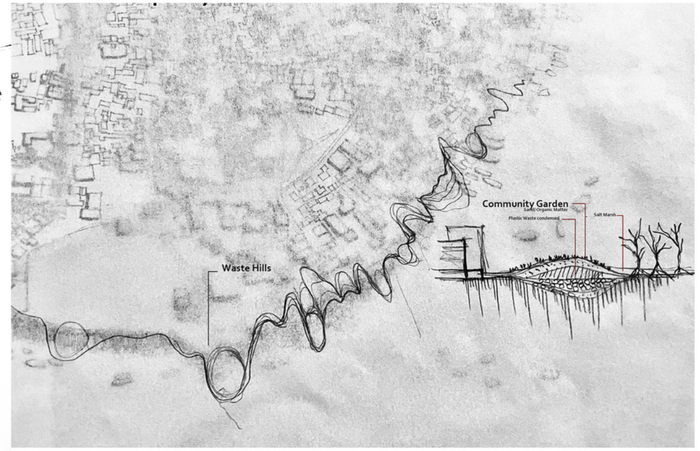
PRESENTATION

Final Drawings
Thesis Framework
Models
Literature and Research
Posters

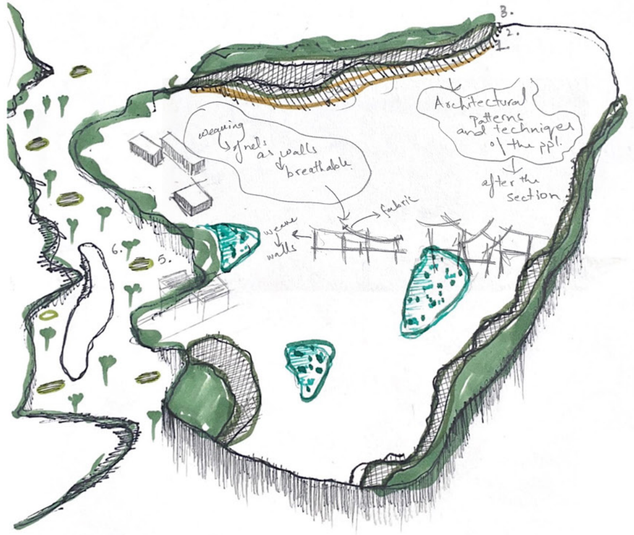
PROCESS

DOCUMENTATION OF THE ISLAND

RETROFITTING THE EDGE TO ATTRACT MARINE LIFE

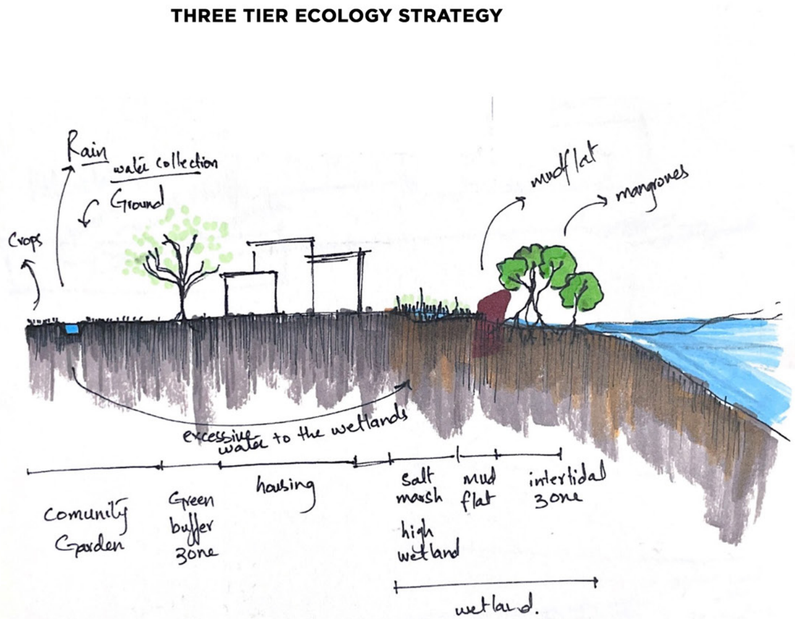


ECOLOGY

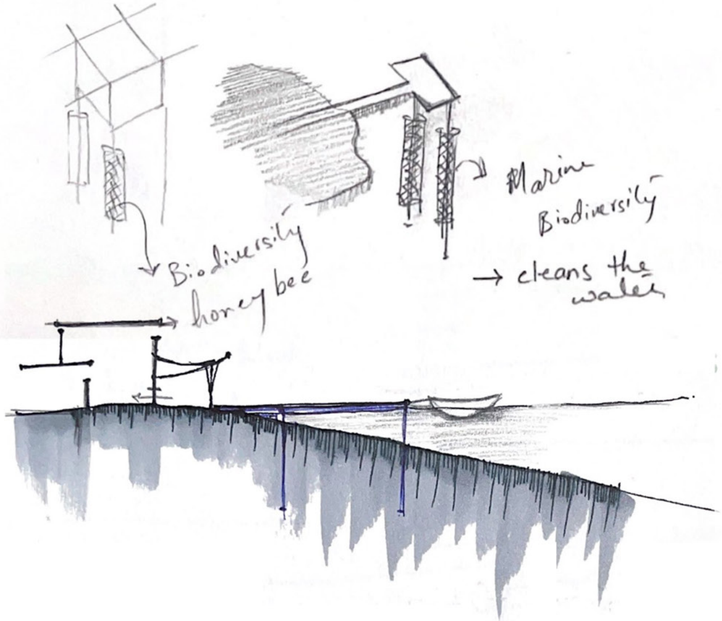


PROCESS

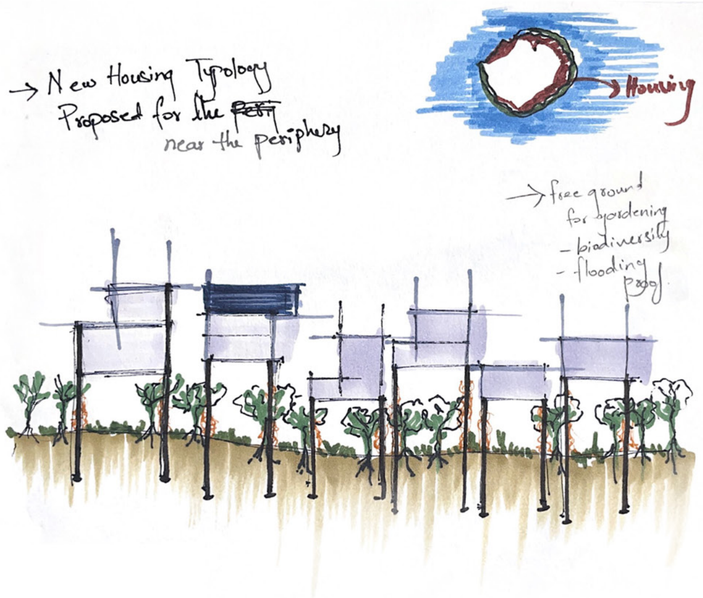
THREE TIER ECOLOGY STRATEGY



RETROFITTING THE EDGE TO ATTRACT MARINE LIFE

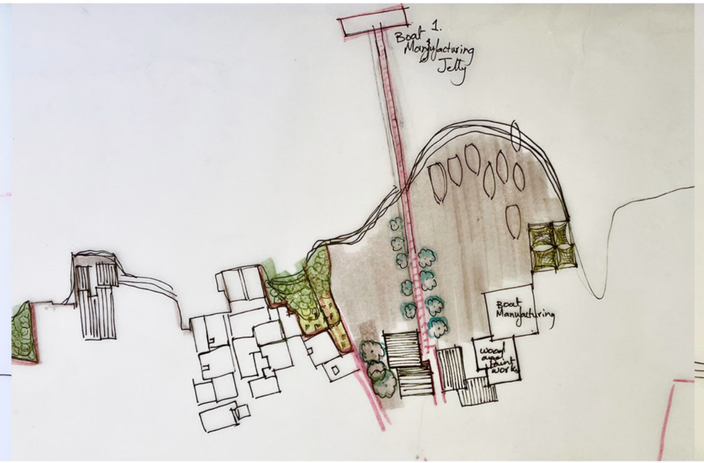


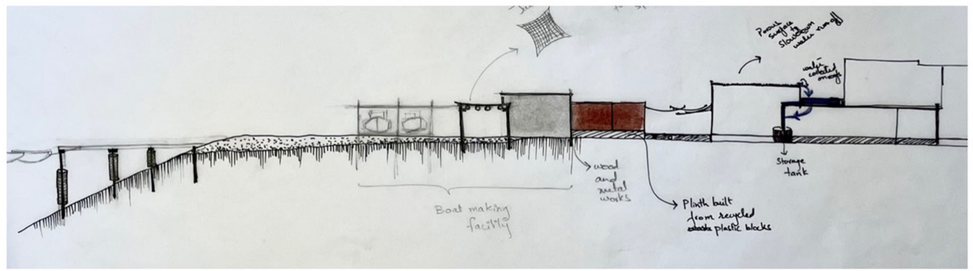
INTEGRATED HOUSING AND ECOLOGY

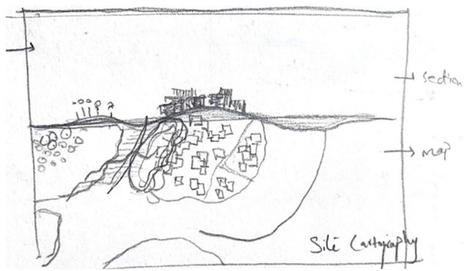


PROCESS

MASTERPLAN EDGE DETAILS







LITERATURE REFERENCES

KARACHI CITY CLIMATE CHANGE - ADAPTATION STRATEGY A ROADMAP
Author: Farhan Anwar

This study identifies and prioritises the people and assets in Karachi, Pakistan at possible risk and the key actions required to make Karachi a resilient city in addition to identifying the critical governance, institutional, technological gaps and constraints. Issues addressed: (i) Pakistan: urbanization and climate change adaptation; (ii) climate change: the Karachi City context;
