

**REJUVENATION OF URBAN OPEN SPACE IN
HISTORICAL PRECINCT-THE PORTLANDS FOR LIVING
MUMBAI**

**MASTER OF ARCHITECTURE
(LANDSCAPE)**

PRAGATI PRASOON
2016MLA004



**SCHOOL OF PLANNING AND ARCHITECTURE, BHOPAL
NEELBAD ROAD, BHOURI, BHOPAL (M.P.) – 462030**

MAY 2018

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Submitted

*in the partial fulfilment of the requirements for the
award of the degree of*

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Department of Landscape
School of Planning and Architecture, Bhopal

Declaration

I Pragati Prasoon, Scholar No 2016MLA004 hereby declare that the thesis entitled "***Rejuvenation of urban open space in historic precinct-the Portland's for a living Mumbai***", submitted by me in partial fulfilment for the award of Master of Landscape Architecture, in School of Planning and Architecture Bhopal, India, is a record of bonafide work carried out by me. The matter embodied in this thesis has not been submitted to any other University or Institute for the award of any degree or diploma.

18th May 2018

Pragati Prasoon

Certificate

This is to certify that the declaration of Pragati Prasoon is true to the best of my knowledge and that the student has worked for one semester in preparing this thesis.

RECOMMENDED

Ar.Sonal Tiwari

ACCEPTED

. Prof Sanjeev Singh
HOD, Department of Landscape

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Above all I thank my family who have stood by my side and encouraged me continuously.

Regards,

Pragati Prasoon
2016MLA004
Department of Landscape Architecture
School of Planning and Architecture
Bhopal

ABSTRACT

Mumbai, the city of dreams was once a collection of seven islands. Home to the Kolis, the islands were known for fishing and agriculture. Over time, the discovery of the islands by the Europeans brought about various changes. Be it the forts or the single landmass formed by way of reclamation; the steam ships or the railway system, we have a lot to thank the Europeans for.

The city as we know it today is one which is blessed with an extensive coastline all around it. While the western and southern sides have been explored and exploited, the eastern waterfront has been excluded. A part of the Port area, the eastern coastline has been hidden from public view for multiple reasons for many years. Due to advancement in technology and reduction in area required for port activities this eastern waterfront is now partially available for development and public view.

The city Port land is of great relevance for the city's future. For both the way the city reinvents itself as well as the region. In fact, the very connection of the historic city to the region would depend on how the land on the city water edge is rejuvenated for use by Mumbai. In this context, the Port land on the eastern waterfront is particularly of great importance, owing to its location and context. The landscape has been fragmented into various specialized zones, separated across the metropolitan area. The eastern water front has immense potential to facilitate connections and linkages of these areas such that their importance is highlighted, making them more valued. Mumbai is uniquely fortunate to have such a long coastline which offers great potential, yet the available and accessible promenade to experience and enjoy the sea is limited. The Portland redevelopment offers probably the last possibility to create several public places with the comprehensive master plan that will give spaces to breathe, relax and connect with the history.

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1 INTRODUCTION

Mumbai, with its magnificent natural harbour on the west coast of India is home to one of the largest ports of the country. This port was the pre-eminent commercial port of India in the nineteenth century, also known as the trade gateway to India. In due course of time, the port has lost its identity and due to an increase in demand of other modes of transport, leading to the eventual loss of value of the port.

This city was born as the set of 7 islands with fishing and agriculture as their major activities which were later transformed to become the busiest and important trading cities of India. This involved construction of several port and docks which initiated various set of activities to encourage the setting of trade in the city of Mumbai.

Being surrounded by the sea, many of the traders and settlers reached the islands using the water route. Slowly but surely the presence of this extensive water route transformed the islands into one of the major hubs for trade and commerce.

With the onset of the industrial revolution, due to the ease of access, and availability of safe harbour, the island became a magnet for industries. Raw material, plant and machinery were easily transported to the islands which were already underway to become a single land mass by reclamation.

The island city was ruled by the Portuguese and British collectively for about 450 years. Being a British colony, the city took an active part in the Second World War by way of



Figure 1 site of Ballard estate before reclamation the road seen from Nicol road, now called as Ramjibhai Kamani Marg(source: Bombay city corner)

Rejuvenation of Urban Open Space in Historical Precinct-The Portland for living Mumbai.

repairing ships damaged by war in its safe harbour. The docks have been responsible for the growth and development of the city we know today as it was the availability of this safe harbour which acted as an incentive to migrate to the city. Mass migration and changes in aspirations of people has created the city we know as the financial capital of the country.

City's character is changing its shape due to urbanism and the spaces which are leftover became the city's open space. Earlier every open space was designed and the space for other activities are meant to be open and interactive in nature. There is a notion of converting the recreational space more than the playground or a park to much more higher level so that it will be benefit the nature as well as the user.



Figure 2 Site Location with its context (Ref: MbPT, Google Earth 2018)

Mumbai city has many natural assets like creeks, mudflats, rivers mangroves which are still untouched and that the access to those sites is from the port area. so there is a combination of both the activity comes in one place that need to be incorporated to give the city a new taste other than the concrete jungles.

City is defined by its physical context example in its topographical relationship. Every city has several stages during its lifetime- how it's developed, how the topography has helped in its growth, how the spaces are being framed based on the activities which will eventually result in a unique urban pattern.

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Now a days Mumbai is known for city of dreams, but the true history behind the statement is quite different. The reclamation of land between the seven islands converted the city into much more interesting and close to the sea has changes the space into much more commercial use.

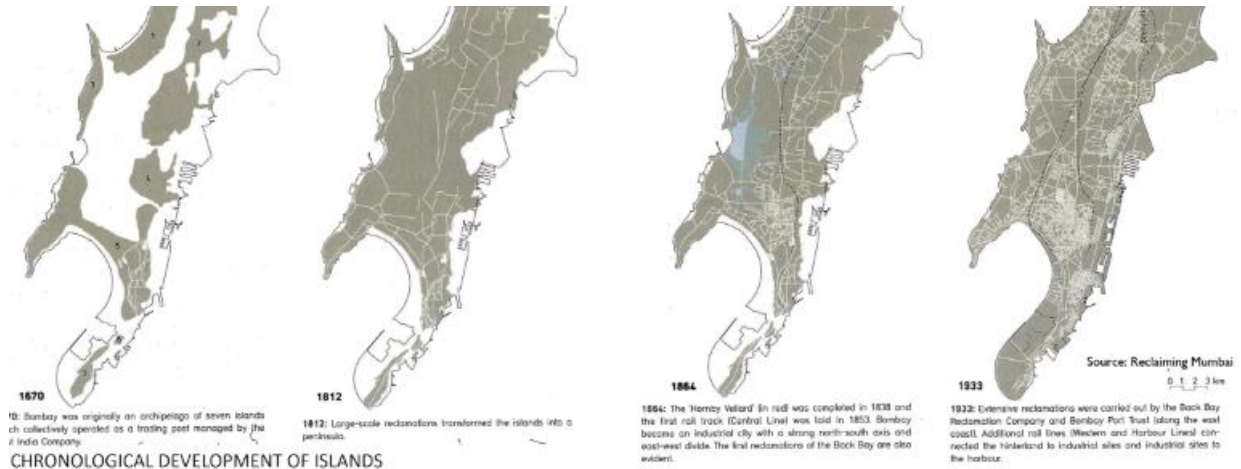


Figure 3 Chronological Development of South Mumbai (Source: Book-Reclaiming Mumbai)

1.1 Site Selection Criteria

The common link between these spaces is change in old industrialized space to a public space. These are the cities that have transformed its Urban landscape to global entity. Those images which are given below show transition through years in different cities across the globe. This transition leaves constant and variables as the marker or the means to identify the change.

Some of the reasons of the selection of site are given above. one of the primary concern was also the proximity of the study

Every site has some feature that attracts the designer to get involved and gives a new identity. This site as some topographical feature like Sewree fort (elevation of 15meters) was used by the port authority to monitor the sea and other ship activities. Secondly, this site is accessed by all the existing gates of port authority namely blue, green, yellow gates etc. there is a chance of upcoming projects to this area for the development of the reclaimed land of princess dock and Victoria Docks. One of the major projects which are

coming is the proposal of the International Cruise Terminal will invite people to access the space.

There are also some of the areas which need to be developed like closed warehouses and passage in between them. Currently, those areas are not in use as those activities have shifted. Area which is meant for shipping purpose has also lost their identity because of the major exchange from other parts of the country. one of the major important factor is the old ship breaking points where we can see the actual ship breaking activity and there is also one more space where the old parts of the ship are sold. Near the darukhana area, there is a big commercial hub of such activity which in general people have never seen in their life.

There is an opportunity to develop this area as an industrial area where both the commercial as well as the public movement can happen, and it will also attract the tourist coming to Mumbai.

So, the criteria of site election are based on these parameters and those areas carry unique feature that needs to be designed.



One of the important factors is its proximity to the mangrove and the flamingo point which are untouched by the city and will attract the tourists. These areas are the soul of Mumbai city which is being lost due to urbanization.

1.2 Existing Proposals of site

The city is changing and there are architects and planners who are identifying the potentials of these areas and started developing a new map for the city. Some of the proposals are mentioned in this section.

One of the interesting proposals is to develop a new Mumbai map, in which they are talking about the restricted walls which are developed by the British for the port activity need to be redefined.

Another proposal came up in terms of tourism potential is to redevelop the port area for the global tourism. The site is to be developed like the edge of Singapore and New York.

“What the city can get”, a new walkway, a new marine drive or a new open space, this proposal has also attracted the user.

There are many spaces inside the port trust which are illegal in nature and need to remove for giving a city a new open space. This led to a statement that “Mumbai port trust to take back its land from tenants”



Figure 4 News clipping from various newspaper showing the upcoming proposals on the port area.

These are the ideas which are coming for reshaping Mumbai Portland, but somehow, they are missing the link to this space. This space has its own history and identity which has been developed over the years. This site has a historically active Sewree fort which was used to monitor the entire areas. This site has potential to change the character from seasons to seasons. Now it's time to see a big picture rather develop into small chunks.

1.3 Thesis Project

1.3.1 Design Brief

The proposed open space shall be planned /designed as a contemporary, eco-friendly and interactive shoreline, shall follow the path of sustainability and environmental sensitise. the overall proposal of the site shall be formulated keeping in mind the phase wise development of the shoreline. The first phase of the development shall include the conservation of the existing structure which carries heritage value. And then revive the ecological character and then the comprehensive master plan which will show the development of entire site.

- Schematic proposal/vision showing the development of coast in terms of open and interactive space.
- Perspective views and walkthrough to justify the concept and envisaged relation of internal and external space.
- Phase wise development plans
- Future growth and expansion potential, if any
- Shoreline to be designed as synthesis of ecology, architecture, aesthetics, science and technology supported by guidelines and policy.
- The shoreline shall have an iconic feature which will give it a distinct identity
- Approach to the sea promenade/shore should be in the form of dual carriage way, beautifully landscape leading to the sea.
- Self-sustained ecologically sensitive area should be developed.
- site should have all the connectivity and the edge should have pedestrian flow so that it will reduce the usage of vehicle and vehicular movement should be at the periphery so that it will not affect the fauna of the area
- planning and design should require less maintenance and conservation and restoration is the primary topic of concern.
- The comprehensive plan will consider that it resolves all the issues of the site and should follow all the guidelines of CRZ and SEZ.

1.3.2 Aim

To prepare a comprehensive landscape development plan for the rejuvenation of the historical precinct of Mumbai Portland.

1.3.3 Objective

- To understand the coastal ecology of Mumbai Portland and related issues with it in urban context for the development of site.
- To study the morphology of urban open space and analysis of its transformation related to Mumbai port.
- Understanding the site and developing as they show the influence of history through landscape comprehensive plan.

The proposal will be based on three phases -comprehensive plan, shoreline development and promenade development, with the fusion of past and present, so that it can easily relate with the surroundings.it will be related to the landscape issues which are currently neglected.

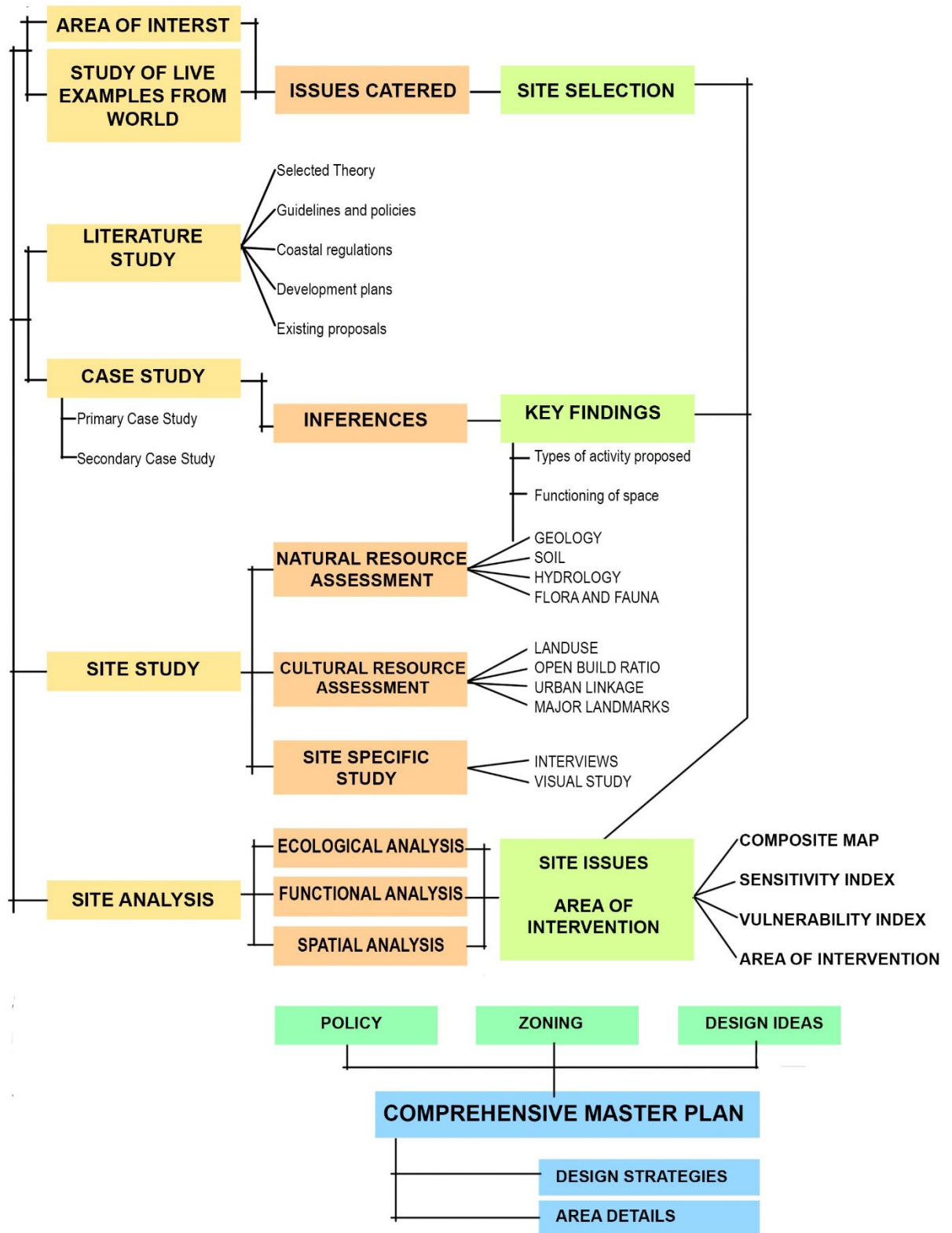
1.3.4 Need of the study

With a continuous emphasis on commerce in the city, large parcels of land have been sold off to the highest bidder. Be it the case of mill lands or other similar large land parcels, the city has lost every opportunity to regain open space for people. Currently, the Mumbai Port Lands provided the last opportunity to enable the city to breathe again which can be made possible through a comprehensive design such that it is feasible for all the concerned stakeholders.

1.3.5 Limitation

- The landscape scheme should be in provided at the policy level for the Eco sensitive zone of phase wise development
- The comprehensive plan will be provided for the zones and the landscape scheme in detail only for the mangrove area as the thesis due to limited time.
- Landscape conservation and preservation techniques given at strategy level not being supported with specific calculations.

1.3.6 Methodology



2 LITERATURE REVIEW

Mumbai, the city of dreams was once a collection of seven islands and Home to the Kolis. the islands were known for fishing and agriculture. Over time, the discovery of the islands by the Europeans brought about various changes.

With the advancement of Mumbai, cities shaped its form has changed the identity. The city as we know it today is one which is blessed with an extensive coastline all around it. While the western and southern sides have been explored and exploited, the eastern waterfront has been excluded. A part of the Port area, the eastern coastline has been hidden from public view for multiple reasons for many years. Due to advancement in technology and reduction in area required for port activities this eastern waterfront is now partially available for development and public interest.

The city Port land is of great relevance for the city's future. For both the way the city reinvents itself as well as the region. In fact, the very connection of the historic city to the region would depend on how the land on the city water edge is rejuvenated for use by Mumbai. In this context, the Port land on the eastern waterfront is particularly of great importance, owing to its location and context. The landscape has been fragmented into various specialized zones, separated across the metropolitan area. The eastern water front has immense potential to facilitate connections and linkages of these areas such that their importance is highlighted, making them more valued. Mumbai is uniquely fortunate to have such a long coastline which offers great potential, yet the available and accessible promenade to experience and enjoy the sea is limited. The Portland redevelopment offers probably the last possibility to create several public places with the comprehensive master plan that will give spaces to breathe, relax and connect with the history.

For study the urban context of Mumbai and its relation to sea, needs the study of urbanism context. In the recent years landscape started changing the city character through design ideas and intervention. People are moving towards the green environment. landscape urbanism suggests the revaluation of the city. This thesis is based on the concept of landscape urbanism. the analysis of space and form, connections and pattern are established to be presented. Its fluid nature this research will have discursive and investigative in nature.

