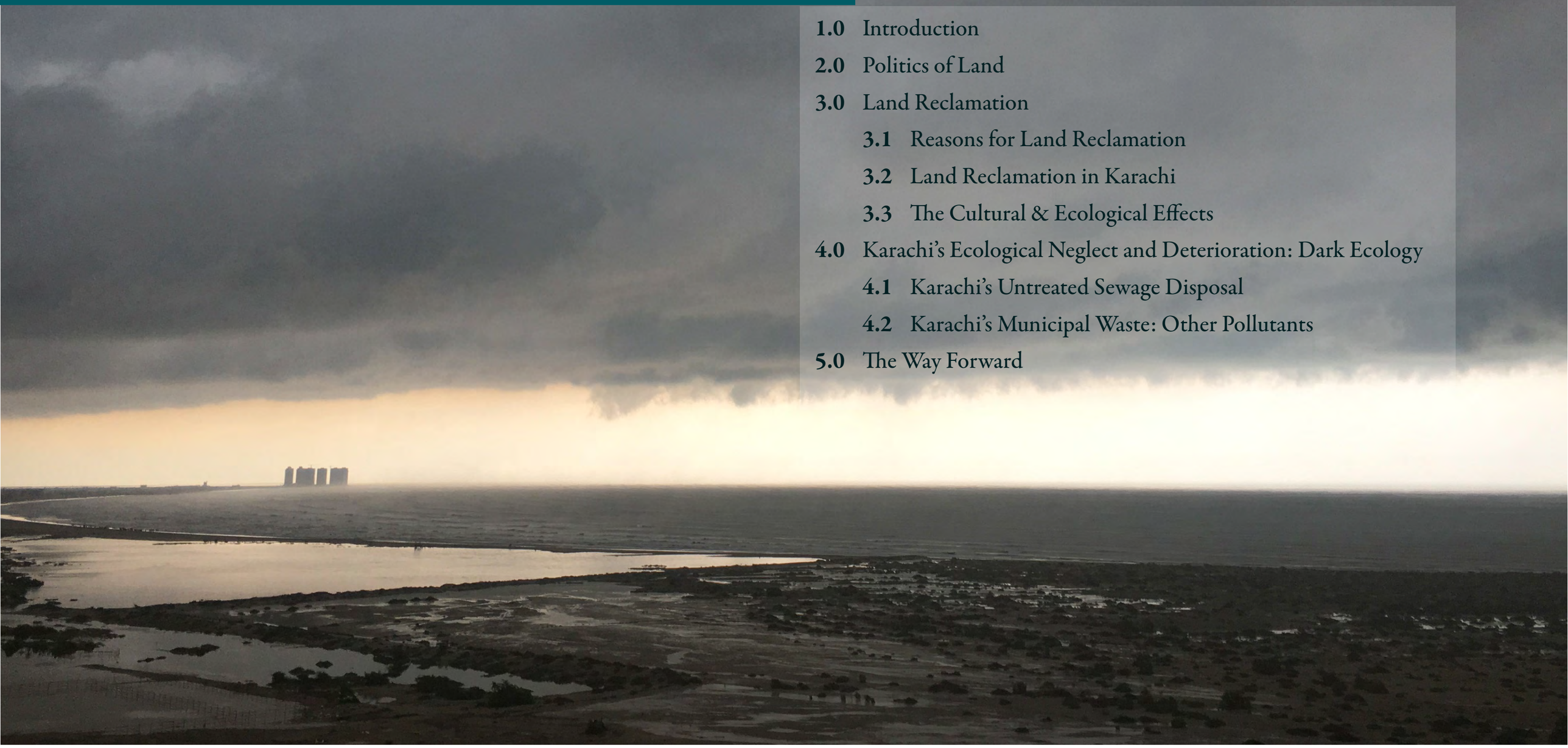
ARCHITECTURE | HERITAGE | RESEARCH

Land Reclamation: An Ecological Neglect

Creating and Claiming Land

A study of Karachi's coastline from China Port till Emaar

contents



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RESIDENTIAL

COMMERCIAL

MIX

GREEN SPACES

UNDERDEVELOPED GREEN SPACES

UNDERDEVELOPED AREA

RECREATIONAL SPACES

SEA

CREEK

Mapped by Anmol Poplani

introduction

Stealing the Sea *(Samandar ki Chori)* by Asif Farrukhi
One of the onlookers called out, 'Where is the sea?'
Nobody answered him.
Where is the sea? He asked again
There were few people to answer him, but really what could anyone say. Where could the sea vanish to?
It must be here somewhere; you probably need to look around a bit more attentively.'
... 'This is a definite sign of a bigger calamity,' another voice was clearly heard saying. 'Could be due to an oil spill, an ecological disaster, a local effect, a nuclear holocaust..' He left it incomplete.
Translated it by Saeed Naqvi

Karachi's story of land reclamation starts from an old love story of the ocean waves as devotees of Abdullah Shah Ghazi, a Sufi Saint. Guided by the moon's cycle, the waves would kiss the walls of his shrine twice a day in deep devotion. This sacred devotion continues to protect Karachi against all natural calamities that the city has been threatened with over the years, even though the shrine and the waves are now separated by vast land. Though Karachi has been fortunate up till now, decades of man-made alterations and activities along the coast now force us to take a step back and critically examine the city's edge to understand the threats our seafront and therefore our citizens now face. There is a dire need to focus on the preservation of our coast rather than its rapid and uninformed development; we have neglected our natural environment for far too long, and we must now work to protect and conserve what Karachi is left with and become saints of our own city.