(iii) understanding the impacts: floods, droughts, extreme heatwaves, and sea level rise; and (iv) managing the impacts.

URGENT INTERVENTIONS NEEDED AT THE TERRITORIAL SCALE - NOW MORE THAN EVER
Author: Kelly Shannon

This chapter discusses the necessity for landscape architecture interventions at the territorial and regional scale. The contemporary world is at a tipping point, one that is disturbingly divided and environmentally devastated. In light of the precarious contemporary political and environmental contexts, there is an urgent need and responsibility for the profession to address the world's most pressing and fundamental issues and to marry social and political justice. Myriad issues linked to climate change, deforestation, energy, water, and food security require a crossing of disciplinary and scalar boundaries, out-of-the-box design thinking, and bold policies, plans, and projects. The chapter outlines six broad strategies that address habitat preservation, new spatial and programmatic reconfigurations of territory, resource management, and settlement morphologies. It is a call to arms for the profession of landscape architecture to act now - before it is simply too late.

THE IMPACT OF SEA LEVEL RISE ON PAKISTAN'S COASTAL ZONES– IN A CLIMATE CHANGE SCENARIO
Author: Golam Rabbani

Pakistan has over 10% of its population living in the vicinity of the coastal zone, over 20 % of coastal area of Pakistan is relatively developed, 40% of industry is situated on or near the coast. Protecting these human assets will be costly, particularly if the effects of climate change are sudden rather than gradual. A rise sea level of a few mm per year, although not threatening but direct and indirect impact of this rise would have a profound impact on the coastal resources for sustainable coastal zone management. Direct land loss of low-lying areas can rapidly damage or destroy coastal ecosystems. In addition to sea level change a rise in global warming will also increase the frequency of tropical cyclones and will further add to the miseries of the coastal states.