Rejuvenation of Urban Open Space in Historical Precinct-The Portland for living Mumbai.

2.1 Landscape Urbanism

Landscape urbanism is a theory of urban planning arguing the best way to organise cities through the design of city's landscape. -tom turner (TURNER)

2.1.1 Principle of landscape urbanism

The principles that deals with landscape urbanism have been observed to be highly varied. In its general notion, it identifies the space in terms of its context. However, main principles that underlie can be classified into mainly three contexts pertaining to ecological, functional and water sensitivity. These underlying principles, to some extent are crucial in governing the design of a given urban space. It is believed that all the three principle areas mutually supportive and create harmony in urban space.

Where productive landscape is contemplated, the foci generally remain in the betterment of the social and economic condition of the population. However, in urban context, the landscape urbanism principles can be focused to leisure and tourism to reap benefits. This include a much talked about "transit-oriented-development" which promotes healthy accessibility and mobility in urban space.

In many cities of the world, water stress (sensitivity) in the urban areas is much discussed. In the wake of water scarcity in many urban areas and the prognosis of 70% population in urban cities alone in near future, various stringent strategies focusing on urban water networks are being continuously formulated.

The third principle of landscape urbanism deals with the conservation of flora and fauna. As our build ecosystem is a home for lots of species, this process considers the effort of all the communities in its preservation and conservation.

The three discussed principles are thoroughly mapped in this study. They provide a framework for application to most projects focusing on urbanism. Although, the conclusion is difficult to generalize considering all these aspects, as the effect is more mixed, however the availability of such principles in guiding the landscape urbanism are discussed in scope of the study.

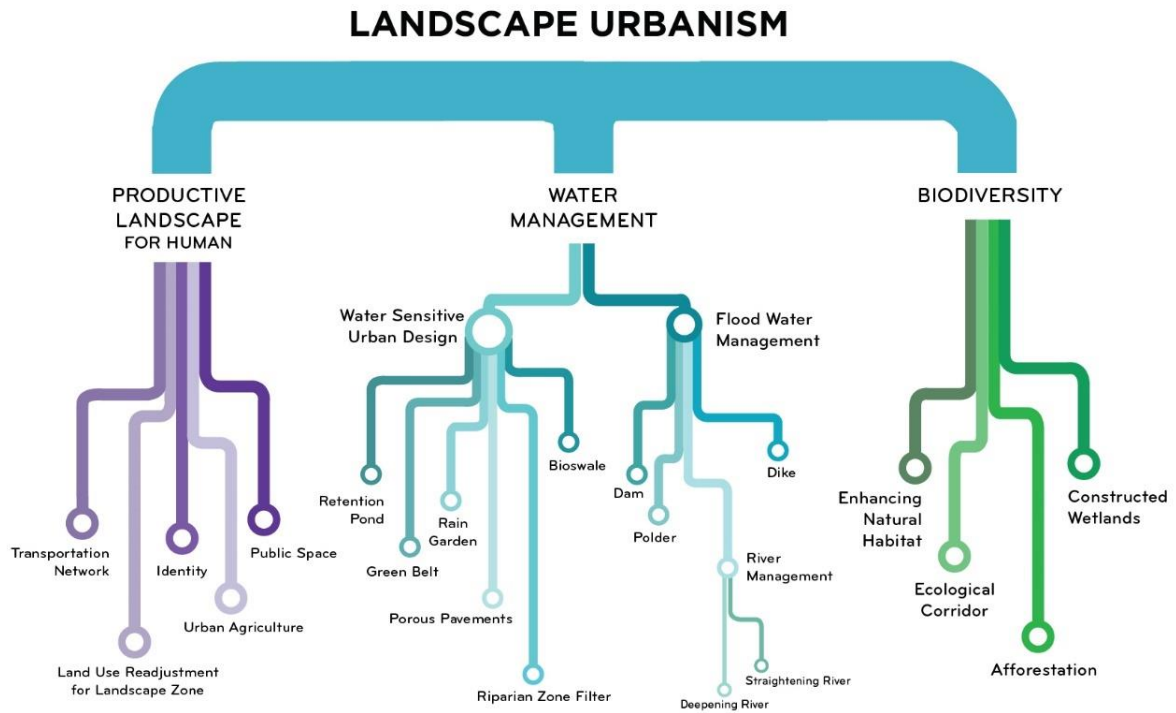


Figure 5 Urbanism Flow diagram

Approach and Methodology

the study of landscape urbanism lead to understand the principles of productive landscape in which a city which has a identical functioning and approach towards the nature. The idea is to break this repetition and non-emotional approach towards the nature. Linking of space and function lead to study the productive landscape, the water management and the biodiversity.as the site chosen for the thesis has all the aspects related to this.

This model represents the concept of landscape urbanism and their relation to the environment.

2.2 Coastal ecology

The ecosystem is a collection of living and non-living objects in a certain area. Coastal region are those places where the water and land meet.it is place where the collection of organisms live. some of the areas are like lakes, oceans, rivers and other water bodies. The intrusion of water and land creates a unique ecosystem with lots of species that helps

in maintaining the ecosystem. This system is extremely sensitive in nature because of the diverse species found with different climatic conditions.

“Coastal ecosystems are therefore the collection of organisms that are found on the boundaries of oceans, lakes, rivers, and other forms of liquid water. The intrusion of water into the land creates unique environmental conditions characterized by many habitats.”¹

These habitats include natural ecosystems, in addition to important managed ecosystems, economic sectors, and major urban centres.

The existence of many coastal ecosystems is dependent on the land-sea connection or arises directly from it (e.g., deltas and estuaries).

At a much coarser geographical scale, there is a spectrum of climate types—from tropical to polar—with concomitant broad-scale differences in bio geophysical processes and features.

“Coastal wetlands such as mangroves, coral reefs, and seagrasses contain some of the most productive communities in the world. It is well established that coastal ecosystems such as mangroves, coral reefs, tidal flats, and estuaries are experiencing degradation and loss.”²

Most of Earth (70.8% or 362 million km²) is covered by oceans and major seas. Marine systems are highly dynamic and tightly connected through a network of surface and deep-water currents.³ The total global coastlines exceed 1.6 million kilometres, and coastal ecosystems occur in 123 countries around the world. Coastal and marine ecosystems are among the most productive, yet threatened, ecosystems in the world.



Figure 6 Coastline on a global basis (source: global rural urban mapping coast project)



Figure 7 Fresh water reserve (source: global rural urban mapping coast project)

¹ www.encyclopedia.com/environment/energy-government-and-defense-magazines/coastal-ecosystems

² cms.ctahr.hawaii.edu

³ <http://portal.nceas.ucsb.edu/>

2.2.1 Types of coastal ecosystem

Estuaries—areas where the fresh water of rivers meets the salt water of oceans—are highly productive, dynamic, ecologically critical to other marine systems, and valuable to people. Worldwide, some 1,200 major estuaries have been identified and mapped, yielding a total digitized area of approximately 500,000 square kilometres.⁴

Estuarine Ecosystem is “a partially enclosed coastal body of water which is either permanently or periodically open to the sea and within which there is a measurable variation of salinity due to the mixture of sea water with freshwater derived from land drainage”⁵

Coastal marshes and lagoons are essentially extensions of true estuaries and are included in estuarine analysis and assessment.

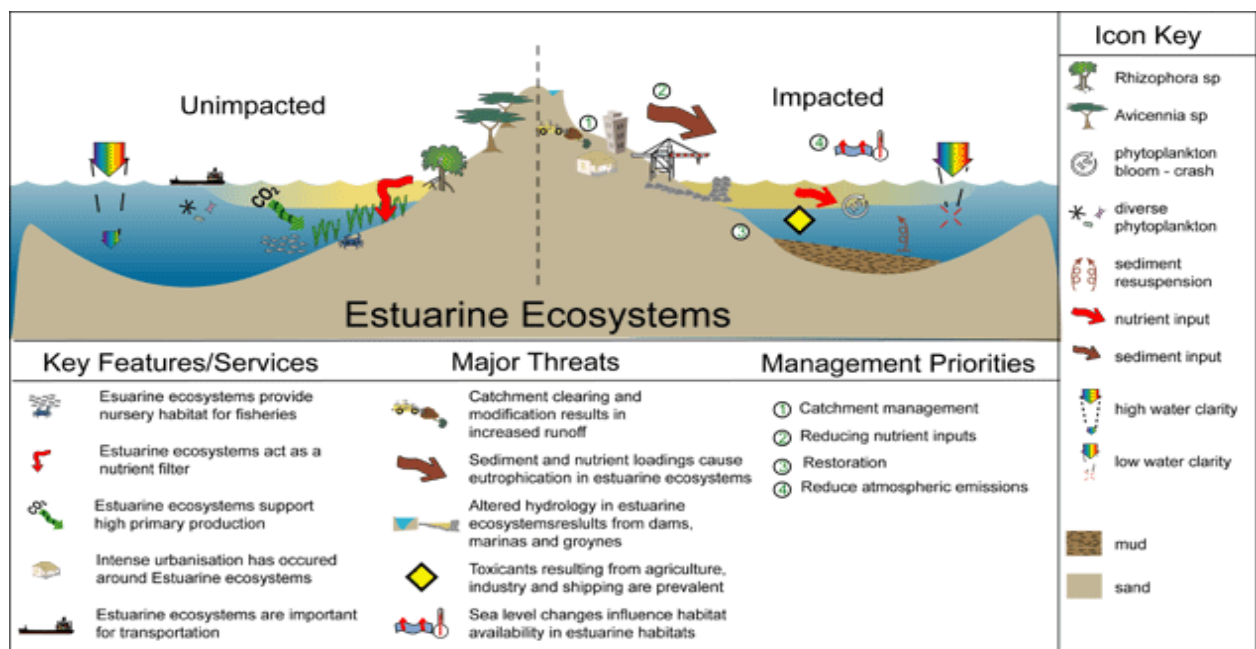


Figure 8 Estuaries ecosystem (Source: <http://blog.wwf.ca/blog/2014/07/02/looking-fair-development-skeena-estuary/>)

Marshes and lagoons- Coastal marshes are coastal wetlands that are flooded and drained by salt water brought in by tides. They are marshy since they are composed of mud and peat.

⁴ <https://www.millenniumassessment.org/en/index.html>

⁵ <http://eprints.cmfri.org.in/>

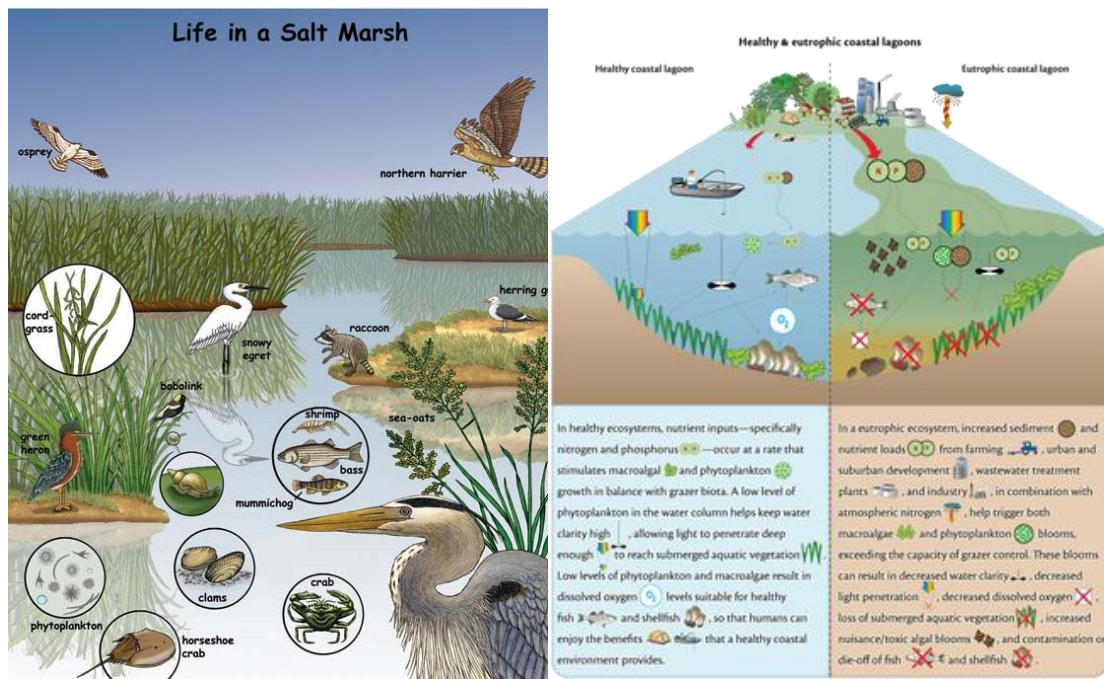


Figure 9 Life in a salt marsh (source: ecosystem handbook)

Mangroves- Mangroves are trees and shrubs found in intertidal zones and estuarine margins that have adapted to living in saline water, either continually or during high tides⁶ (Duke 1992).

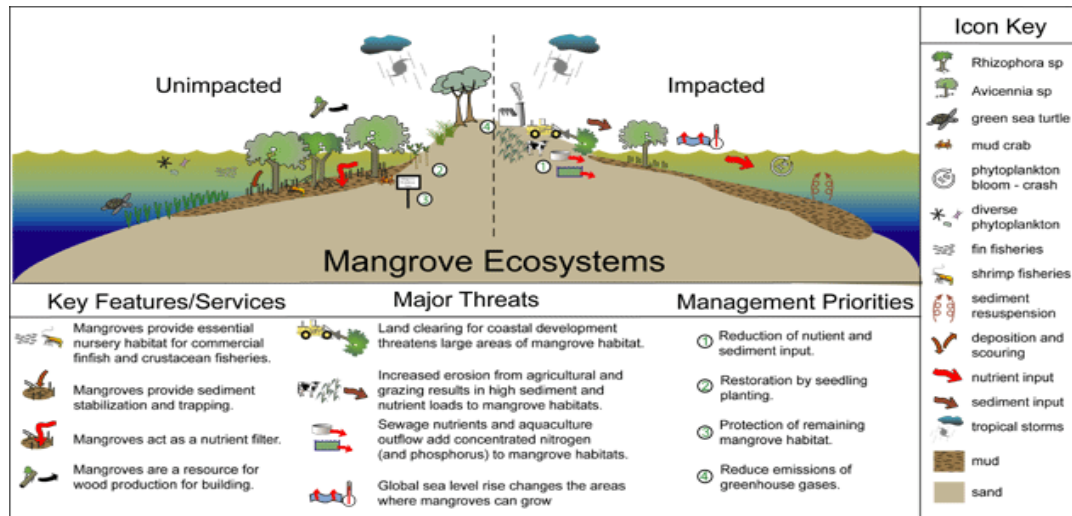


Figure 10 Mangrove Ecosystem (Source: <http://ian.umces.edu/discforum/index.php?topic=108.0>)

These forests are found in both tropical and sub-tropical areas, and global mangrove forest cover currently is estimated at between 16 million and 18 million hectares. Based

⁶ <https://www.millenniumassessment.org/en/index.html>

on the coastal characterization presented above, mangroves line approximately 8 percent of the world's coastline.

Riverine mangroves also provide protection from flooding and erosion, as well as sediment trapping, a nursery function, animal habitat, and the harvest of plant products (due to highest productivity).⁷

Intertidal Habitats- Deltas, Beaches, and Dunes-The intertidal zone is where the land meets the water. Coastal areas are constantly changing because of the rising and falling water levels. With these variations, comes a plethora of organisms.⁸

Organisms of the intertidal zone may live underwater, partially underwater, or they may be terrestrial.

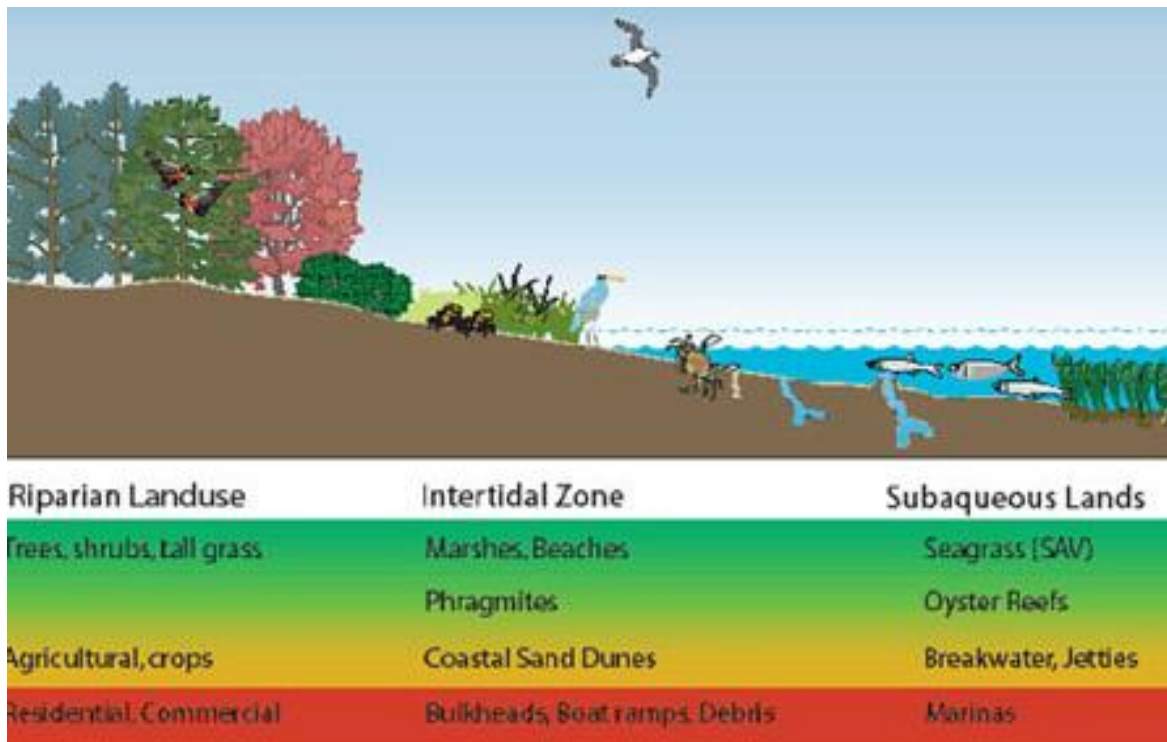


Figure 11 Graphical representation of intertidal zone

⁷ <https://www.millenniumassessment.org/en/index.html>

⁸ <https://ieep.eu/>

2.2.2 Potential

Coastal aquaculture-The naturally bred juvenile fish and shrimp seed were trapped in impoundments and allowed to grow to be harvested in due course. The development of commercial hatcheries in the early nineties, as part of the Blue Revolution, spurred the growth in shrimp aquaculture.