The demand for land has increased rapidly in recent history as the global population continues to spike and countries race to develop and expand further. As a result, the process of land reclamation has emerged as a frequently applied solution to meet the ever growing demand for land. Land reclamation is a process through which new land is created by "raising the elevation of a waterbed or low-lying land, or by pumping water out of muddy morass areas". This can be achieved through dry earth movement, which includes earth that is extracted from land-based areas, "dredged from a borrow area or other area and placed at a site to raise the level of the land or build new land" (Land Reclamation, n.d.).

Land reclamation is in no way a new process, and has been carried out since ancient times. Previously, it was used largely as a means for agricultural production, land cultivation, and creating new land for settlements (Martín-Antón et al., 2016). For example, many parts of Venice were built through processes of reclaiming marshlands using canals and wood pilings to have stronger foundations for settlements (Martín-Antón et al., 2016). One of the first major land reclamation projects in modern history took place in the 1970s, when the Netherlands extended the Port of Rotterdam by a surface area of 2000 ha (OSPAR, 2008). This was arguably the start of the modern era of land reclamation.

Major land reclamation projects in recent history are largely concentrated in coastal cities, primarily in Asia; Of the 14 largest mega-cities located along the coast globally, 11 are in Asia. The rapid expansion of the world's coastal megacities through reclamation and infrastructure is a phenomenon that has emerged over the last 30 years and is a direct result of rapid economic growth and subsequent urbanization of these areas. It is researched that almost 40% of the global population resides within 100 km of the coast, which exerts considerable pressure on this critical zone. In addition to this, the rapid urbanization at the coast is usually accompanied with "major geoengineering interventions [such as Coastal Land Reclamation (CLR)] that form part of what is called 'ocean sprawl'", which increases the pressure on the delicate ecosystems of those areas (Sengupta et al., 2020). The common pattern of building beyond land as a feature of the urban development of coastal megacities is under-researched and needs to be studied more thoroughly, especially to understand and assess the level of damage that CLR has done to the ecosystems of the coastal megacities (Sengupta et al., 2018). This stands true for Karachi as well, as major CLR projects, coastal development projects and others have been in the works for years without proper research done on the host of issues pertaining to the ecological, environmental and cultural impacts on Karachi's edge, including the legality, and the morality of it all.

Karachi's edge can be identified through its key elements as a port, a source of income for its fisherfolk, a public space for its citizens, a home to a vast amount of flora and fauna, and what is now becoming a prominent trait- land used for real estate and housing communities. Waterfronts in Karachi have fallen victim to the Dubai-esque perception of development, which entails the rapid urbanisation and 'modernisation' of Karachi's infrastructure by significantly altering the land and its resources (Heymans et. al. 2019). As such, land reclamation has been used to 'modernise' the coast of Karachi, harming elements of the natural environment to accommodate the built environment. This idea, pertaining to the prioritization of the built environment over the natural environment within city planning, started receiving international criticism in the 1970s and has been globally challenged with the emergence of a new paradigm- Urban Ecology.

Urban Ecology, a term coined by Jean-Marie Pelt, stands at the interface of the natural and the built environment. It views the whole landscape of the city as consisting of a singular ecosystem wherein one element cannot be studied independently of the other, and reconciles the 'human' with 'nature' in a mutually beneficial relationship (Rebele, 1994). We can utilize the framework of Urban Ecology by applying it to local level issues on the coast of Karachi. Current patterns of land use have significantly damaged the natural environment and coastal ecosystem of Karachi's edge by encroaching upon land and water that serve as a habitat for many indigenous species of plants, migratory birds and marine life. Furthermore, current patterns of land use are devoid of inclusivity and placemaking for local communities. Due to the persisting prevalence of such 'development', Karachi's ecosystem, and therefore its citizens, are now threatened and there is a desperate need for preserving our dying edge instead of 'developing' it.

politics of land

Land is one of the most important political functions of today's world; the ownership of land and territory holds immense power in modern society. European thinkers have philosophised that land ownership was one of the foundations of 'civilised' society. Jean-Jacques Rousseau in his discourse on inequality wrote, "The first person who, having enclosed a plot of land, took it into his head to say this is mine and found people simple enough to believe him, was the true founder of civil society." Without delving into what Rousseau truly thought about land ownership and 'civil society', it is interesting to note the importance that land ownership has within his philosophy, and consider the importance that land ownership had within European 'civil' society, especially during periods of colonisation.

Before the British Raj, the concept of private property and individual land ownership in India was very different from what we know it to be today. Traditional systems of land ownership and land use patterns in India were replaced through the implementation of British policies and newly introduced ideas of modern individual private property. Systems and laws like the zamindari system, ryotwari system, mahalwari system, and the Indian Forest Act of 1920 that made all forest land government owned, made land distribution very unequal and polarised under British rule. By Independence in 1947, an estimated 40% of India's rural population was working as a landless agricultural labourer (Indian Land Rights: a History). The concepts of land ownership and land saleability promulgated by the British arguably gave basis to the modern day inequalities and problems we see within the subcontinent, and specifically in Pakistan, in regards to land ownership, land rights, and even land development projects such as land reclamation. The British were one of the first to carry out major land reclamation projects in India to connect and develop satellite townships, especially in the coastal cities of Bombay and Karachi. Within Karachi, areas of Old Clifton and Boat Basin that were once natural swamps and islands were reclaimed and eventually connected to the main city infrastructure. From 1916 to 1920, approximately 144 acres were reclaimed from the sea in Karachi (Moore, 2018). The noticeable lack of accountability in Pakistan surrounding land development projects, land ownership, and laws is also reflected in the severe lack of accountability when it comes to protecting the environment and the ecology of the lands that we are racing to develop.