EFFECTS OF MANGROVE DEFORESTATION ON MANGROVE MUD CRAB FISHERY: NGOMENI-MALINDI, KENYA
Author: Esther Fondo

Mangrove forests support diverse animal populations of commercial importance among them is the mangrove mud crab Scylla serrata. Destruction of mangroves through deforestation, conversion into salt pans and for aquaculture has been a major concern and is likely to affect the systems the mangrove support, including crab fishery. Mud crab catches from areas with different levels of mangrove destruction in Ngomeni area, Malindi Kenya were analysed.

THE INVENTION OF RIVERS ALEXANDER'S EYE AND GANGA'S DESCENT
Author: Dilip Da Cunha

The Invention of Rivers explores the art, science and infrastructure that has gone into materializing and naturalizing rivers on the earth surface and the role that this design project has played and continues to play in colonizing places of rain. Printed in full color and featuring more than 150 illustrations, The Invention of Rivers proposes rain, or the "ocean of rain," as an alternative starting point for imagining, understanding, and designing human habitation.

PROJECT REFERENCES

1. Floating concrete Islands to repopulate Mangrove forests

APTUM architecture

Isla Rhizolith is a prototype concrete structure to revitalize Colombian shorelines among urban areas vulnerable to ongoing flooding. in reaction to the continued destruction of mangrove forests. A rhizolith is a root system encased in mineral matter - created through processes of erosion and cementation - that protects and strengthens the natural composition of the earth. The prototype is a breakwater system comprised of 'root-like' concrete elements and planted mangroves that, when set floating upon the water, act as both an artificial and natural rhizolith.

2. TetraPOT

Sheng-Hung Lee and Wan Kee Lee

"A symbiosis between artificial and natural sea defence"

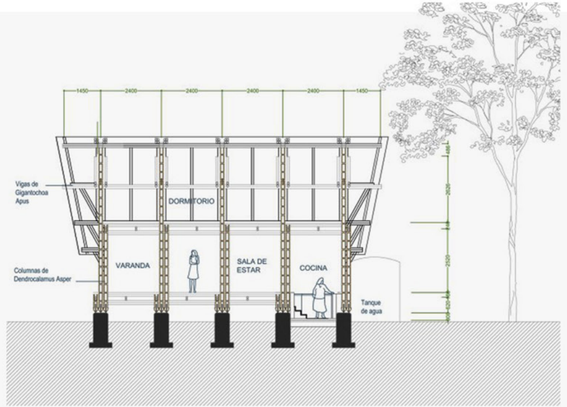
TetraPOT is a similar shape to current defences – often made from large concrete blocks called tetrapods, designed to prevent soil erosion. TetraPOT's three-pronged concrete shell protects a pre-seeded container, made from compostable material.

The TetraPOT's concrete exterior will protect the plants as they're maturing, while fully grown roots will help anchor each block in place.

The system works on the same principle as naturally occurring mangrove forests, which have complex root systems that help prevent erosion. The designers estimate around 14 months for the roots of each TeraPOT to start interlocking.

3. BAMBÚ SOCIAL

El Rama, Nicaragua



A pilot for sustainable social housing in El Rama, Nicaragua, developing a building method by the use of the widely available resource bamboo. This building method can be practiced in a completely local manner. The model house acts as a library for the students and professors of the local university

4. Makoko Floating School

NLÉ Architects

The coastal community of Makoko, a slum neighborhood, off the Lagos Lagoon in Lagos, Nigeria is receiving an upgrade to its current solution.

The Makoko Floating School makes use of local materials and resources to produce architecture that applies to the needs of people and reflects the culture of the community. Wood is used as the main material as the structure, support and finishing for the completed school.

The srchitects have employed strategies to make the floating architecture sustainable by applying PV cells to the roof and incorporating a rainwater catchment system. The structure is also naturally ventilated and aerated.

The completed structure rests on a base of typical plastic barrels. This simple solution reflects a reuse of available materials that can provide multiple uses. The barrels at the periphery can be used to store excess rainwater from the catchment system.

Thank You