The large potential for export and high profitability resulted in extensive areas brought under shrimp farms by conversion of paddy lands and destruction of mangroves especially in states like Andhra Pradesh.

Salt production-A second important coastal livelihood is salt production. [India is the third largest producer of salt](#)⁹ in the world with an average annual production of about 157 lakh tonnes with sea salt making up about 70% of the salt production in the country.

(P.Parthsarthy, 2012)

A majority of those who work in the salt pans are socio-economically backward and mostly illiterate and are often migrant labour.

Many of the salt pans are small holdings and are being swallowed up by 'development' activities of nearby towns and cities as in the case of Mumbai, Maharashtra and Tuticorin, Tamil Nadu.

Coastal tourism-Recreational tourism is a relatively new entrant but is a fast-growing segment with the increase in disposable incomes and strong advertising.

[Tourism in India today is the largest service industry, with a contribution of 6.23% to the national GDP and 8.78% of the total employment in India. Coastal resorts along the beach areas are steadily expanding, often at the expense of the local fishing communities whose access to beaches is often restricted.](#)¹⁰

Several coastal locations in India have been important from a religious as well as cultural point of view.

⁹ <http://www.hindustanstudies.com/>

¹⁰ <https://economictimes.indiatimes.com/industry/services/travel/indias-is-the-worlds-7th-largest-tourism-economy-in-terms-of-gdp-says-wttc/articleshow/58011112.cms>

Coastal biodiversity-Coastal Biodiversity ecosystems include mangroves, mudflats, salt marshes, coral reefs, sea grass beds and lagoons, all of which are highly productive and support extensive fisheries and associated livelihoods. Coastal wetlands, among the most productive of ecosystems, have been mapped by the Space Application Centre as covering 40,230 km².

Probably only about a third of India's coastal habitats have been surveyed for biodiversity, with mostly commercially important fin fish and shellfish, corals, larger reptiles and mammals inventoried.

Urbanisation

[The growth of urban areas that form coastal cities, places an increasing demand on natural coastal extractive and non-extractive resources.](#)

[The use and conversion of coastal land and catchments is considered a permanent effect of growth and development.](#)¹¹

Urbanisation has direct effects on biodiversity and the state of the coastal environment. The location of coastal urbanisation inherently translates to socio-economic vulnerability.

2.2.3 Issues

Tourism-Recreation and leisure now form a major component of human activity and, when combined with travel, comprise the growing tourist industry.

Tourism can bring numerous socio-economic benefits to a region, in terms of creating local employment, stimulating local economies, generating foreign exchange, stimulating improvements to local transportation infrastructure, and creating recreational facilities.

In turn, it causes lot of negative impacts on environment as well as the socio-economic scenario:

Climate change, Dredging, Sand mining

¹¹ <https://www.unenvironment.org/>

2.3 Coastal Guidelines and Regulations

Site is along the coast of Arabian sea and comes under Mumbai Port Trust. Its has approx. of 14km of clear shoreline with multiple activities of Port. According to the ministry of environment and forest this site comes under CRZ 1A category.

2.3.1 Coastal regulation zone

CRZ-I



Figure 12 CRZ Demarcation (Source: MbPT)

Areas that are ecologically sensitive and important, such as national parks/marine parks, sanctuaries, reserve forests, wildlife habitats, mangroves, corals/coral reefs, areas close to breeding and spawning grounds of fish and other marine life, areas of outstanding natural beauty/historical/heritage areas, areas rich in genetic-diversity, areas likely to be inundated due to rise in sea level consequent upon global warming and such other areas as may be declared by the Central Government or the concerned authorities at the State/Union Territory level from time to time.

Area between the Low Tide Line and the High Tide Line.¹²Permissible activities under CRZ 1A. Eco tourism

activities like mangrove walks, tree huts and natural trails

In mangrove buffer only construction of pipelines and transmission lines, construction of road is permissible.

¹² <http://www.moef.nic.in/rules-regulations/crz-notifications>

National Coastal Management Authority

These designated authorities were the State Pollution Control Boards. Because the Pollution Control Boards are not only overworked but simultaneously have a limited role to play insofar as it relates to controlling of pollution, as also of the Management Plans, the Central Government should consider setting up under Section 3 of the Act, State Coastal Management Authorities in each State or zone and a National Coastal Management Authority.”

This established the Coastal Zone Management Authorities (CZMAs) as the only institutions at the State and National level in charge of overseeing the implementation of the CRZ Notification. They came into existence in 1999 and are now 16 years old.

State Coastal Zone Management Authorities

The composition of SCZMAs should include 1 NGO (by name), 4 experts (by name) and 5-6 ex-officio members from the various Departments viz Department of Environment, Urban Development, Fisheries, Industry, Pollution Control Board, local bodies.”

Maharashtra: The Department of Environment and Energy, Mumbai

ICZM PROCESS-integrated coastal zone management

Coasts are not uniform by nature; they are shaped by differing physical, social, economic, biological and cultural factors. As a result, there is no one standard for implementing an ICZM solution.

In general, though, the implementation of an ICZM policy, programme or project in a region usually requires several iterative stages, which form part of a typical policy or project development cycle. These stages can be broken down into five steps as described by Olsen et al., 1998:

- Identification of issues
- Plan preparation
- Formal adoption and funding
- Implementation
- Monitoring and evaluation

2.4 Case Studies

2.4.1 High Line Park, New York

The High Line is an elevated railway transformed into a public park on Manhattan's West Side. The park features lush horticulture, artworks, seasonal food vendors, community programming, and unique views of the Hudson River and New York City skyline.

The park's attractions include naturalized plantings that are inspired by the landscape that grew on the disused tracks, and views of the city and the Hudson River. The trail is made of pebble-dash concrete walkways that swells and constricts, swings from side to side, and divides into concrete tines that meld the hardscape with the planting embedded in railroad gravel mulch. (Shannon, 2009)



Figure 13 old pictures of high line park and its surroundings

The High Line Park also has cultural attractions. As part of a long-term plan for the park to host temporary installations and performances of various kinds.



Figure 14 Old map of high line park (source: reclaiming Mumbai)

its success has inspired cities nationwide to reimagine obsolete infrastructure as public space. Additionally, the project has spurred real estate development in the neighbourhoods that lie along the line.

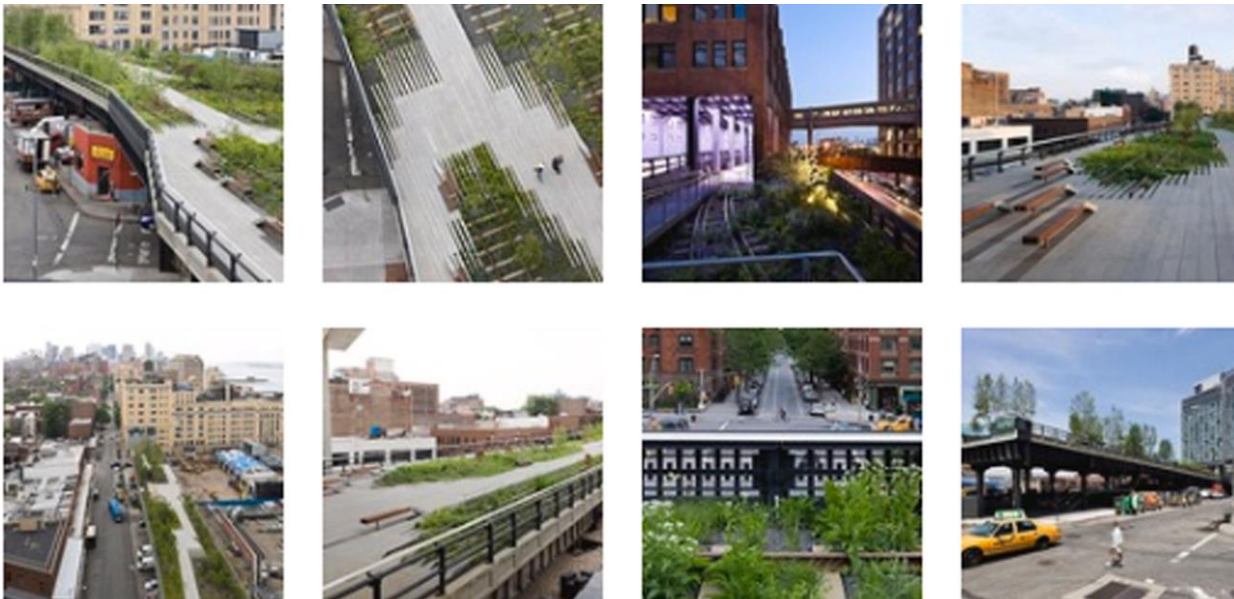


Figure 15 Existing Image of High line park (Source: book-Reclaiming Mumbai)

2.4.2 Lagunage de Harnes, France

In 2005, French landscape architect François Xavier successfully converted the image of a coal basin into a public park through the creation of aerated lagoon system for purifying waste water using phytoremediation processes.

the lagoon combines technical efficiency with high quality water ultimately used in bathing pool with landscape and ecological qualities.

the project creativity exploits the use of water, air and vegetation as a tool of purification. A series of terraced pools create movement through water planted surface along the contaminated site.



Figure 16 Image of LAGUNAGE DE HARNES (source: reclaiming Mumbai)

the utilization of aerated lagoon and stabilization pond technology capitalizes on natural processes and low-tech methods.

2.4.3 Historical precinct of Pondicherry

Pondicherry is the French interpretation of the term “Puducherry” meaning new settlement. The land gained importance as a trading destination from the roman times Initially began as a small fishermen village which later emerged as a bastion town with the market at the center and the developments radiating from it. The present Pondicherry has boulevards and radial gridded roads.

PHYSICAL SETTING OF THE CITY

There existed a large stretch of sandy barrier along the East coast, backed by a line of tidal lagoons surrounded by marshy lands.

Towards the north, behind the sand dunes, there exist a stretch of grassy swamps which is been fed by tiny streams, alternating with cultivated uplands.

The grid iron pattern of the city is a contribution of the Dutch Planning Principles, which gave Pondicherry its distinct identity as a Port town

The town limits are being categorized by the boulevards which ultimately molded it into its oval shape.

The segregation between the French settlement and Indian settlements which is more far away from the sea, made the French settlements, ie where the civic buildings are mostly present has become the tourist spot of the town, whereas the Indian settlement still exists as residential areas, where there is a clear-cut distinction between Hindu, Muslim and Christians.

Analysis

The open spaces have reduced over time. There are positives and negatives regarding the open spaces and its location within Pondicherry. If we consider the case of

French settlement-we can see that the open spaces scattered along the water edge, i.e. along the Beach road, which is a beautiful promenade. This is the major happening space of whole Pondicherry.

It becomes a host for lot of activities like New year celebrations, yoga classes for World Health Day, De factor day celebrations etc.

At the central part of the French settlement where the fort was located once. Today the space is occupied by a park which is well maintained and is a venue for lot of activities like cultural program and political meetings etc.

The British East India Company built the Fort (Mumbai precinct) leisurely between 1686 and 1743 with three gates, a moat, esplanade, level open spaces on its western fringe (to control fires) and residences. (remnant of the fort wall is pictured).

In 1860 the fort was demolished by the then Governor Sir Bartle Frere to provide adequate space for the growing civic requirements of the city and thus it was restructured.

The Dadabhai Naoroji Road, which was known as Hornsby Road running along the bastions of the Fort was made into a broad avenue and large impressive buildings were arranged according to the new government regulation of 1896.

It was mandatory to have with these office buildings a pedestrian arcade in the ground floor that performed as the unifying element tying together the various building facades. The result was a spectacular array of Victorian, Gothic, Indo-Saracenic, Neo-Classical and Edwardian structures.

In 1869 the Flora Fountain was laid where once the Church Gate stood which eventually became the iconic image of Bombay.

PRESENT STATUS

Dadabhai Naoroji Road – linking the famous Crawford Market to Victoria Terminus and moving onto Flora Fountain in the south – forms the main commercial spine and image centre of the city. By its very existence as a dynamic commercial artery, as well as the fact that it is virtually the civic centre with the Municipal Corporation headquarters, the Times of India and various banks and public plazas located on and around it, the area plays a critical role in framing the public perception of Mumbai.

The spaces used

The spaces include open spaces as well as the huge amount of indoor gallery spaces, with Kala Ghoda's art galleries, museums and cultural spaces.

Along with this is the outdoor pedestrian movement arcades which also form the venue for art exhibitions and the programmes. There are also many location advantages that contribute to the special character of the Kala Ghoda Art District.

The area occupies a pivotal location within Fort and is on the tourist circuit of Taj Mahal Hotel - Gateway of India - Flora Fountain and The Asiatic Library.

The major reason for its success is the easy accessibility via water, rail and road and the whole area is flanked by one of the city's largest greens – the Oval Maidan to the west – and is situated in the heart of the city's business, commercial, and administrative hub, close to Horniman Circle garden.

2.4.5 Inferences

VISUAL ASPECTS

The major concern of Pondicherry is that the whole area which was designed by overlooking into the water is not in scene anymore. The visual and physical link has been closed from the Jew street and Bazaar road.

At least those areas which has the potential to be developed as a big open space overlooking the backwaters should be identified, which could be developed and eventually will help in increasing the footfall along the water edge.

CIRCULATION

The access points should be conserved without modification as far as possible. Parking areas has to be properly demarcated and paid.

VEGETATION

Planting in areas should be done to provide shade, emphasising view, creating enclosures, act as sound and physical buffer, space articulation etc.

The plantings should be well maintained and pruned regularly so that no heritage is been destroyed and is been investigated.

STREET FURNITURE

There should be a common guideline for designing the street furniture, its location and artistic quality. These should be placed in areas where they are needed, and not placed haphazardly.

The style should not be something highly out of box, the sense of place should reflect from these detailing also.

3 CONCEPTUAL FRAMEWORK

3.1 Historical Background of the Site

Mumbai has layers of history since the stone age, and it's difficult to understand the history from that time because of the reclamation and the invaders came to this area. Initially, the site was known by Koli's "the fishing community". Their livelihood was depended on fishing and agriculture. Their surrounding area was much more important for their development.

Later when the Mauryan empire came to this place and saw a safe harbour after this the identity of this areas has changed. The intention of studying this topic is to understand the layers of invasion on this place. Broadly the site has been characterized into five overlapping, which includes the Koli's, the actual owner of this place and their livelihood was depended on these lands. This was before reclamation approx. the era of 1500.

In 1509, Portuguese came to India and they saw this land as a trade potential and in later years those islands were passed to Portuguese as a lease for trade. This was the initial development of the lands and later the 1534-1668, Portuguese ruled this place, and, in the meantime, East India company has formed, and the existing navy is formed at that time.

We can also see the Portuguese and Dutch style of building the port area and they are in working stage. After this the land which is known as the Portland was gifted to England then since then the docks came into existence and the major trade has been started with the second port station as the Surat. We can also find evidence of those in the laying of architecture. Some of the heavy locks and engraving are also found in those places.

In 1800 the crown shifted to East India company and all the trade activities were handled by them in later years. This has changed the map of the city and the safe harbour was changed to the shipping port. This led to the city to change its character to urban jungle and the negligence of the mangroves and environment has destroyed the initial life cycle of the Kohli's which was the actual soul of the city.

There are many studies has been conducted to know the change in environment has brought the eye on this area and the Mumbai port authority has started this land as an

ecologically sensitive area. The map shown below is bring attention to the reader the parallel and untouched history of the Mumbai.

For Map of chronological study of Annexure

3.2 City open space and Linkage

The idea of studying the open space is to understand the people behaviour towards a space.in the earlier section shows the layered history of the area. This section will only deal with the open space and its linkage to the site.



Figure 19 Open space map of Mumbai (Source: Municipal Map of Mumbai)

Figure 20 Open space map of Mumbai (Source: Municipal Map of Mumbai)

The type of open space shows the quality of life of the city and reflects the dignity of public space. Open space can be of many types like playground, garden, parks etc but if we see in context of Mumbai we find it very less and very congested. the only open space in terms of city context are those space which are linked to the Arabian sea. On the western edge of the south Mumbai is covered and developed in the recent years. Those areas give a dynamic character to the city and development of marine drive and its extension gave a city a linear space. On the eastern edge where the shipping activity is happening those areas are still neglected. eastern zone is complexly under

the port authority and those areas are only accessed by the staffs of port authority. This

site has lost of potential in terms of ecology as it contains loss of environmentally sensitive areas.

The map given shows the important landmarks and open space and their linkage to the city.

4 SITE CONTEXT

Mumbai port trust is one of the oldest and major port in India, established in 1873. the total site area on the west coast is approx. 400sqkm. 14km of land starts from Colaba on the south to Wadala on the north. Most of the southern and central part comprises of offices, jetties, wharf, berths, docks and warehouses. whereas the northern part of the Mumbai Portland still has ecological value consisting of mangroves, mudflats and creeks. Some of the areas on the extreme north towards the Mahul creek comes under the Bhabha atomic research centre. there is a patch in between the BARC and the Sewree fort are still untouched. But the access to those areas are still prohibited.

The selected site comes under Mumbai port trust starts from Sewree mudflats to the operational docks of 14km. The margins of the site has mangroves, mudflats, sewree fort, warehouses, operational docks etc.