land reclamation: reasons

Along this vein, the rapid urbanization and infrastructure development in Pakistan, and especially the coastal city of Karachi, has led to incredible monetary value given to land. As is the case with many South Asian coastal cities, land developers in Karachi have frequently used land reclamation, specifically CLR, not just as a solution to shortage of land for development, but as a means of profit even when there is other land available. This is because the creation of new land "[provides] what amounts to a developmental magic act: government officials can virtually point their fingers out to sea, say 'voila,' and a blank slate of prime positioned, high-value real estate almost instantly appears" (Shepard, 2018). Developers and governments essentially get "blank slates of land" that they can easily develop "without the hassles and expenses inherent to relocating people, settling with existing land owners, and redeveloping an already established area" (Shepard, 2018). These incredibly lucrative CLR projects are therefore very attractive to land developers, and that is why so many CLR projects have emerged within recent years, especially in South Asian coastal cities, and in Karachi, where the practice has been focused on Housing Societies.

Internationally, countries have practiced land reclamation for many valid reasons. The most common are to build airports, such as in Japan, Singapore and Hong Kong, to extend ports, such as in Rotterdam in the Netherlands, and for agricultural purposes, such as in the United Kingdom (OSPAR). Some countries use land reclamation as a solution for inaccessible coastlines as well; they use it to reclaim the edge and increase access to the beach. In South Asia, as already mentioned, 'development' and economic gain is the main motivating factor. The Sri Lankan 'Port City' being constructed right out of Colombo is a prime example of this. Funded through Chinese investment, and inspired by Dubai-esque development, this 665 acre project is being built entirely on reclaimed land from the Indian Ocean. It has been described as a 'smaller Singapore' with "its own business-friendly tax regime and regulations – and possibly a different legal system to the rest of Sri Lanka" (Safi, 2018).

Mumbai/Bombay also has an extensive history of land reclamation stretching back to its colonial period. The modern conception of Mumbai is that it once consisted of seven islands, but the Portuguese and the British held different views- the Portuguese believed there were four islands and the British believed there were two. This perception of the English arguably informed their attitudes to Bombay's environment and the first major reclamation took place in 1710 as a means for the British to 'secure' Bombay and also as a response to its harsh geopolitical climate (Riding, 2018). Reclamation continued in Mumbai well into the modern era, and the "highest number of land reclamations [have taken] place in the past forty years in the city's more than 300 year history of reclamations" (Deshmane, 2015).

land reclamation: karachi

Many of the coastal land reclamation projects in Karachi were not in response to a lack of land for development, but rather as a means of creating high-value real estate for profit, as discussed earlier. Defence Housing Authority (DHA) Phase-VIII has seen some of the most high-profile residential, and even commercial, CLR projects in the country. Karachi Port Trust (KPT) has also carried out massive CLR projects to expand their facilities- the most recent project being their Deep Sea Container Terminal (China Port). Aside from CLR, land reclamation projects have also been carried out within freshwater bodies, such as the extensive reclamation of Chinna Creek to create KPT residential land in the mid-2000s.

Over the last 30 years, DHA Phase-VIII has undergone extensive land reclamation. Some of the most prominent projects include that of the DHA Phase-VIII Extension, which includes the Emaar development. The land has been created for both residential and commercial use; a commercial section, 'Saahil Commercial', is demarcated within the Phase-VIII Extension, and the first of the three 'crescents' of Emaar is reserved for commercial high-rise development.

Satellite imagery of DHA Phase-VIII in 1984 and 2018, showing the extent of land reclamation within the area

The Blue Line represents the Main Road (Edhi Avenue), and the Pink line is Sahil Avenue.

It is important to note that the Phase-VIII Extension real estate plots are pushed all the way to the edge, which, although providing prime real estate to DHA, is very detrimental to the ecosystem of the waterfront, and greatly limits the availability of the beach to the public. Contrastingly, the Seaview Apartments along Main Seaview Road (Edhi Avenue) are built at a setback from the beach, and have four roads (two service lanes, and two main roads) between the apartment complex and the start of the beach, and are therefore still contained within the city. These four roads merge into two narrower roads as you approach Phase-VI-II and the Phase-VIII Extension. From here, Sahil Avenue / Khayaban-e-Saahil, the latest intrusive intervention, branches out to the edge of Phase-VIII Extension, allowing the public to take their vehicles right to the edge without any buffer. The difference in set back of the Seaview Apartments and Phase-VIII residential areas from the edge is very noticeable, as is shown in the illustrated maps.

Seaview Apartments set back from the coast, constructed in the 1980s

Housing plots designated on reclaimed land with no set back in DHA Phase 8 Extension

Within DHA Phase-VIII there are multiple similar examples of development projects right along the edge of the water. Creek Marina, a celebrated 6-star residential and commercial high-end development, started construction in the early 2000s and was meant to be finished in 2010. It now looms, half-finished and abandoned, at the southern edge of Phase-VIII, right opposite the most recent coastal high-end complex, Emaar; both constructed upon reclaimed land, and both limiting the access that the public has to the waterfront of Karachi.