4.1 Mumbai Port

The site area is surrounded by the city of Mumbai from the western side and Arabian sea on the southern side. site has a unique feature

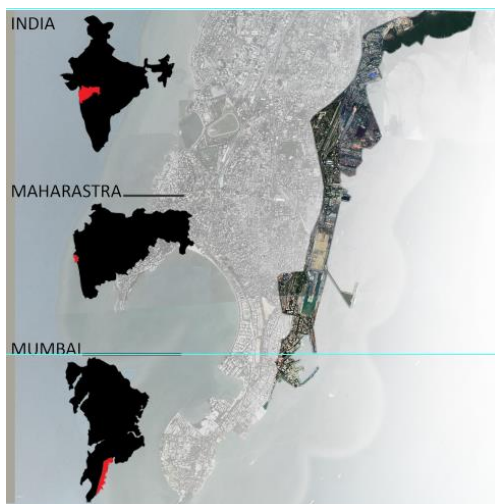


Figure 21 Location Map of Mumbai

of safe harbour where all the shipping activity happens. The areas inside the port trust is mainly used by office people and the areas on the northern side are used by oil refineries and natural gas commission (ONGC).

There is an upcoming project of trans harbour of 22km, 6-lane freeway connecting Mumbai at Sewree to Navi Mumbai at Nhava Seva. This project will pass through the existing mangrove. The major impact will be on the flamingos which are coming once in a year.

The site consists of various activities throughout the periphery of the site. Some of the prominent areas are listed below.

MANGROVES



The band of green that separates much of Mumbai's coastline from the Arabian Sea is almost entirely submerged at high tide. When the sea retreats, the band becomes visible, in clumps of densely packed trees interspersed with narrow creeks.

Figure 22 Existing Mangrove at Flamingo Point

WADALA ESTATE



The area is predominantly occupied by marshalling yards and oil companies with their oil installations, oil tanks and filling points.

Figure 23 Oil Containers at Wadala Estate

SEWREE ESTATE



This site is from sixteen century. sewri fort and the remains of sewri village. it has container depot for port activity.

Figure 24 Ruined structure of Sewree Fort

COTTON DEPOT



This area primarily consist of ferro cement concrete structures with portal frames constructed around 1925 for the storage of cotton bales there.

Figure 25 Working activity inside the open warehouse

CHARCOAL AND GRAIN DEPOT



This area was allotted the function of charcoal storage.

Figure 26 Boats for shipping activity

MAZGAON RECLAMATION



Figure 27 Scraps of ships at Mazgaon

The open fringe profile bunders of Mazgaon reclamation estate (darukhana) were built in the 19th century for maritime trade in wood and coal from neighbouring state but have lost their relevance in the present economy. Parts of these areas have been replaced by wholesale iron and steel storage and large chunks of the bunders have been encroached upon.

MAZGAON FORT AND FERRY WHARF



Figure 28 Naval ships at Mazgaon jetty

This precinct holds the 17th century old fort built by British but raised by Siddi General. On the west, the fort is presently known as Joseph Baptista Garden. On the eastern side, Mazgaon Docks, which holds defence activities and related infrastructure, administrative offices of the port, MbPT warehouse and jetties for passenger boat services and fishing.

OPERATIONAL DOCKS



Figure 29 Jetty and Wharf at docks

The operational docks consist of the Indira Dock, Prince's Dock and Victoria Dock, which handle the goods coming into and going out of the city. The total quay length of the dock is 7.7 km. The Prince's Dock is presently being land as an off-shore container terminal by the MbPT.

BALLARD ESTATE

The business area, planned in the 19th century, houses corporate sectors of offices and includes the MbPT head office, new customs office and the office of clearing and forwarding agents and shipping containers.

4.2 Natural Resource Assessment

4.2.1 Regional Setting

site is located on the edge of a safe harbour of Arabian sea, where the water is bit calm as it comes under bay. Site is linear in nature of 2.5km in width and 14km in length. Site edge is under bay region. Surrounded by city from western side and sea on the eastern



Figure 30 Site and Surrounding Map of Mumbai Port with Area

side. From the norther side ecological area is present and from the southern side navel area.

The site is located on the edge of a safe harbour of Arabian sea, where the water is bit calm as it comes under bay.

Rejuvenation of Urban Open Space in Historical Precinct-The Portland for living Mumbai.

Site is linear in nature of 2.5km in width and 14km in length. Site edge is under bay region. Surrounded by city from western side and sea on the eastern side. From the northern side ecological area is present and from the southern side navel area.

4.2.2 Geology, Soil and Hydrology

The geological region of Mumbai consists of deccan traps of hard and soft rock. Deccan trap flows towards the 150m towards the west.

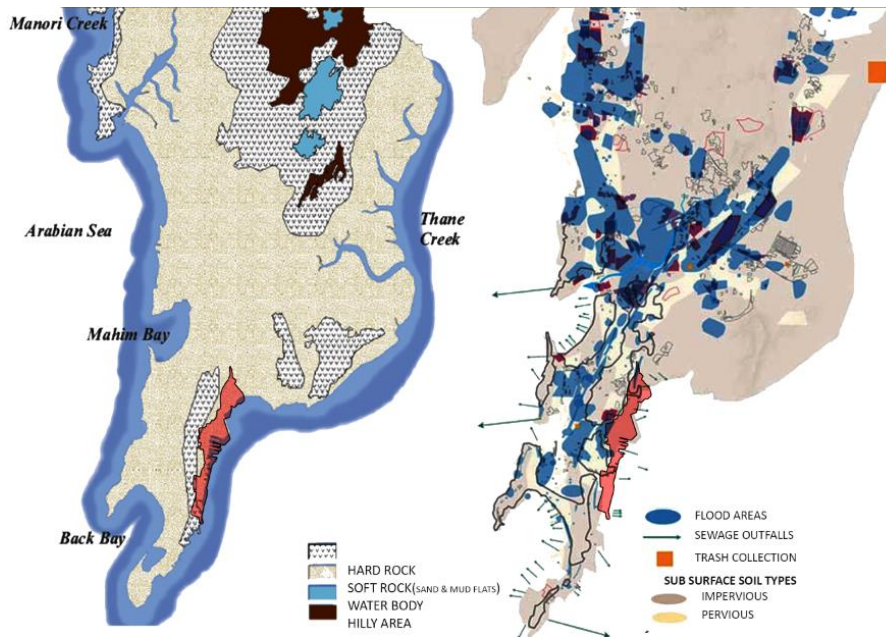
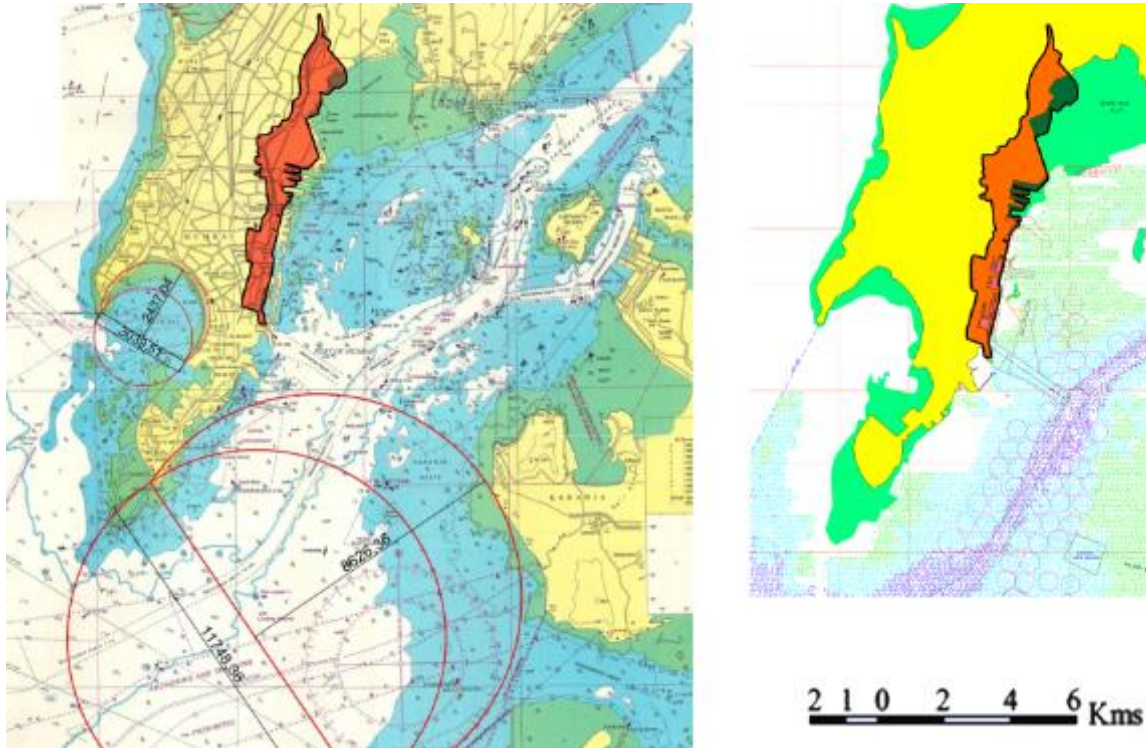


Figure 31 Hydrographic Map of Mumbai (Source: Mapsof.net)

This basalt layer is overlain by residual soil which in turn is overlain by marine clay. In general, the colour of marine clay is grey to dark black and its nature is soft to very soft. These are silty marine clays. At some places, these are mixed with fine to medium sized sand

and gravels and at some places with gravels of weathered rock. The thickness of this layer is variable. The residual soil is the weathering product of underlying basalt. These are reddish brown in colour. These are hard to very hard in strength.

Critical analysis show that the region has a tidal variation of +5m. there are ship loading unloading activities because of the safe region.



4.2.3 Flora and Fauna

Mumbai Portland has a flamingo point near the Mahul creek region. This site has been identified as the major bird area by the bird international group in 2014. *Figure 32 Bathymetric Map of Mumbai (Source: MbPT)*

during the winter season the lesser flamingo which are listed threatened by the IUCN visits every year. There are also other water birds, both residents and migratory dependent on the mudflats. There are globally threatened birds are also found there like *Greater spotted eagle, eastern imperial eagle, Aquila heliacal and White backed vulture gyps bengalensis.*

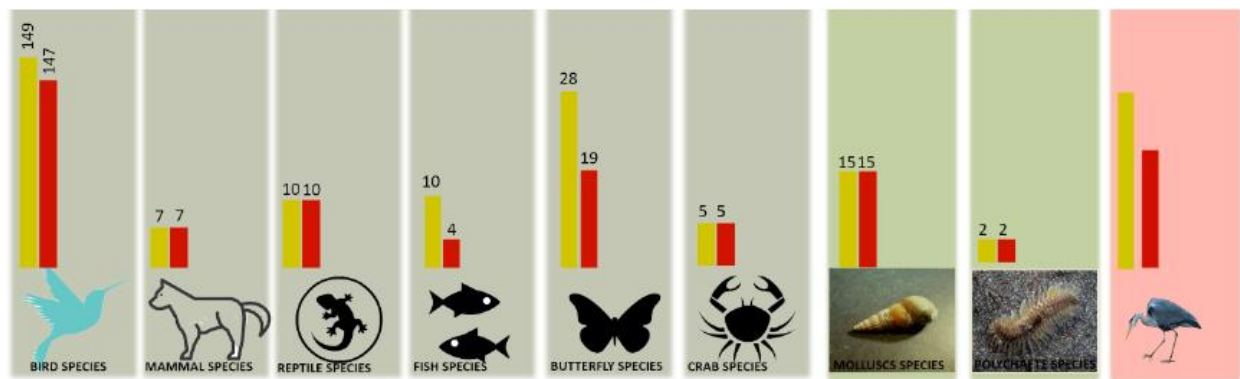


Figure 33 Graphical representation of existing flora and Fauna (Ref: Bombay natural history society-2014)

Comparative analysis has been shown to analyse the degradation number of bird species coming to Mumbai. Recent results observed that no. of species has been reduced because of urban issues. There are list of birds and mangrove species which are inter-related to each other.



Figure 34 Graphical representation of birds coming to the site (Ref: Bombay society of history-2014)

4.2.4 Mumbai Mangrove

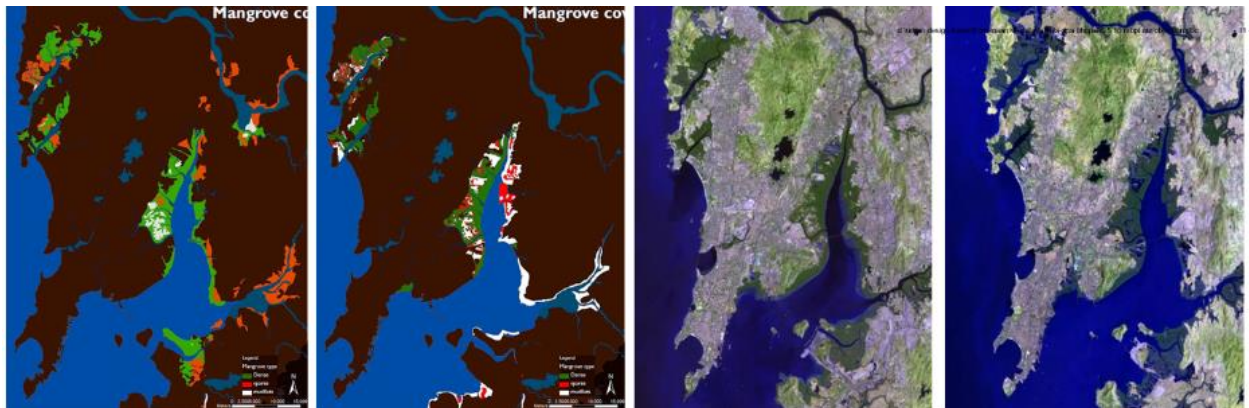


Figure 35 Mangrove depletion in recent years (source: maps of Mumbai)

Mangrove forests provide essential functions and services to coastal communities. These include acting as carbon sinks thereby mitigating the effects of climate change; providing nutrients for marine life; and enhancing protection to coastal communities from associated storm surges and erosion by capturing soil during periods of heavy precipitation, thus stabilizing shoreline sediments.



Figure 36 mangrove cover and species (Ref: Mangrove mapping and change detection around Mumbai (Bombay, Received 21 April 2004, revised 19 April 2005))

4.2.5 DCR

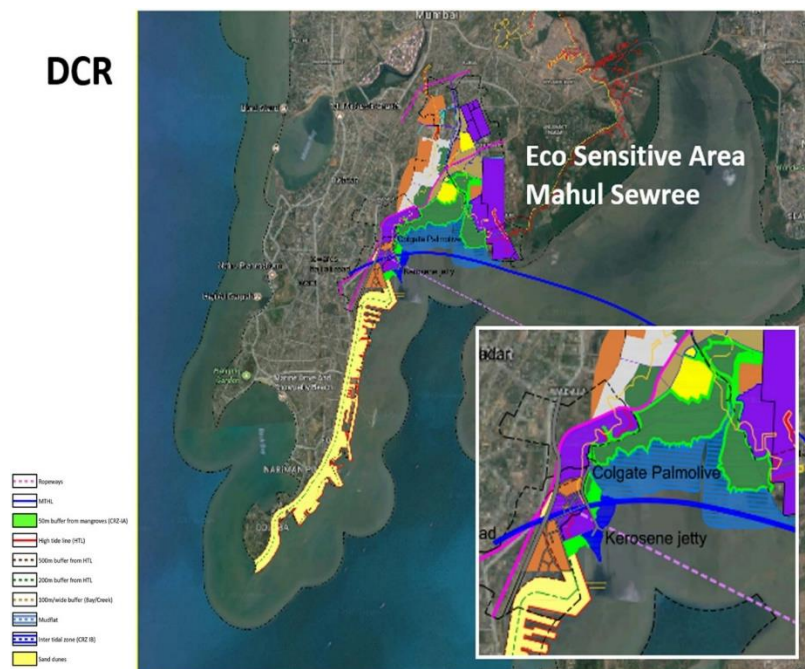


Figure 37 DCR of Mumbai port)Source: DCR 1967)

the site comes under CRZ 1A zone, with 200m and 500m buffer. Edge are used by port activities. Northern side where there is mangrove will have a buffer of salt panes and mudflats. The site has mangroves and saltpans.

At kerosene jetty upcoming proposal of MTHL linking to Navi Mumbai.

Rejuvenation of Urban Open Space in Historical Precinct-The Portland for living Mumbai.

4.3 Cultural Resource Assessment

For accessing the functional aspect ,five important layers to be studied as shown below



Figure 38 Proposed Land use Map and Open space Map

Land use map shows the major areas next to the sea are either covered with port activities or by the proposed reclamation.

Open space map shows the major grain is next to the industrial zone which is highly congested and need to be developed critically.

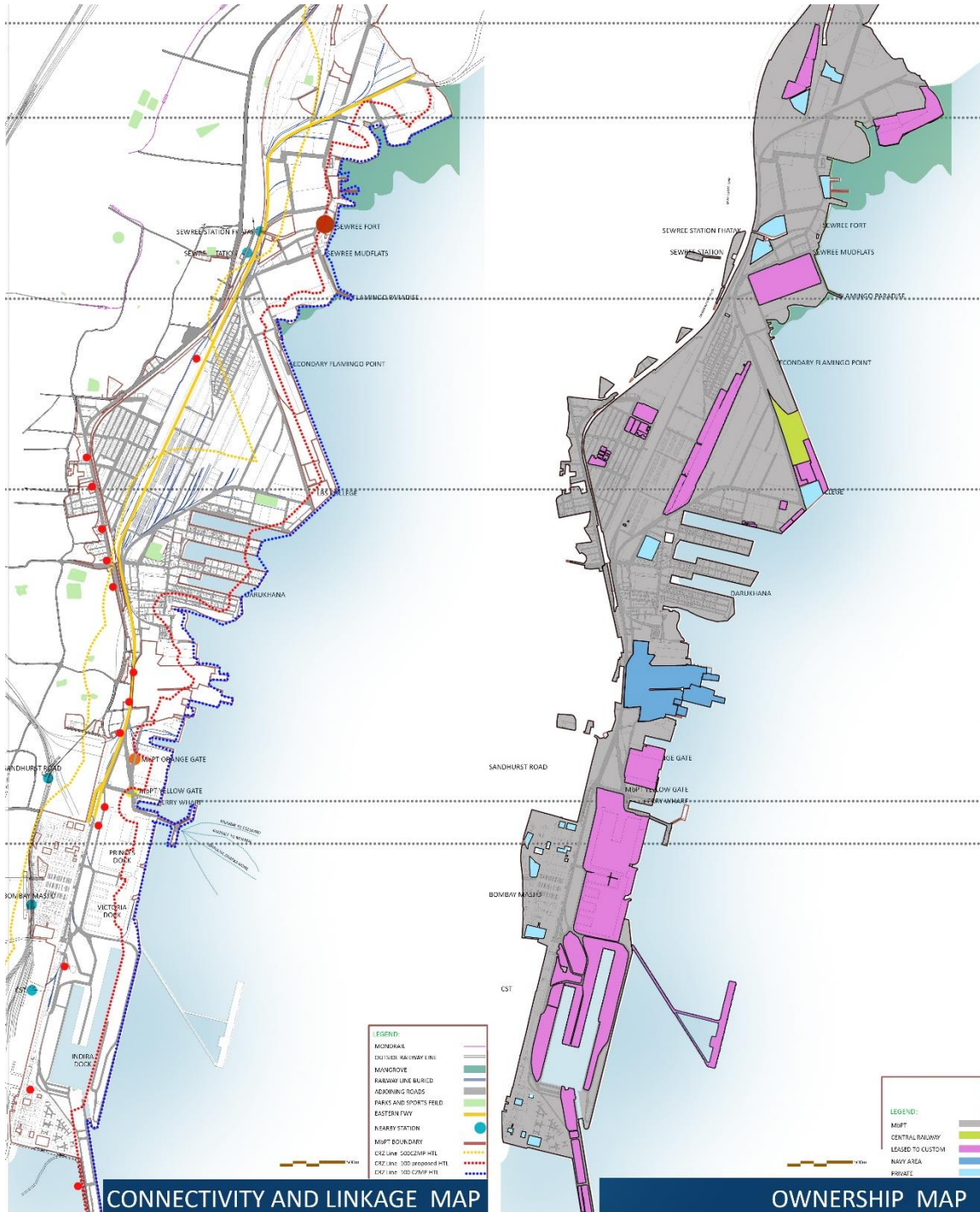


Figure 39 Linkage and ownership Map

There are mainly two linkages is prominent on the site one is from the sea side used by port activity and other are the gates marked in red dots are operated by port authority, not accessible for local public.

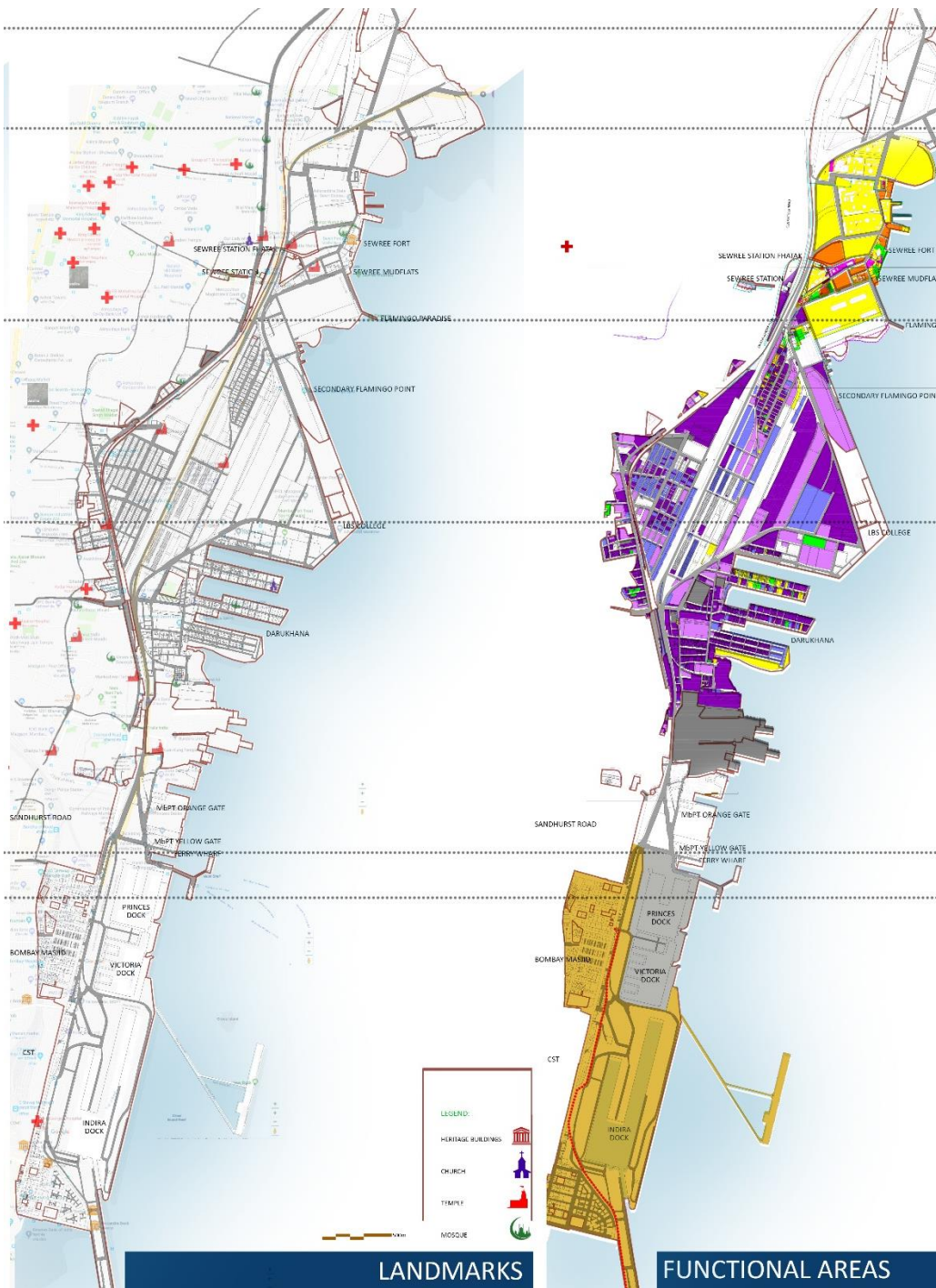


Figure 40 Land mark and Functional areas

Major landmark is on the land side but s such specific site which has historical value is only one i.e. Sewree for which is next to the mangrove.

5 ISSUE IDENTIFICATION

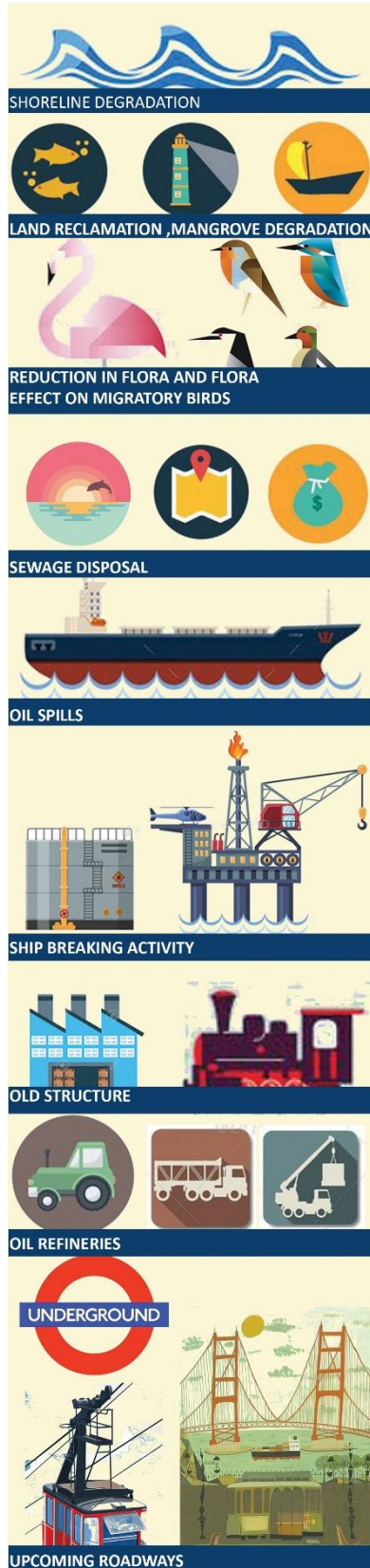


Figure 41 Graphical Representation of identified issues at the Site

Shoreline degradation

Construction of structure along to the waterline of the open sea coast as well as the creeks is multiplying rapidly.

Land reclamation

Existing shoreline is disturbed due to reclamation. Creation of new land is seen because of reclamation of shallow water bodies in mangrove.

Mangrove degradation

Excessive use of urban products and negligence of mangrove destroys the mangrove. All the factors enlisted are of major concern and directly and indirectly impacts the mangroves

Reduction in flora and flora

Recreational activities and excessive sound impacted the fauna of this region.

Effect on migratory birds

Migratory birds have changes its route to other ways because of the reduction of mangrove forest

Sewage disposal

City's outlet of sewage water directly coming to the sea hampers the sea water as well as the water pollution. Incriminate disposal of untreated water from the residents and slums residing nearby is the main reason of water pollution

Oil spills

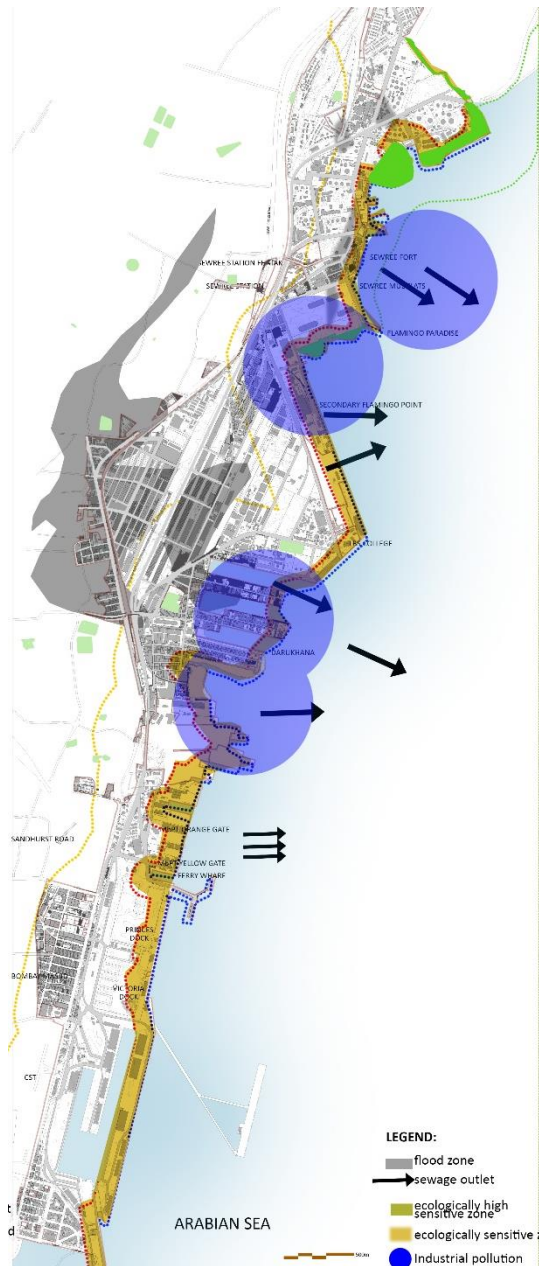
Ship breaking activity and oil spills effected the water quality of the sea.

Ship breaking activity, Old structure, Oil refineries

6 ANALYSIS

Site has potential to be developed into high potential area for the city.it can also be globally accessible. for understanding the site, it is necessary to study the site into multiple layers. Given three are the primary layer of study and the composite map is the over all analysis of development.

6.1 Ecological analysis



Ecological analysis required to identify the area which are ecologically sensitive in nature. The areas marked in blue circle are the influenced areas of sewer line. The black arrow is the sewer outlets. areas are demarcated based on the visual analysis and some of the data gathered from research institutes.

The site comes under CRZ 1, which means no construction activity will be done.

Based on these parameters. The city contour profile with high and low tide lines and geology is overlapped to get the sensitive areas.

The overlapping gives the soft areas inside the city as well as the edges. This has also given the strategic point of intervention and will also help in action plan.

6.2 Functional analysis



Figure 43 Composite Map

Composite map is made by overlapping the existing proposal on the site and the areas which can be developed primarily.

This is done based on land use, open space and linkage map.

The primary concern areas are shown in green. These areas are of high importance because as it has historical value and majorly abandoned site.

Development of this area will attract the use to the site and will help in understanding the nature of development.

Some of the area which are market in red cannot be developed as their lease is still not over or under the navel activity.

6.3 Spatial analysis

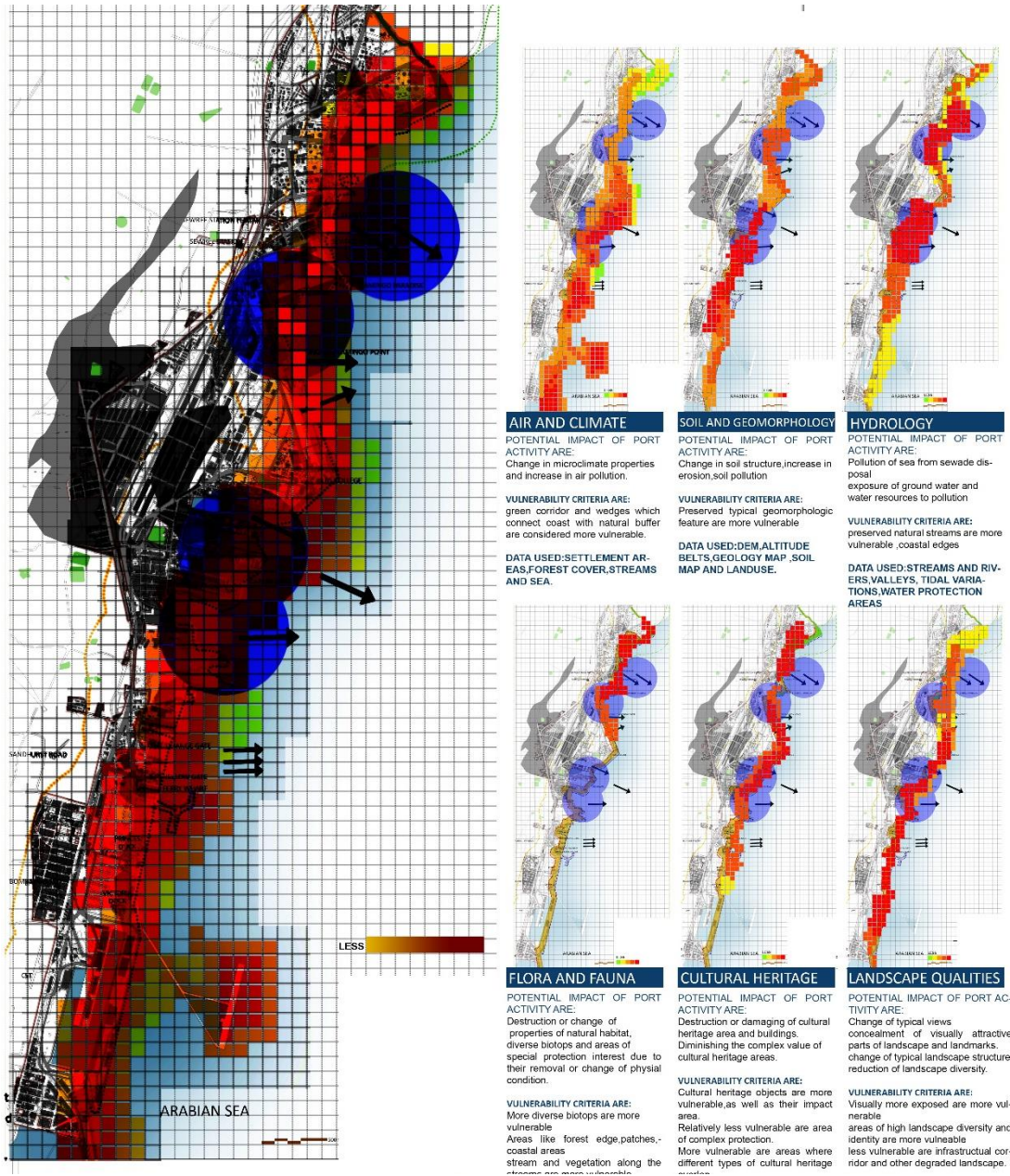


Figure 44 Vulnerability Map

this map is made based on giving one point to each zone. There are six zones-air and climate, soil and geomorphology, hydrology, flora and fauna, cultural heritage and landscape value.one point is given to each area which are affected by above parameters. These grids are made of 50X50M.

6.4 Intervention Areas

All the three layers is merged and identified the major intervention areas. The red market areas are no intervention areas, the top most part of the site is eco sensitive area can requires the developed approach of a landscape architect. The middle portion has industrial value and can be developed as industrial landscape and the lower part is the restricted one for the use of MbPT.



Figure 45 Intervention Map

7 DESIGN PROPOSAL

7.1 Landscape Design Programme

The proposed landscape scheme is envisioned a landscape script with different activities, turns, modes and experience permeate the thought and actions of the new shoreline for the city of Mumbai. This will give a new sense of belongingness which will connect to their past to present.

Different component in the proposal will treat the entire scheme in phases. Each scheme will resolve on issue and will also be connected to the innovative gift to the city.

As the city has its own character and identity but when it comes to history, we can easily say that it has lost their identity.