Creek Marina plans, alongside an image of what it looks like currently from site visit.
Source: http://www.creekmarina.com/theme/about/

'Development' that is forced up till the edge of the water is clearly not a new phenomenon in Karachi. Back in 2007, a civilian coalition called Saahil Bachao emerged to mobilize against DHA's extensive 'Waterfront Project' that aimed to construct theme parks, marinas, expo centres, expensive hotels, and condominiums along Karachi's Clifton Beach. Of the project, Architect Arif Hasan wrote:

> The DHA Waterfront Project is one face of real estate violence and authority's complicity. The awareness about this subject is one step on the road to organize people. It is clear that the concept of 'development' is not the same for the different social groups ... In Karachi's case the new development project attempts against a single principle of access to public spaces for everyone (Hasan, 2006).

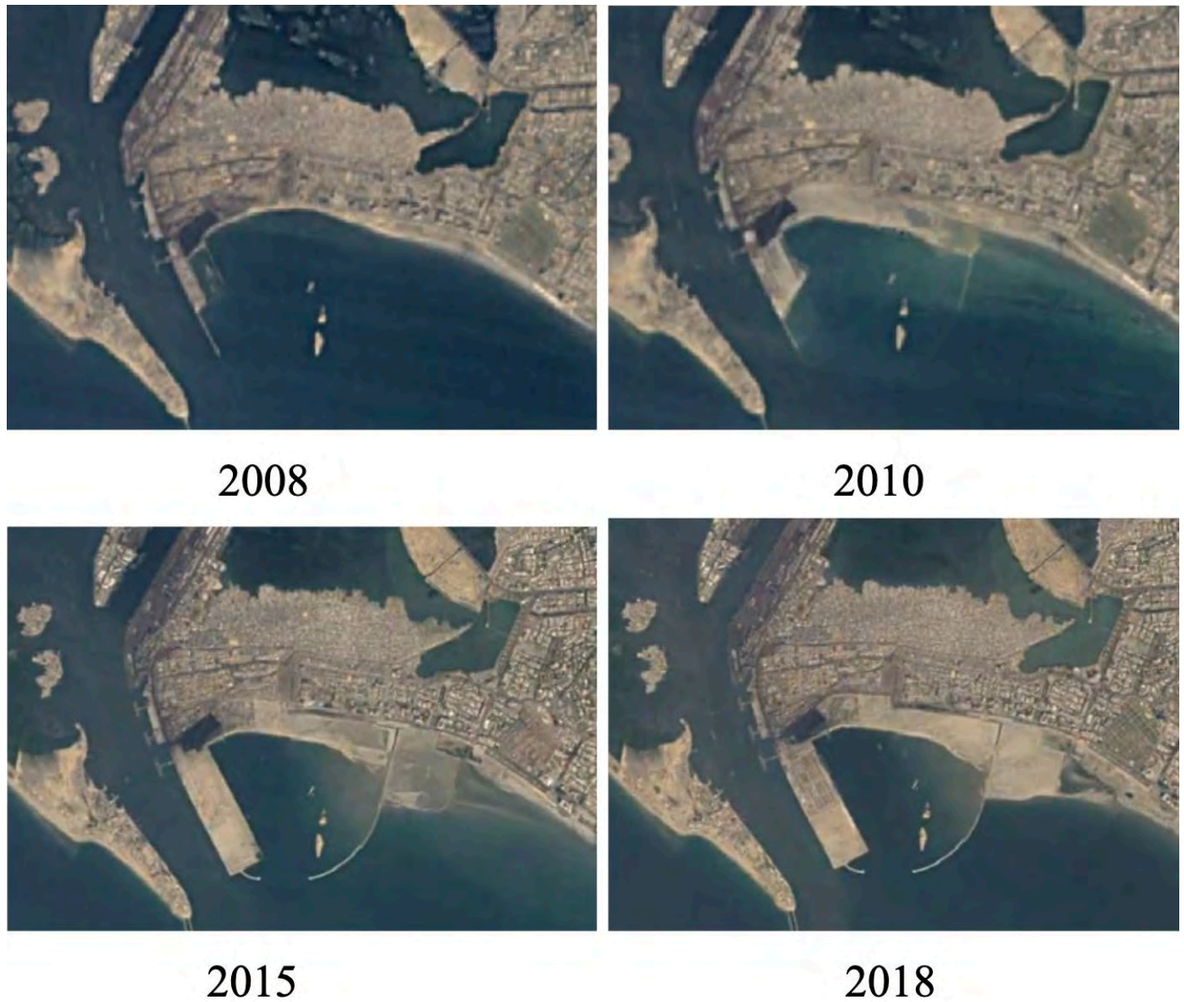
The Saahil Bachao Coalition was successful in pausing the development plans back then, but new plans by the Cantonment Board Clifton (CBC) have since emerged to 'develop' the strip of beach from Nishan-i-Pakistan to the Chunky Monkey amusement park.

The development proposal for CBC's Project

With problems eerily similar to that of the 'Waterfront Project', this plan would entail land reclamation into the sea, would produce massive amounts of waste during and after construction, create large concrete structures that are not sustainable or desirable for the area or the common man, and would further damage the delicate and vulnerable ecosystem of Karachi's coast. The Sindh Environmental Protection Agency (SEPA) approved of this plan in February 2020 without a detailed Environmental Impact Assessment (Ilyas, 2020), which is a legal requirement under the Pakistan Environmental Protection Act of 1997. In a DAWN news article, Dr. Asif Inam said that Clifton beach is experiencing rapid sedimentation of the material dredged from KPT's Deep Sea Container Terminal (China Port), and that any structure built along Clifton Beach would obstruct the naturally occurring process of longshore sediment transport from the West of Clifton to the East, thus resulting in "accumulation of sediments on the western side and erosion on the eastern side of the structure" (Dr. Inam qtd in Ilyas, 2020). Besides the clear issue of the project's inevitable detriment to Karachi's ecology, this information brings into question the sustainability of this project's upkeep due to issues created by past coastal land reclamation projects.