7.1.1 Zoning and Guidelines

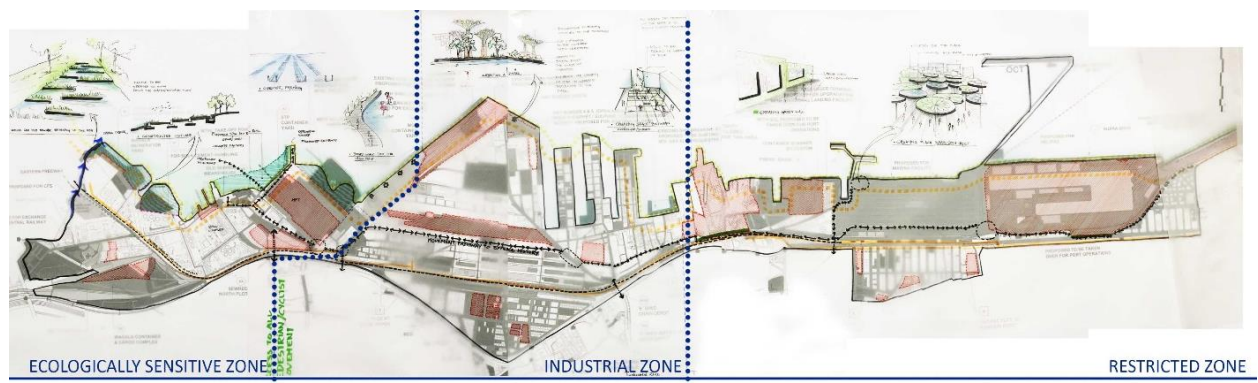


Figure 46 Proposed zoning Map of Site

The notion of the design of shoreline of Mumbai is inspired from the philosophy of ecological balance to bring out the inherent quality as the way of life for coast. The design quest is to articulate the expression of existing scenario to the landscape so as to follow contemporary character yet innovative in manner.

After merging all the ecological and functional layers of the landscape, concluding idea is shown in the image.

The proposal intends to the project is to portray the image of contemporary architecture of eco sensitive zone fused with the use of natural elements and spaces with the existing materials and elements.

The vast spread of industrial zone in the core of the site with the slopes and regional drainage defines the program with a strong zonal development planning towards the sea and partial development towards the core zone.

The requirement of the frontage for the connection to the shoreline will be punctuated with the plazas and road development.

The basic principles of visual connectivity are applied in a manner as to create a sense of space, directional of naturally occurring tidal variance and water elements.

After analysing the site of 14 km and understanding its character, concluding comments will be in the form zoning. There are basically three zones of development.

- I. Ecologically sensitive zone
- II. Industrial and abandoned zone
- III. Restricted zone

Ecologically sensitive zone



Figure 47 Proposed Eco sensitive Zone

The northern side of the port consists of creeks, mudflats, mangroves, saltpans and sewage disposal area. The current situation of this zone is in vulnerable condition. Site length is approx. 3km and coastline is 3.5km which consist of navel area.

The site consist of existing oil refineries and oil spills outlet to the sea. Narrow niches currently used as dumping ground and mangroves is currently in depleting stage because of the sewage disposal.

The proposal is based on catering these issues.

Issues 01-creeks connecting to the sea are going to be reclaimed and converted into concrete space.

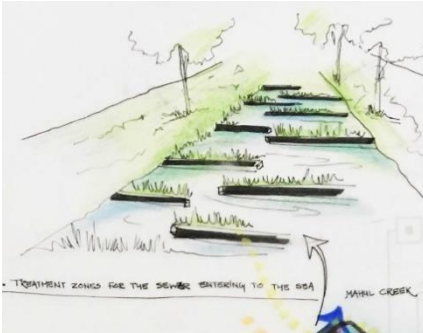


Figure 48 Sketch showing the water treatment through baffles

Those areas will be catered and restored as it contains natural drainage.

proposal is to retain those creeks and make a natural water treatment zone through baffles and reeds will solve this issue and the edges will be converted into

Issue 02-sewage disposal to the sea.there are three open drain connecting to the sea is creating a disturbance to the mangrove and also to the fauna.



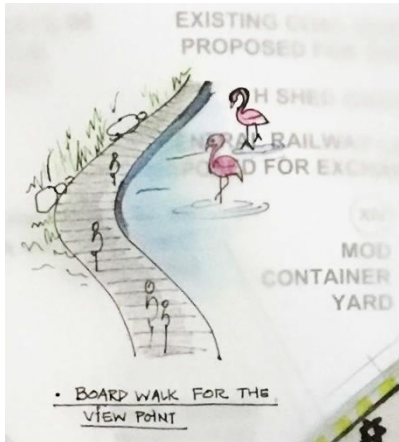
Figure 49 Sketch showing proposed stepped terraces

For resolving this issue constructed wetland will work better as it purifys the sewage water into stages and also improve the ecosystem.Constructed wtland will work verically.sewage water coming to the sea will be collected at one point and transferred vertically to the other

steps.each step will bedesigned with gabian wall.

Entire process must be visible to sunlight so that water treatment can be done throughly.for the tourism purpose and public movement to these area will be developed through projected terraces.

Issue 03-mangrove and flamingo point

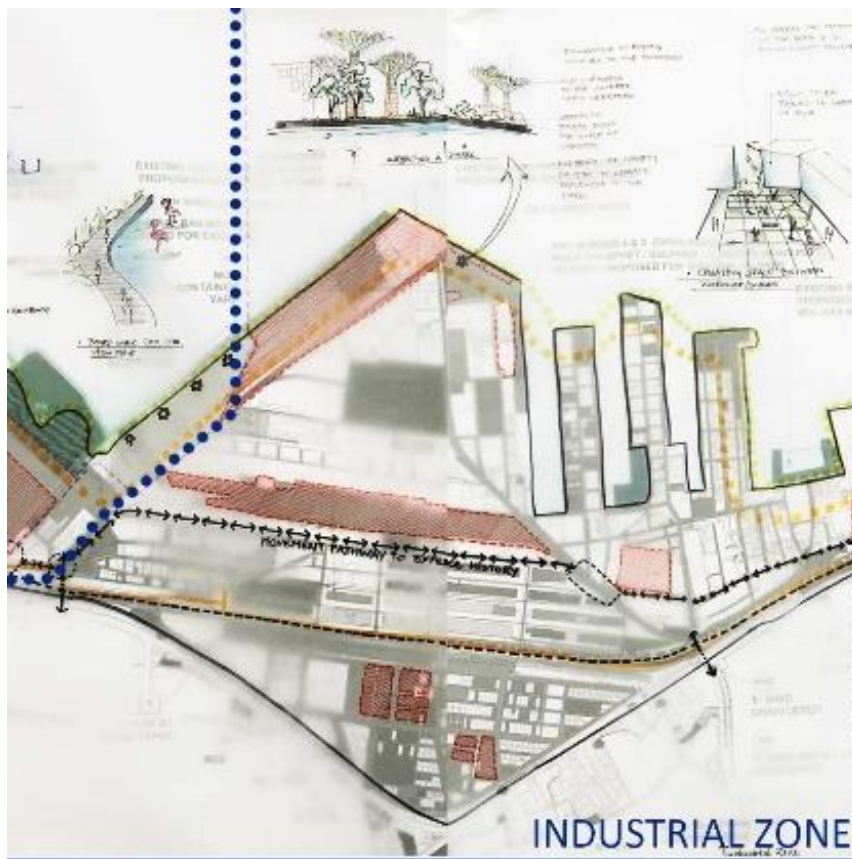


These are the two potential areas of attraction which will attract globally. These areas need to be developed so that one can see the internal features of the site.

Once a year these areas become the attraction point. The idea is to develop these areas and convert it into a high potential zone. As the site is ecologically sensitive and comes under CRZ 1A category, intervention should be minimal in nature and for attracting tourists, a flamingo point will be

accessed through dramatic walkways. This will create interest to the user and will benefit the ecosystem.

Industrially sensitive zone



The second zone is the industrial zone, having warehouses and old machineries and ships. There are also ship-breaking activities at these edges. These variations are historical in nature. One cannot find this kind of area throughout. There are also commercial activities coming to this area.

This site has so much potential that it carries the industrial variant edge

and to be developed as industrial park. There are many spaces which are lying in between these areas are not in use, can be developed as living museum.

The central road parallel to eastern freeway will be the primary access to the site. On both side of the road warehouses are in working stage. Those roads need to be developed and rest of the abandoned areas will be converted into living space with the help of trees and interactive design.

issue 01-abandoned industries.

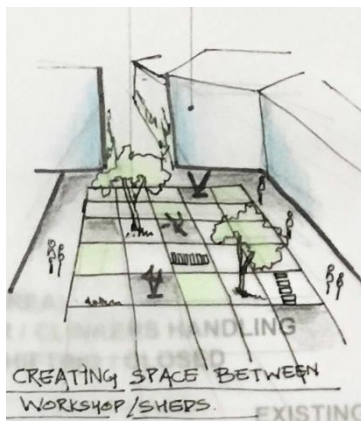


Site next to railway plot are in abandoned stage which need to be developed as major attraction point. Idea is to make the abandoned chimney and long pivotal structures interesting so that it can be visible

from far. this will interest people coming either from city or from the water site.

All those elements of these shapes will be treated with plants and creepers and for the balance in symmetry more trees and colour elements should be added. one of the important aspect of these elements in night that it will reflect light on the water which will also create interest to the people.

Issue 02. connecting roads and punctures between closed warehouses.

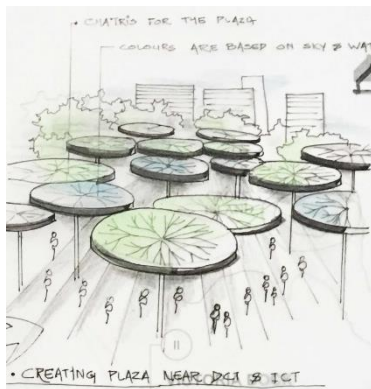


Areas of such types can invite nonsense activities and can be developed as illegal activity zone. For making these areas interesting, plazas should be created so that one can create activity over there. Some of the areas can be used for festive purpose over there.

Restricted zone

Southern side of the Mumbai port area are less development zone as these areas are under high security zones and currently shipping activity is in process. But the potential development of this area is because of the upcoming international and domestic cruise terminal.

There are some of the areas which can be developed are like the access points and junctions where public movement will happen. Those area will be developed by creating plazas and waiting space.



Idea is to create a space where one can walk as well as wait and can also complement with the surrounding structures. Small elements will be introduced like metal sculptures or old ship parts for the interest of people coming there for travelling.

Some of these ideas will be implement at the policy level. Due to restriction of time these zones are divided and as of landscape thesis, major emphasis will be on eco sensitive zone which will deal with the coastal ecology and mangroves.

Rest two areas can be developed as future scope of development. There is a hierarchy of development ideas has been developed. If anyone wants to work on this project can further develop the ideas and can create a long chain of movement of 14km.th=e initial proposal and ideas are given in image.

As of thesis am developing the ideas of ecological sensitive zone.

7.1.2 Concept development

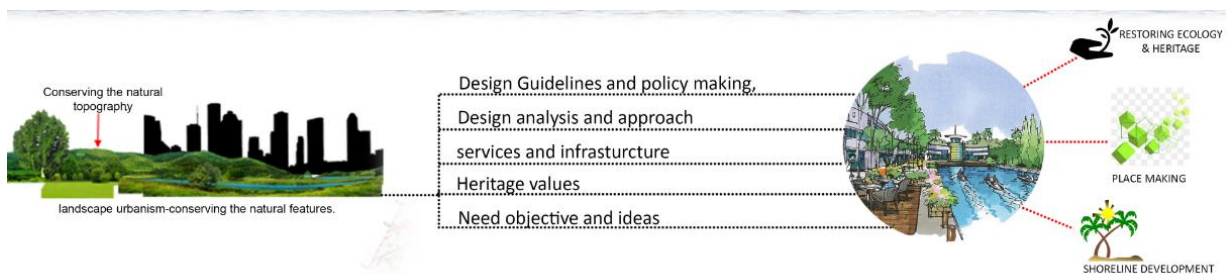
So, for the reconnect to the past,



Figure 50 Flamingos (Source: The Asian Age, 17th Dec 2017)

We, the people and birds of Mumbai, want to re-explore the integrity of the city, revisit the punctuated spaces that gives us breath to the living things. Reexplore the heritage of Sewree and their functional aspect to revitalize the nature. It's time to link the magnificent history of Mumbai in the creation of new shoreline to the city. Imagining a city more of ecological value rather than a concrete jungle.

From the history to the concrete jungle, a new idea a new thought a new identity to the city will be established. With this idea of developing the edge, different component will perform reminiscent of different eras to create a variety of experience with in the site. it will establish a meaningful, ecological and emotional connect to the space, a place that loses its current casualness.



This shoreline will engage the visitors and will give a soothing feeling from the city hustle. A model of knowledge will also be replicated to know about our nature and their attached traditional practices.

To comprehend one need to over a little ahead from the setting, after all this is how we all experience inside and outside.

- For establishing the goal, the entire concept is breakdown into three parameters based on site analysis
- Restoring the ecology; mudflats, mangroves and other ecological features to be restored
- Place making; giving a space a new identity and enhance the character of the space
- Efficient implementation; all the issue resolving factors to implement in such a manner that it gives a new sense of space.

7.1.3 Design Ideas

Developing the idea needs four phases of intervention are as follows;

Restore coastal ecology: rejuvenate and restore water bodies through sustainable eco engineering techniques linked with efficient watershed management. Check and eradicate invasive and undesirable vegetation species threatening the coast. Creates habitats for foster bio diversity

Improve access and linkage: make the sea and sea front accessible to the residents and other city dwellers and establish a symbiotic relationship between the sea and the communities. This would encourage the city and the stake holders to be active partners in conservation efforts.

Provide for recreation: provide active and passive recreating along the buffer by creating a green recreation corridor. Provide for socio cultural and leisure activities that can bring community together.

Create a unique protect identity: incorporate site elements such as signage and seating lighting decks and boardwalks etc through an integrated approach maintaining a constant design vocabulary.



Figure 51 images are to explain the design intent only

We speak, we look, we pass through spaces, perspective is revealed, corners turn, scale changes. The depth dimension is revealed, details can be explored, the urban tired soul are given a chance to resume their affair with nature to whom they truly belong.

7.2 Comprehensive Master Plan

7.2.1 Design Development and Proposed Landscape Scheme

The notion of design of the new shoreline for Mumbai city is inspired by the philosophy of ecological balance to bring an existing life to the of Mumbains. The design is to articulate the expression of landscape in a contemporary manner yet to be in innovative in manner.

Landscape is treated as-space Landscape is treated as a space – time field from which dramatic - and subtle - events emerge and have created different spaces based on the different theme in which human's ontological entanglement with landscape.

- Zone 01-naturally interactive ecology
- Zone 02-city a better environment
- Zone03-preserving the history
- Zone 04-where u can touch nature
- Zone 05-the contemporary history
- Zone 06-leaving the city's hustle bustle

Zone 01-naturally interactive ecology

Ecology restoration has increased new heights in modern era. The advent of new technologies has achieved new experiential levels. A virtual connect have taken the art of belonging ness to a new level. There is virtual connect to the nature is created everywhere with artificial rain, wind, light smell and touch. This is what we are trying to revive in its actual sense.

As we enter to the site we were welcomed by numerous the native trees near the open gallery of mangrove. These trees are already existing and some of them are preserved to understand the basics of mangrove.



These will add the dynamic effect to the area. This area will be dedicated fully to mangrove conservation and preservation techniques, with the leaves and smell of the space changing seasons to season.

The open space next to the inspirational gallery will be the demonstration area for mangrove conservation and techniques.

Each area will be accessed by people but only the areas which are highly sensitive will have limited access to the restoration department where they will work and protect the edge through mangrove species plantation.

People can see the transition of build environment and nature and the natural process will be implemented through design motifs. For the entrance and access the area will have stories of developed of mangroves through graphics and sculpture. There were pavilions which will face towards the grandness of mangrove species and the seasonal stream, which adds to the idea of physically experiencing the life cycle of the area.

This space is more of knowledge gaining area rather than recreational, but one can start their experience through this part. This area can be experience individually and with the sequence with all the shoreline.

Mangrove species to be planted are *Avicennia marina*, *Rhizophora*, *sonnaratia* etc to be planted.

Zone 02-city a better environment

this area is more of self-healing urban decays.one does not want to see the areas as existing but after the design it will have their aesthetical value with the self-sustained ecosystem. This area will have terraced wetland which will purify the sewage water.in the initial areas there were sunken ponds where the water will be collect will be the restricted

Rejuvenation of Urban Open Space in Historical Precinct-The Portland for living Mumbai.

zone. The secondary zone from where the terraced wetland will be started can be seen through projected decks will deficiently create interest to the public. This area will be accessed through the mangrove zones through boardwalks inside the mangroves and through boats from the water. This space will be visually knowledge enriching space. in this part of space one can enjoy the sunken courts and celebrate the calmness of the city.



The focal point of the space will be the projecting deck which will give directions to see the dramatic music of water and bird to the space. The open space will be used for activities like traditional gathering where one can see the ideology of kolis people.

Though the space is designed in semi ecological space with more of bio engineering techniques, the projecting deck adapt itself in every aspect to social interaction around and within it. the decks is enlivened with lotus pons and flowering trees and the narrow pathways created over the bunds will create interest to the people coming to this place, especially the young people.