In a quote for the same article, Naeem Mughal, the director general of SEPA, said that the CBC project does not pose any environmental risks because the area is devoid of ecologically important flora and fauna. He also said that there is no threat of marine pollution as the project would have a sewage treatment plant, and mentioned that the project would "upgrade the beach which currently stinks with polluted water" (Mughal qtd. In Ilyas, 2020).

KPT's Deep Sea Container Terminal, locally known as China Port, was also a massive CLR project that happened without much knowledge or involvement of the public- perhaps because the project was along the stretch of beach that is not as frequented by visitors. This project has created a huge mass of land along the coast in front of Indus Valley School of Art and Architecture, and a new harbour, including breakwaters and an artificial bay.



Satellite images to show the progression of KPT's land reclamation from 2008 - 2018

A warning sign on KPT's reclaimed land

land reclamation: cultural & ecological effects

Land reclamation projects can have long-lasting, and often-times permanent cultural and ecological impacts on the area they are carried out in. Culturally, many land reclamation projects, especially in South Asia, have led to the displacement of local fishermen and indigenous communities- a loss of their culture, heritage, livelihoods, and the destruction of their homes. A prime example of this is the Malaysian 'Penang South Reclamation' (PSR) Project. Currently on pause due to push back from locals, this project will transform a remote fishing village into Malaysia's "next outpost of progress" by building three man made islands upon which a new "smart city, industrial zone, and transportation hub will be built" (Shepard, 2018). There is a very legitimate fear amongst the locals that not only will the fish become extinct, but so will the fishermen once they lose their fishing grounds.

Most of the land reclamation projects in South Asia are designed to cater to the wealthy and elite of the city, and therefore the inflow of capital and the development of these projects leads to the gentrification of the areas around it. Locals are pushed out of neighbourhoods that once belonged to them, spaces in the city become entirely inaccessible, and many projects take over/encroach onto areas that should always be available to the general public. A model example of this kind of encroachment and access control is Emaar's Crescent Bay in Karachi. The major land reclamation work that went into creating the three 'crescents' for the residential and commercial high-rise project not only badly affected the ecology of the ocean, but also encroached upon a beach that was once accessible to the public.

The continuity of access to the public beach is hindered during high tide by Emaar Development's stone retaining wall

The ecological impact of these CLR projects, especially when carried out without the proper Environmental Impact Assessments (EIAs), are greatly pronounced. Simply put, they lead to incredible amounts of pollution in the waters, changing of wave and current patterns due to the creation of new land, the erosion of beaches, siltation (as mentioned by Dr. Asif Inam), and the destruction of delicate ecosystems and habitats. Coastal areas also become more vulnerable to flooding and other climate disasters as a result of the disruption of natural coastal protections due to CLR. With the ongoing effects of climate change being most pronounced along coastal regions, focus should be given to the conservation of naturally existing coastal protections rather than to their disruption/destruction.

karachi's ecological neglect and deterioration:
dark ecology

Susan Shuppli, an artist-researcher and writer, explores the concept of 'Dark Ecology' in her work, which can be applied to Karachi's edge to really understand the precarious nature of the edge. Dark Ecology makes us revisit notions regarding nature as a romanticized victim of climate change due to anthropogenic activities, and as an ally that we have failed to respect and protect in an unsaid treaty. What we cannot afford to forget is the 'dark' aspect of our ecosystem; when neglected, ecology turns into a foe -- an unforgiving and viscous force that threatens our very survival and can and does quickly stop sustaining us due to our reliance on it. It is this reality that we need to keep in our minds as we wade through the strange, unpredictable and ravaged waters of our coastline and think of ways to co-exist within a single ecosystem.

Karachi's coastline currently faces threats from multiple sources: untreated domestic and industrial sewage disposal in the sea, the degradation of the fishing sector, the unsustainable relationship of the general public with the sea, and the uncontrolled commercial activities along the coast, to name a few. This section of the paper aims to capture the damage inflicted upon Karachi's edge, and the steps that can be taken to mitigate these threats.

Karachi is home to a 90 km long coastline that provides protection to the city and its citizens. It has a variety of flora and fauna, and stands as an effortlessly beautiful and attractive public place. According to the WWF, Pakistan's coastline is a habitat for 134 ray and shark species, shrimp, tuna, green turtles, and salmon. It used to be home to the 6th largest mangrove forest in the world, but dwindled down to 35th over the years (Nawaz & Shahzad, 2019). While doing field work, the documentation of decayed marine life, we often witnessed at the foot of Emaar Project, a terrestrial plane with crabs crawling across the beaches with their busy claws constructing temple-like structures across the sand, construction boulders and tetrapods carpeted with moss and the unexpected but exciting arrival of blue bottles, corrals and turtles depending on the season, but soon into the field work- a lot of marine life was found dead and decayed on the city beach due to water pollution, and plastic disposal.