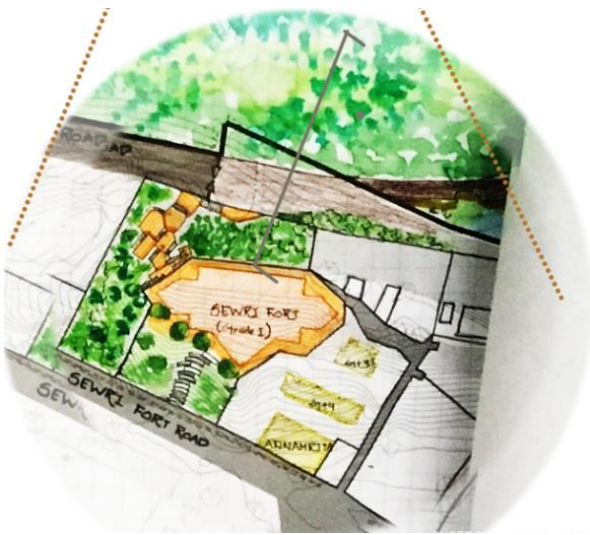


This space will also help in creating a series of visual sequences into the realm of involvement of space and activities. The traditional activities will enhance the quality of space and help one to relate with the intrude of gabion walls that enhance the quality of space and help them to realty with the forgotten experience of the past. Flexibility in space and freedom of

movement contribute to the movement of the user.

Zone03-preserving the history

a structure remains standing and carrying a history of more than 500 yr. will be preserved by the conservation department. The surrounding areas will be accessed by the local people. Activity like creating a viewing points, birds hide will be proposed as this site is at the highest point of the site. Earlier this point was used to monitor the port activity. Similarly, with the same ideology the site will be used for the viewing purpose and there will be a connection directly to the sea promenade. There are steps viewing out from the slope and that slope will be stabilized by the plants species selected.



The primary connection to this site will be from the sewree fort road. And on the back of the form rip rap edge will be created to interest the user.

Plant species like *Boswellia serrata*, *dalbergia sissoo*, *prosopis specigera* for 20% slope

Species like *Boswellia serrata*, *albizzia odoratissima*, *dalbergia sissoo* for 10-20% slope

Species like *tribulus terrestris*, *heteropogon contortus*, *ruellia tuberosa* for 5-10% slope

Zone 04-where u can touch nature

The shade of green and blue is intended to a punctuation, calm and quite place around mangroves and a gateway to the nature has been designed as a focal point in existing flamingo point. The visitor who walks down for the flamingo point, suddenly encounters the gateway to the nature through a small pathway, to a deuce mangrove forest and sudden element of surprise to the vast sea with a sharp view of flamingos coming to that place seasonally.



In addition to the build site explains the transition of blue and green zone, the history of the traditional cultures and the intention of the artistic design of the nature.

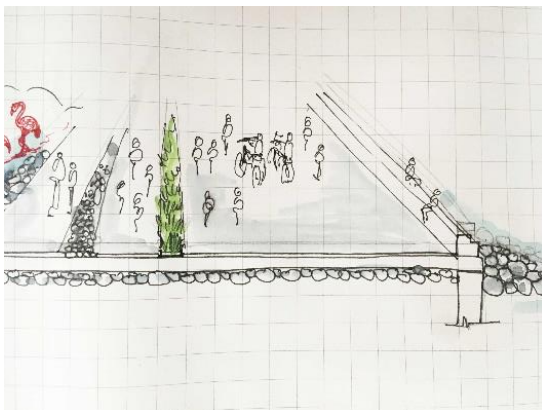
This area includes mangrove maize boardwalk, elements of surprise from the nature, and a framed structure.

It will establish a meaningful, emotional place that loses its current casualness.

This zone is very much blend to the idea behind it providing the openness and closeness with the forest and the shade of blue one will experience through the greenstick makes the space ore elegant; brings us to the lap of nature and a meaning full space.

Zone 05-the contemporary history

As a part of the transitional phase, the nature and the biodiversity, certain areas of nature's landscape have been left undisturbed and protected as a part of the design. The sound of water hitting the stone and spelches touching the feet of the people will give soothing feeling. The access to these areas will constitute the existing pathways which are designed as a buffer from the city and sea. The use of plants will reduce the monotony of the space. Heighted walls will be reduced with the design of plants and existing trees.



These walkways will act as a segment of landscape containing trees and other forms of life and geographical feature, that are delimited and protected within the roads believing that preserving a patch of vegetation in a relatively undisturbed state is necessary for the expressing one relation to the divine of nature. Hence the remain isolated paths will also be

created by activities and services.

Activities which require tranquil seeing like practices, some musical activity, are proposed in this zone.

The overall idea will be the siting of these areas of calmness and in direct contact with nature.

Zone 6-leaving the city hustle bustle

When u enter the space, one should get the feeling to closeness to nature and with this idea, we tried to enhance the roads with the suggestive sections. There are mainly three types of road which are connecting to the space will be designed in such a way that it follows to the nature and the sea.

Road with 30m of wall to wall space will have direct connection to the shoreline. Small pavilions and seating areas are provided along with the natural trails and pollinator pathways. All the services will be providing in the proximity of 200m from the propose shoreline in the zone. vehicular access will be stopped in in the proximity zone only routes to the emergency access will be allowed and will have full carriage way. parking facility will also be provided along the road stretch and punctuation and pause point will also be creating to enhance the interest of the user.

Vegetation and structure: the vegetation in the proposed area exhibits a large variety of flora which will attract fauna that depend on one another for this existence, the vegetation comprises of several storey of trees along with shrubs, herbs and ground cover.

7.2.2 Master Plan



the development of site will have three phases. The first phase will be conservation stage in which the coastal edge and the mangrove will be restored with a parallel work of cleaning the edge.

There is one more long-term process of purifying the water from contaminants and plantation of trees at the edges will be of primary concern.

The areas which has sewer outlets will be treated first s they are the major water effecting element. The primary process will the the vertical flow contracted wetland which will collect the water and purify it with water plants and reeds.

One of the important aspect will be the public interaction will be possible only if guidelines mentioned to be followed. The entire site will be accessed by public in fully o partial manner depending upon place to place.

Areas which my primary concern will be the mangroves and public involvement. this will be done by the mangrove maize.

The lower area where the maximum amount of industries are present will have manicured landscape as the city need a space where they can sea the nature and city skyline both.

7.3 Design Strategies

the design strategies. as the initial level of intervention including the guidelines of development that will help in developing the site.

Strategies will be formulated in five primary layers that will help in making the comprehensive plan. The layers are as follows:

- I. Mangrove restoration and public involvement
- II. Water resource management
- III. Coastal shoreline management-edge treatment
- IV. Culture and heritage management
- V. Circulation network

These layers will be discussed in detail with guidelines/policy/principles.

7.3.1 Mangrove Restoration and public involvement

Mumbai mangrove is one of the largest evergreen forest with a gradual slope of mudflats.it also spreader in the intertidal zone of bays and creeks providing a rich ecosystem to the surrounding. They consist of various types of flora and fauna and biotic feature and their interaction.

Mangroves of Mumbai is under massive destruction and there are decline in the density in last few years. The main reason for this loss reclamation of land either for construction, dumping of oil refineries or land for paddy cultivation.

the site which is dealt in this thesis comes under the CRZ 1 category.Mumbai mangroves has gone through many deforestations leads to erosion as Mumbai city has mostly reclaimed land.so suggestive measure for stop the erosion and balance the sea level is to protect the mangrove.

One of the important feature of the site that as it comes under the Mumbai port authority.

7.3.1.1 Identifies issues related to Mangrove



Figure 52 View of mangrove from Sewree Fort

Mumbai mangrove is in a degrading stage because of the current activity. Edges are disturbed due to sewage disposal and industrial dumping forced the reduction of its numbers. There are certain species which are predominant and helping in maintaining the eco balance and continuously disturb.



Figure 53 View of Mangrove from Flamingo Point

Rapid construction for commercialization and tourism purpose introduced commercial projects and reclamation. This has decreased the no. of mangroves and edges are destroyed with modern materials.

7.3.1.2 Proposed strategies for Mangrove revitalization

It is a three layer of intervention in which the mangrove zone which start with creek will have different characteristic as compared with the downward.

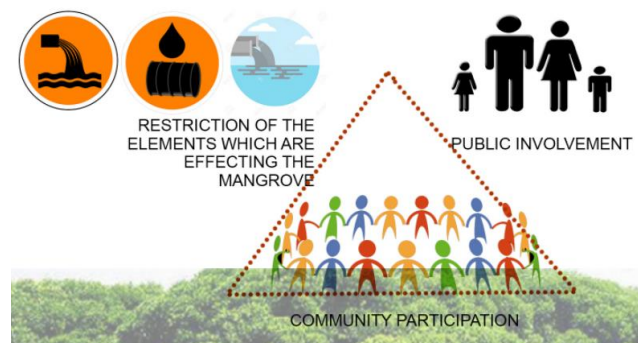


Figure 54 Graphical representation of mangrove restoration.

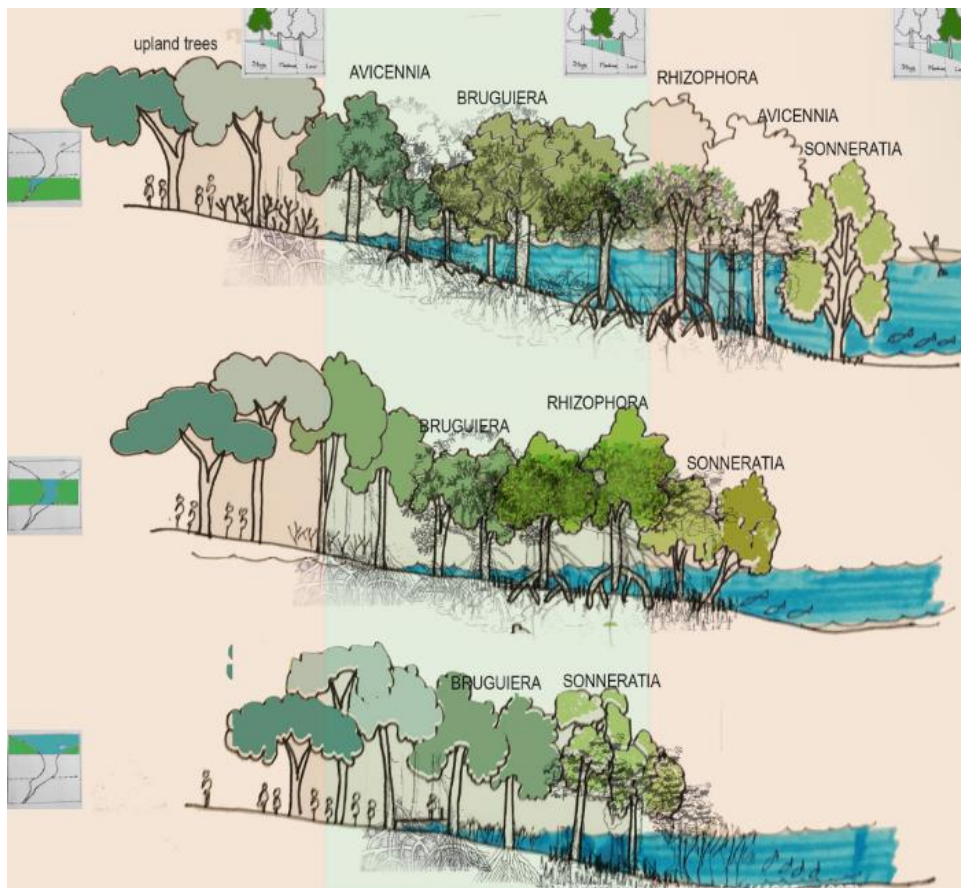
The proposal for interaction with mangrove will consist in following steps

Public participation

Public involvement will consist of involvement of kolis through shrimp farming. kolis are the people who are linked with this land. The strategy will include the involvement of kolis people through involvement in mangrove nursery development. This will help in increasing coastal habitat and will increase economic benefit through ecotourism.

Restriction of activities which are affecting mangroves

Based on above two the proposal will articulate the protection of mangrove from the effect of oil refineries and then the public involvement to the site. Restoration programme to restore the natural hydrology pattern that will include volunteers for the propagation of the plants. Use of existing plant saplings, collect seedlings, rate of stabilisation, growth of sapling will be the primary concern.



The entire process is done into three levels. All the levels are accessed by public but with restriction. On the upwards phase public involvement will be with knowledge gaining or sampling activity. On the second phase where the slope is quite less will be accessed by board walk and on the lower area through boards. they are critical zones of estuaries where all creek water meets the sea water.

7.3.1.3 *Guideline for mangrove revitalization*

- Many important initiatives have got underway in Coast line of India in the last decade to address integrated management of marine and coastal resources and to ensure the protection and sustainability of the environment.
- The establishment of Marine Protected Areas to conserve marine biodiversity should been an important measure towards sustainable management.
- CRZ should been proactive in the adoption of an ecosystem approach to management, including consideration of a broad range of economic, social and cultural aspirations.

7.3.2 Water resource management

7.3.2.1 *Identifies issues related to Sea*



Figure 55 City sewer outlet to the Mangrove

direct flow of sewage water to the sea has disturbed the ecology and the water also. The surrounding areas are also affected due to direct inflow of oil and other impurities.



Figure 56 Public plastic disposal and ruined ship at the coastal edge.

Old unusable ships are placed at the sea edge and disturbing the water with the waste and metal extracts. Plastics and other dumps thrown by public has developed the site into miserable space.

7.3.2.2 Proposed strategies for water management **Eco filtration through baffles**

At the higher levels sedimentation ponds will be prepared for the pollutant water. Sediments will be collected and extracted manually. Water will be followed to the sea through narrow creeks. Narrow creeks will have baffles which will increase the flow of water .through reeds water will be purified.

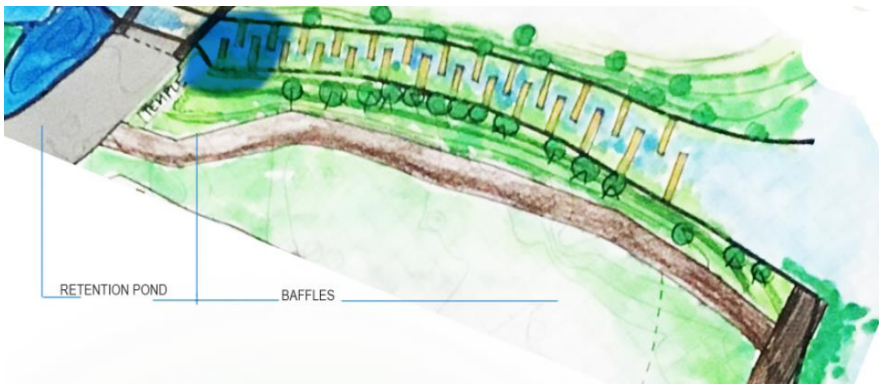


Figure 57 Water purification through baffles.

Terraced constructed wetland

Constructed wetland system can be described as the ecosystem enhancer as they purify water and filter pollutants that connects to the sea. This can also be called as the bio filters. through this process one of the idea is to purify sewage water connection to the Arabian sea in Mumbai.

These bio-filtration systems will rely on vegetation to hold the soil, filter contaminants, absorb nutrients, intercept and transpire water, and support healthy and diverse soil biology.

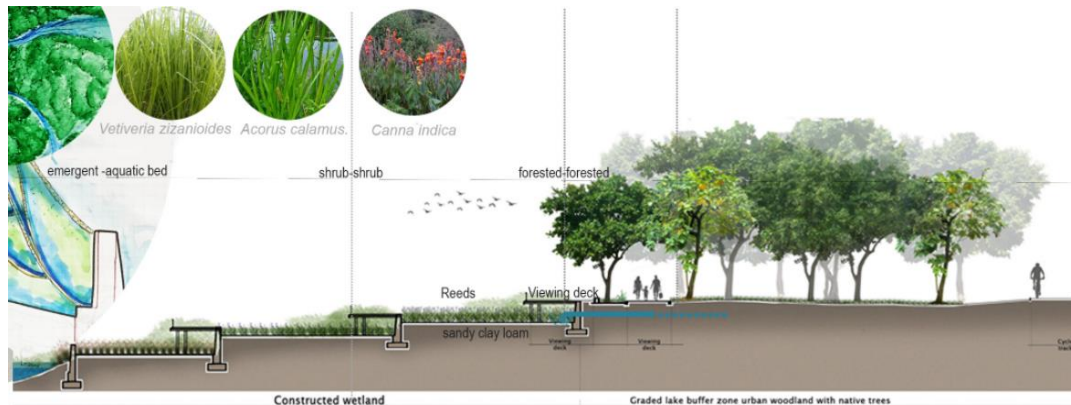


Figure 58 Schematic section showing vertical flow constructed wetland

The proposal will start with solving the current issue of drainage connected to the sea through pipes which are directly impacting the sea. There are two major pipelines which are coming next to the MPT road and small creek. These two edges and the centre of the road is comprised mangrove in front and the drainage is impacting the mangroves. The main aim is to create a new shoreline for the city needs public involvement to this area. This leads to design a space which allows public activity as well as the water treatment system. Rather than build a bund to prevent flooding, these eco-terraces serve as sedimentation and holding ponds, cleaning and filtering water before it reaches the lake. Several native plants have been found effective in acting as bio-filters such as Canna indica, Vetiveria zizanioides, Acorus calamus.

7.3.2.3 Guideline for water resource management

- Monitor discharges from industry and wastewater plants, to ensure that nutrients and other pollutants are maintained at acceptable levels.
- Retain any existing areas of wetland and saltmarsh in an undisturbed condition. Often the best management practice is to 'leave alone'. Establish buffer zones around saltmarsh and wetland areas of at least 200m, to protect against influx of nutrients and pollutants.
- Avoid building drains or levees that alter drainage patterns, direct fluids and waste into wetland or saltmarsh areas.

7.3.3 Coastal shoreline management-edge treatment

Coastal edges are the most critical part of restoring the ecology. This is the transition zone where all the major ecosystem happens. Currently the site has concrete edge which has almost disturbed the entire ecology. Initiative is to conserve the ecology by treating the existing edge which will help to revive the system as well as promoting the public interest.

7.3.3.1 Identifies issues related to existing coast



Figure 59 Coastal edge with Palm and temporary structure

existing coastal; edge is used by MbPT for old shops or for safeguarding. There are temporary structure are made for monitoring.