The coast is home to a variety of indigenous species of plants that provide natural vegetation to the environment. In an interview with Tofiq Pasha, an urban gardener/maali, he discussed how these native plants are known to grow and spread themselves without curation. He stated that these plants have come about naturally, and although commonly known as wild plants, the rhetoric around them needs to change. He explained that these 'wild' or 'jangli' plants are a **fortunate gift from nature** that grow themselves and prove to be anything but detrimental to its surroundings. Instead they provide natural vegetation, enable biodiversity in fauna such as with the arrival of various butterflies because of the Athel tree, are extremely resilient to the local climate and conditions, and utilize minimal water.

What we commonly see, though, is DHA's **forced curation** of planting non local vegetation which is extremely difficult to nurture and expensive to maintain- It's important to also mention here that development authorities have limited knowledge and lack field learning of existing natural growth.

Bassia Prostrata (Forage Kochia)

Tamarix Chinensis (French Tamarisk)

Tamarix Aphylla (Athel Tree)

Ipomoea (Morning Glory)

Bromus

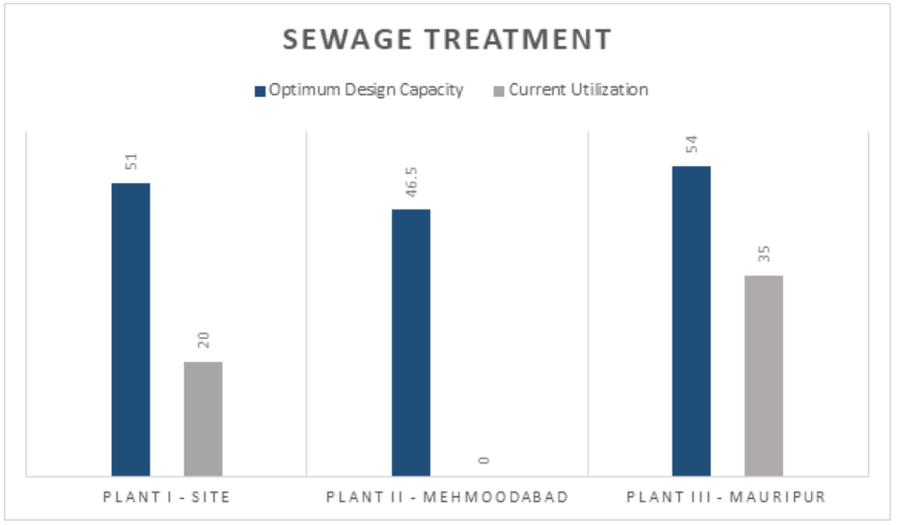
Shrubs on sand dunes:
DHA Phase-VIII

The stretch of Karachi's coast from China Port to the reclaimed land of DHA Phase-VIII Extension, while known for its heavy commercial, real estate and industrial activities, is home to the above mentioned flora and fauna, and to fisherfolk that have practised artisanal fishing since Karachi was a mere fishing village. It is this very coastline that is known to protect Karachi's dwellers from cyclones, fuel Karachi's development, provide livelihoods, and provide one of the only freely accessible multi-class public spaces in Karachi. But it is also the same space that is slowly dying due to our dangerous concept of 'development' and aggressive interventions.

karachi's untreated sewage disposal

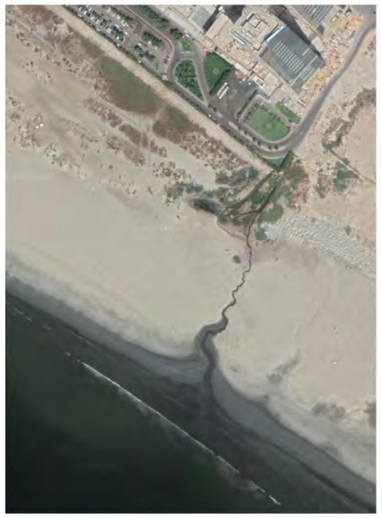
Karachi is home to approximately 16 million people and is the center of industrial activities and international and domestic trade through its port (Worldometer, 2020). Hence, it is no surprise that a significant amount of municipal and industrial wastewater is produced daily in this urban habitat. Karachi's management of this wastewater and its disposal location -the ocean- has become increasingly concerning. The table to the right represents data on the wastewater generated daily in Karachi, and the abysmal management of sewage treatment plants by Karachi Water and Sewerage Board (KWSB). The plants function inefficiently and well below their capacity, only treating 12% of the sewage released into the water, as mentioned by Seema Jilani in her 2017 study on coastal water quality.

Sewage Generated in City	472 MGD
Optimum Design Capacity of Sewage Treatment Plants	150 MGD
Quantity of Sewage Treated	50 MGD
Shortfall in Sewage Treatment Capacity	32 MGD
Untreated Sewage	417 MGD



Information Source: KWSB

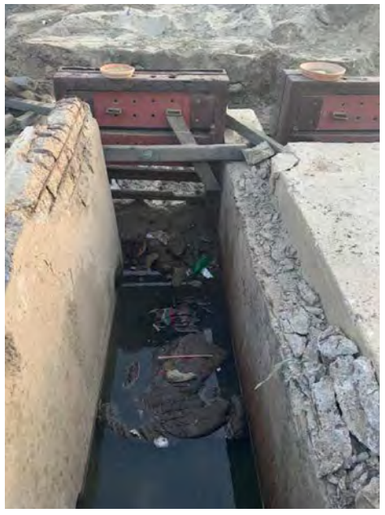
Commercial buildings along the coast often dispose of their waste directly into the sea due to ease of proximity. In some cases, this disposal is visible through satellite imagery, as shown below:

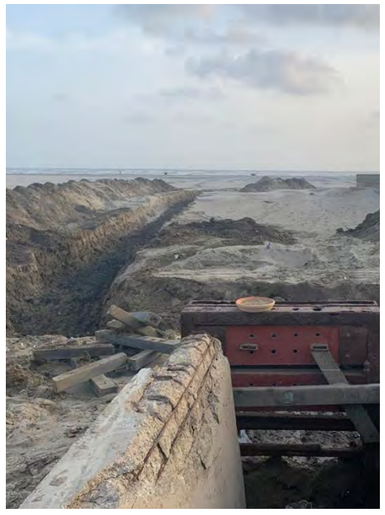


(a)

(b)

(c)





Photographic Examples of Sewage Paths along the Edge from Site Visit

Commercial Typology
(a) Dolmen Mall (Mixed Use)
(b) Mcdonald's Restaurant
(c) Defence Marina Club Area

Jilani explains that a substantial amount of sewage is discharged on the Manoro Channel, and 80% of the aggregate wastewater is dumped into Karachi Harbour, including wastewater that drains into the Lyari and Malir Rivers that flow into the sea. The Lyari River fulfils the crucial function of maintaining water levels, yet there are rumours of a gentrifying park project on Lyari River in the works. The project calls for the creation of the 'world's largest urban forest' by Lyari and then Malir River, along with the construction of recreational facilities, playgrounds and a jogging track for locals there (The News International, 2020).

Satellite image of Lyari River, an important channel of wastewater disposal into the sea, also functions to maintain water levels

Jillani's 2017 study proved that due to the disposal of industrial effluents and sewage into the sea, the quality of Karachi's sea water has been rapidly deteriorating. The water has alarming concentrations of heavy metals, organic pollution, volatile matters, etc. (Jillani, 2017). Jilani explains that reasons for a higher amount of pollutants and higher concentration of metals is largely due to the sewage disposal of the Lyari River that flows into the sea, which contributes even more significantly than local port activities.

The observed effects on the ecosystem of the sea include increased eutrophication, disturbance in the food chain and a threat to biodiversity, reproduction and growth of species and the very physiology of marine creatures (IUCN, n.d.). Additionally, the sewage disposal enables an alarming rate of coral bleaching and increases the risk of erosion and inundation in low altitude coastal areas. Furthermore, it directly affects the reproduction and biodiversity of marine life, which in turn threatens the livelihoods of local fishermen, reduces stock for fisheries and even threatens food security (IUCN, n.d.).

Within the ambit of health, such ravaged waters are the habitat and feed of the very fish that we consume, introducing massive amounts of heavy metals and pollutants into our diet as well. Additionally, the public bathes in this water, giving way to health hazards, which can be illustrated by the fact naegleria (an amoeba found in warm freshwater) was easily spread across sea water due to the sewage disposal in the sea and Nallah by Sea View (MMA, 2019).

Currently the Karachi Water and Sewerage Board (KWSB) has come up with two projects to deal with the untreated sewage disposal. The first project is already under works, and aims to increase the treatment capacity of the existing 'Sewage Plant-III' in Mauripur by almost 800%, to the tune of Rs. 36,117.459 million (KWSB, n.d.). The second proposed project is to treat industrial waste by establishing plants in five different industrial zones: Korangi, SITE, TransLyari, F.B. Area, and Super Highway SITE Phase 2. The treatment plants were expected to start functioning by June 2021, however the project has yet to commence (Ali, 2020).

It is important to highlight again that a major problem lies in the poor management and underutilisation of existing sewerage plants and infrastructure. Building further expensive infrastructure needs to be thought out given the current precedent. The DHA COGEN Desalination Plant, previously known as Defence Cogen Limited (DCL), is just another example of costly infrastructure that has not been utilised and has instead incurred a heavy loss of more than Rs.150, 000,000.

A much more sustainable approach to our sewage issues is needed. An example of such is the Decentralized Wastewater Treatment System (DEWATS), developed in India. DEWATS encourages the development of small scale affordable sewage systems that treat and then enable the reuse of treated water for gardening and toilet flushing (Chaturvedi, n.d.). It cuts down domestic water supply by 50% through water reuse, and uses approximately 90% less land and is almost 80% less costly than large scale wastewater treatment plants. Such cost-effective and sustainable sewerage systems should be incorporated by the local governments across our city to treat our waste. On a local level, the Orangi Pilot Project's highly successful low cost sanitation program proves that small scale sewerage systems are part of our city's precedent (Hasan, 2010) and that projects similar to the DEWAT system can be incorporated in Karachi.

Abandoned DHA Cogen Desalination Plant, DHA Phase VIII

karachi's municipal waste: *other pollutants*

The contamination of our coastline does not end with sewage disposal; it is further aggravated with the accumulation of plastic pollution, oil spills and nuclear waste from Karachi Nuclear Power Complex, hospitals, pharmaceutical organisations, factories in Korangi, and small cottage industries.

The issue of plastic pollution is also visibly serious across Karachi's coast, as 50% of the total garbage on the Clifton beach consists of plastic. The water collects, transports, and washes ashore plastics such as plastic bags, plastic water bottles and cans. These pollutants then harm marine life and biodiversity (The News International, 2017). Currently, Karachi's public beach is not well maintained and suffers poor management by the Cantonment Board Clifton (CBC). Tractors are used to clean the beach, and though they prove to be a quick method, they're hardly efficient or environmentally friendly. The heavy tractors tend to **collect parts of the natural environment**, for example seaweed and vegetation, instead of just solid waste (Borrell, 2018). The use of such heavy vehicles and claws is also very **harsh** on the ground, and ends up squashing and pressing into the sand the sea creatures eg. crabs, sand structures built by them, sand dunes, seaweed, vegetation, and ironically the very garbage that the tractors are supposed to pick up. The physical suppression of garbage into the ground simply removes it from view, but **retains it within the natural environment.**

CBC needs to **cease using tractors** to clean the beaches, and should instead use **manual labour**. The already-existing labour force used by CBC to clean the main Sea View Road can be repurposed to clean up the public beach. Furthermore, CBC needs to implement policies to deter beach-visitors from littering the beach by issuing small fines, providing garbage collection bins and placing signage that clearly communicates the importance of maintaining a clean natural environment. The Bombay Chowpatty beach, one of the most populated and frequented beaches in India serves as an exemplary case study in terms of its cleanliness. The residents have been made aware of the beach's historical and recreational significance, which has enabled them to prevent littering and pollution (Chatterjee; Lyer, 2016).

Beach cleaning work underway by Cantonment Board Clifton (The Times of Karachi, 2017)

ecology observed along coastline during
site visits: visual documentation

the way forward:

Open Space Allocations on Reclaimed Land

Karachi is in dire need of more open spaces for public use. There needs to be a proper ratio of built environment versus open space within Karachi to create a city that is favourable to the locals and to the ecology of the land. Cities like New York and Chicago can be looked to forinspiration, as they have properly mapped out and regularised the city's ratio of built to open space, and are reaping the benefits.

Reclaimed land within Korangi, DHA, and Clifton could be easily converted into trekking trails for locals and tourists alike as a means of mindful recreational activities. The image to the left and following show 'urban forests' that already exist in Karachi in these areas, and with some planning and imagination, this natural vegetation can become an escape from the busy, chaotic urban life of Karachi, and allow for a much needed natural 'getaway' for the public. After lockdown within the city, we have started to notice the need and desire that people have for open public spaces, and we should adapt existing areas to fulfil these needs.

existing open space with vegetation
on a housing plot in DHA phase-viii

Native Plantation Drive

It is an accepted fact that Karachi is in dire need of more greenery. This is usually misinterpreted by officials and locals as the need to plant more trees, regardless of their species or the cost.

A much more sustainable and beneficial way of making Karachi greener is incorporating **non-curated naturally growing vegetation** in the city, and allowing the indigenous plants to grow and thrive. Plants such as the morning glory, wild grass, keekar, pillu, and tamarix are resilient and grow naturally in the area, and are very beneficial for the ecology of Karachi.

According to Tofiq Pasha, allowing vegetation to grow without curation or intervention on KPT's reclaimed land has brought back local butterflies, geckos, migratory birds and if allowed to become a wild life trail, it could bring back mongoose, komodo dragon and porcupine etc which were found in open lands of Karachi back up till the 90s.

We need to allow nature to reclaim the lands that we have tried to lay claim to, and allow it to repair itself. In order to incorporate these areas into our urban landscape, the green spaces can be used as recreational spaces- as already suggested, trekking paths can be made, and signage can be put up to educate locals regarding the plant species in their communities and their advantages for the land.

Image	Specie
	Hylotelephium
	Tamarix chinensis *(French Tamarisk)*
	Caltropis Gigantea *(Giant Milkweed)*
	Latifolia *(Broadleaf Milkweed)*
	Santolina Chamaecyparissus *(Lavender Cotton)*

Image	Specie
	Bromus (*Brome Grasses)*
	Tamarix Aphylla *(Athel Tree)*
	Convolvulus Arvensis *(Field Bindweed)*
	Ipomoea *(Morning Glory)*
	Bassia Prostrata *(Forage Kochia)*

Infrastructure Rethinking

On an administrative level, we need to start rethinking our infrastructure in Karachi, specifically in regards to the excessive commercial activity along the coast. There needs to be a focus on preservation rather than development. Current restaurants, high-rises and recreational spaces permanently alter and encroach upon the public beach, often restricting access to parts of it, and thus ruining the sanctity of a free and accessible public space (MMA, 2019). Such encroachment from private sector businesses on public land needs to be highly regulated and controlled.

Additionally, we should consider introducing softscapes to create coastal buffer zones and prevent the natural environment from being harmed by public activities. This should be done along the distance of Sea View Road/Edhi Avenue and the sea, and within Phase-VII Extension where the Sahil Avenue meets the water. The expansion of the softscape can act as a pedestrian zone to provide access to pedestrians and cyclists, with formalized hawkers providing services to tourists, pedestrians, cyclists or any other passerby.

The current period of lockdown has revealed the importance of giving the city 'silent time', a recovery time which is designating a time after which the area of the beach should be pedestrianized. Perhaps during weekends motorised traffic on Edhi Avenue / Main Seaview Road should be limited to allow the city and the ecology to recover and rejuvenate itself. Bicycle and walking lanes should also be introduced along Edhi Avenue to encourage people to cycle along the edge instead of taking their vehicle. Ethical plantation be part of the larger vision and development authorities, now reflect open ratio division of built and open space. Covid-19 has taught us, mental and physical wellbeing during crisis is the only way forward in urban cities, where nature and manmade collaboration needs intervention.

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The first part of this research:

“How ‘development’ undid Seaview”

Published in Samaa https://www.samaa.tv/environment/2019/07/how-development-undid-seaview/

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