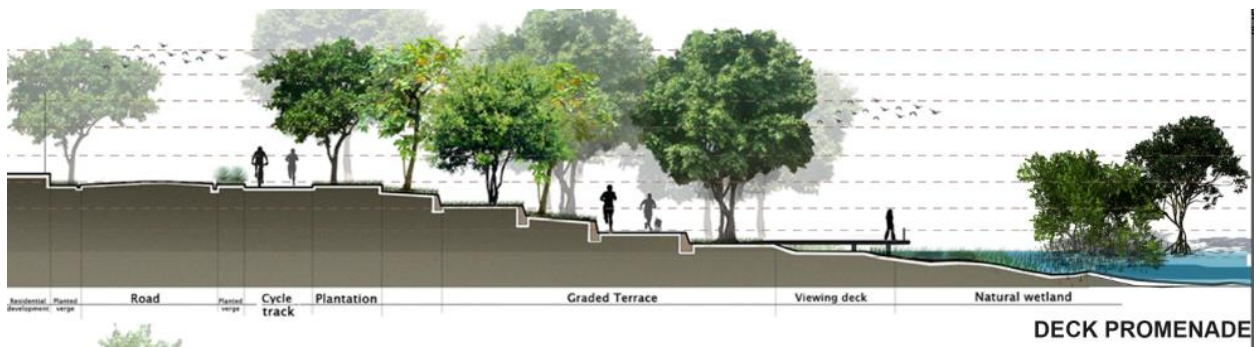
Figure 60 Coastal edge at Flamingo Point

Concrete retaining wall made at the edge and edges are used for dumping ground.

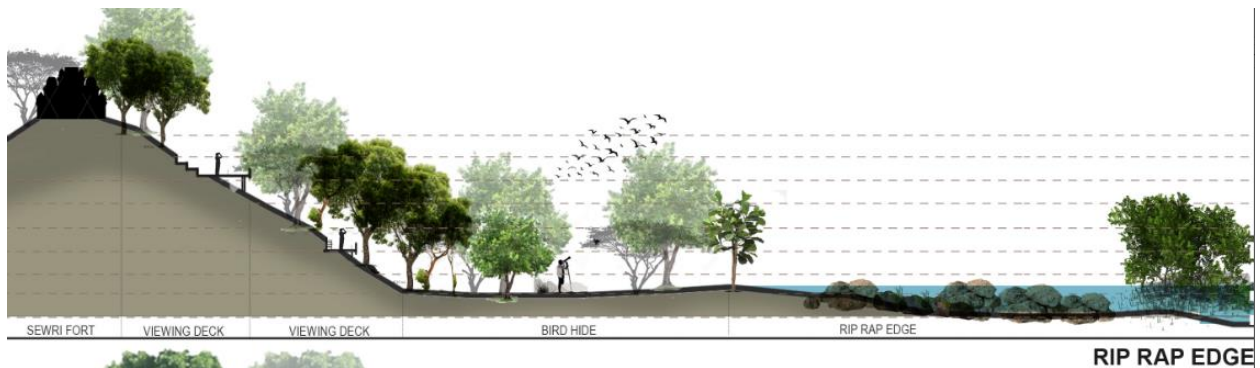
7.3.3.2 Proposed strategies for edge treatment



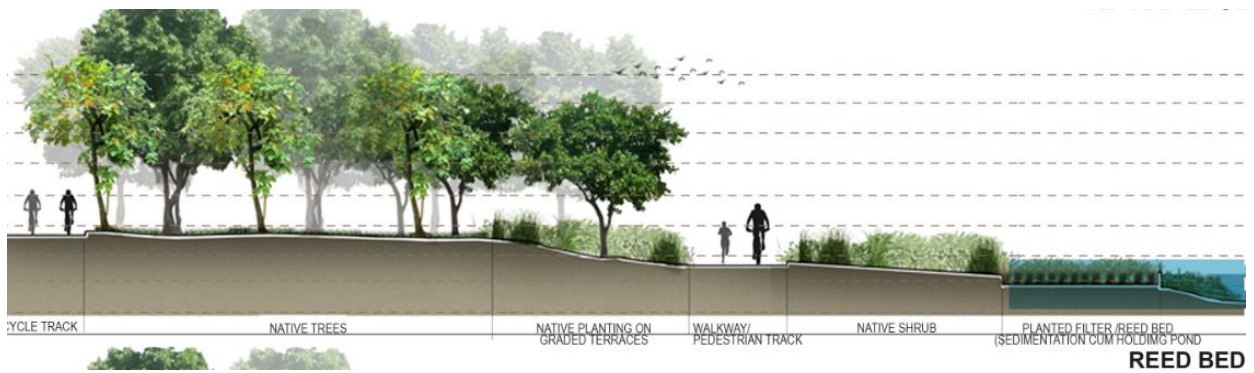
Retained natural edge-mangrove restoration and implementation of species which will help in enhancing the coastal edge and will also purify the water. Species introduced will be selected based on bio remediation plants.



Deck Promenade-Gradual edges will be converted into terraces and for public activity. Through decks public will view the water and other activities.



Rip Rap Edges: The edges next to the Sewree fort will be accessible for public. The sloping terrain will be stabilized with selected plant species and small terraces will be made to retain the actual use of Sewree fort. The lower are is mainly for bird hide. There are lots of migratory bird coming to the site, will be explored by this maize. The edge will have big stones that will help people to explore in the water in the low tide.



Reed Bed: This type of edges will be made where one can visually interact with water without physical disturbance. Walking or cycling walkway will be made near the water. The lower part the reed plants will be made so that soil will be retained and help to protect the edges.



Rocky Shore-interesting and manicured landscape for the public interest. From ecology to industrial edge. Promenade for public interest will be developed with sitting platform which will create buffer and big boulder will slow down the water movement at edge.

7.3.3.3 Guidelines for edge Treatment

- All the sea edges should be retained as per mangrove conservation plan and no public activity is allowed on the mangrove edge.
- Existing trees will be retained in any condition.

No plantation is allowed near to the Sewree fort as it can damage the fort foundation.

7.3.4 Culture and heritage management

7.3.4.1 Identifies issues related to Sewree fort

One of the important site which has historical value and meant for specific activity will carry the importance of the history. Currently the site is not explored by the local people because of the existing scenario, this site come under grade 1 structure and we cannot disturb this with out the permission of state archaeological government.

So the proposal will be based on conserving the site as well as retaining the site and surrounding.



Figure 61 Visually nit accessible from primary road

the front façade of screwed fort if covered by multiple other buildings. Some of the buildings are legal but many are illegal as surveyed.



Figure 62 Ruins of Sewree fort

Sewree fort is in extremely bad situation.no one can access the building. Walls are falling. Some of the structure has already abandoned by the archaeological department. Developing this area requires permissible activities.

7.3.4.2 Proposed strategies for Sewree fort development



The fort edge will be developed in terms of terraces and vertical landscape. This will help in maintain the balance with slope and fort.

Figure 63 Schematic section of development near fort

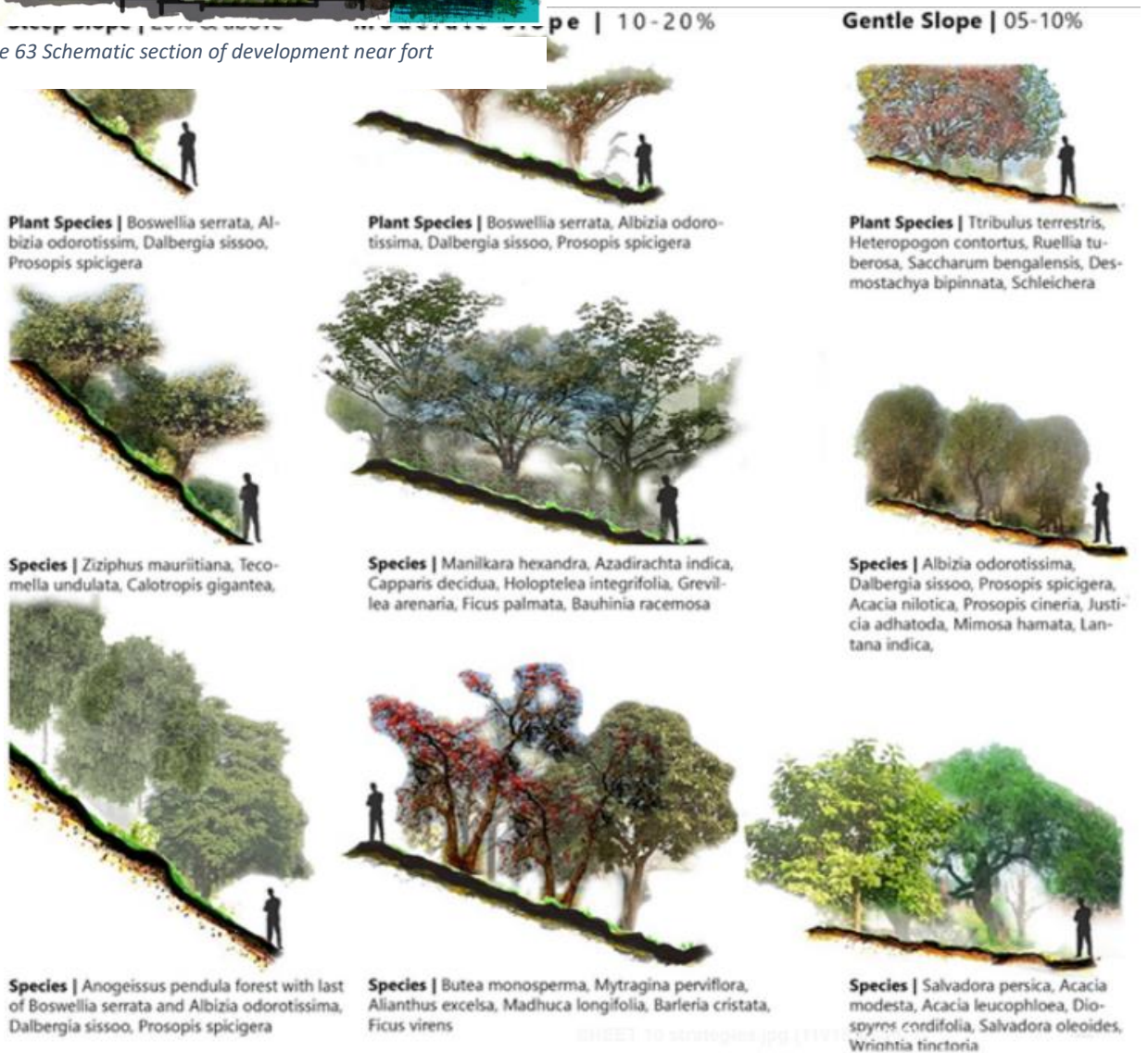


Figure 64 Tree plantation scheme

7.3.4.3 Guidelines for Sewree fort development

- Improve storm water outfalls. Wherever possible provide vegetated swales or treatment trains and minimise pipes on the beach. Ensure that saltmarsh communities are valued for their uniqueness and the role they play in our coastal ecosystem.
- Monitoring of saltmarsh is essential to determine the current health of saltmarsh communities and to ensure that land managers and specialists are alerted to any changes or degradation.

7.3.5 Circulation network

Creation of shoreline is a new aspect to the city but providing a linkage is much more important. Sometimes it needed to control the access to protect the coastal edge and public safety.it is important to design pathways leading to sea with create interest to user and give an identity to the place. Design will include proper planning construction and management.

Existing site has two types of road one which connects the city to the ocean i.e. Sewree bunder road, Messant road and Coaltex road, each having a width of 20m from wall to wall will be developed as the primary connection to the city with the green linkage. the secondary road runs parallel to the sea i.e. the Sewri fort road, which changes its width from 20m to 10m from end to end. This road is the main spine of the site which carries multiple character of the area.it has ecological value as it carries banyan and peepal on both the sides and the heritage structure “the Sewri fort” is connected to it.

One of the road which can be called as tertiary road doesn't comes under port authority but can be developed in the same pattern as the primary road.

7.3.5.1 Identifies Issues related connectivity to the site



Figure 65 Existing Messant Road

site is connected through majorly three roadways. Each roadway is used by oil refinery people. road edge is used by either truck parking or small shops. Access to the site is not very welcoming. Local people never used to come to this site because of the current scenario.



Figure 66 Existing Coaltex Road

Exiting rod has a potential of development in both the ways, as it carries a connection to the site as well as it gives a wonderful view of Mumbai skyline.

7.3.5.2 Proposed Strategies for connecting people to the site

The idea started with connecting the city with the road linkage through green corridor. The entire idea will be followed throughout the road and each road will have its specific assets. For making the streets more interactive the idea id subdivided into six sections dealing with the water management throughout the road, the second type is to create activity on the road edge as these are the primary connection to the sea, third accessibility, fourth is the economy generation through these roadways or walkways ,fifth is the road should tell the story of the area as the site has historical importance like the road connecting to the Sewree fort will have colonial wall of 17th century and the last one is the involvement of the community to this area is much needed.

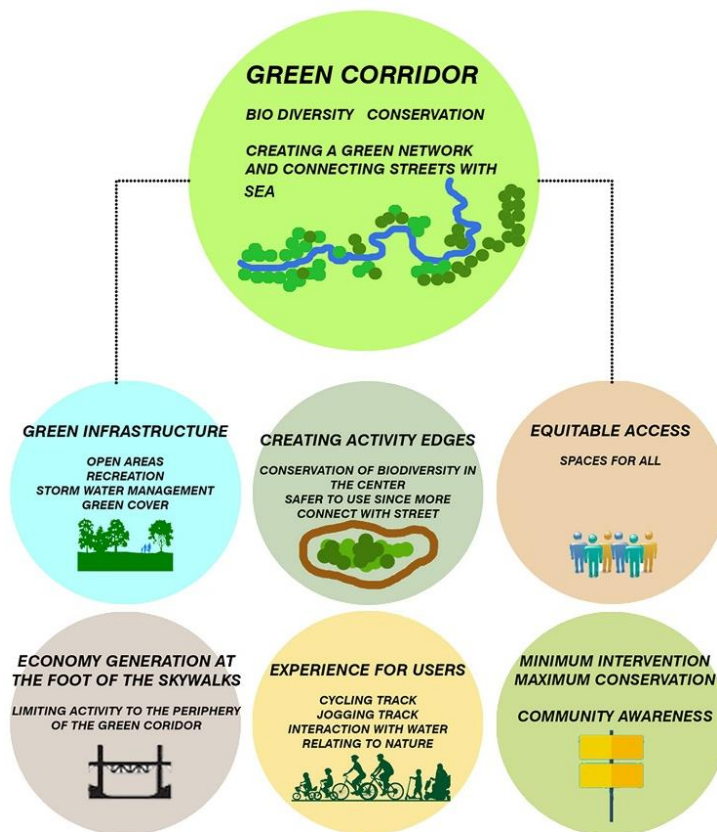


This section of Mumbai shows the clear image of green connection of the city to the sea. The city green level is very less, and the edge has full of green environment.

For developing of the site, the necessary parameters are taken into consideration and the primary road is designed according to the new activity.



the thought was to make these roads user and pedestrian friendly with adequate green strips to make these into prototypes for reducing the carbon stress on the city.



Given flow diagram is to show how the entire process will work. On the broader level, worked on the green corridor connection and the second level shows the work process to integrate with user.

One of the important consideration is the construction method near the shoreline. Inappropriate construction can lead to damage of the ecological heritage as well as increases the maintenance. The coastal space attracts the user and in self it has

diverse range of values and uses. Planning of this area also consist of the parking which need to be accommodated in the design. the site is designed that it has parking facility as well as multipurpose activity.

7.3.5.3 Guideline for circulation network

- All the vehicles are permitted before the buffer line of 500m from the shore line. For accessibility use of electric rickshaw is permitted.
- Existing trees will be retained in any condition, if it comes under the carriage way then only that trees will be relocated.
- All the road will be designed in consideration with the storm water management.

8 BIBLIOGRAPHY

- P.Parthsarthy, S. R. (2012). ECOSYSTEM VALUE OF MANGROVE ECOSYSTEM OF GUJRAT,INDIA AND ITS SOCIO ECONOMIC IMPLICATION. Chapter 13.
- Shannon, J. G. (2009). *RECLAIMING MUMBAI*. Sun Architecture.
- TURNER, T. (n.d.). *Graden design and landscape architecture*.
- Chang, S.E., Adams, B.J., Alder, J., Berke, P.R., Chuenpagdee, R., Ghosh, S. & C Wabnitz. (in press). Coastal ecosystems and tsunami protection. Report to the National Science Foundation of the USA
- Shannon Development (2001). Shannon Estuary: Proposal for an Integrated Coastal Zone Management Strategy. Inception Report.
- Short, A. (2002). Australian Approaches to Coastal Management: Keynote Address. New Zealand Coastal Society Conference, 2002
- Clark, J.R.1992. Integrated management of coastal zones. FAO Fisheries Technical Paper No. 327. Rome, FAO. 167 pp.
- Coastal CRC.2006. Cooperative research centre for coastal zone, estuary and waterway management. Local Government Authority Information Factsheets, Australia.
<http://www.coastal.crc.org.au/lg/index.html>
- CZAP.2002. Improving the state of the coastal areas. In:Coastal zone Asia Pacificconference, Bangkok, Thailand, 11–17 May.
- Thailand Coastal Development Institute. Dahdouh-Guebas, F., Jayatissa, L.P., Di Nitto, D., Bosire, J.O., Lo Seen, D. & N. Koedam.
- Jeppesen, G. 2004. Overview of the integrated coastal zone management (ICZM) project. Sabah, Malaysia, DANCED ICZM project.
- Kay, R.C. & J. Alder, J.2005. Coastal planning and management.London, E&F Spon. 380 pp. 250 Khazai, B., Franco, G., Ingram, J.C., Rumbaitis del Rio, C., Dias, P., Dissanayake, R., Chandratilake, R. & S.J. Kanna.2006.

Referred Books

- Mumba to Mumbai, The Indian express group, Mumbai, edited by Pauline Rohatgi, Pheroza Godrej, Rahul Mehrotra, **Originally published:** 1997
- Mumbai 100 years ago, <http://sistercities.lacity.org/Events/MumbaiMasala/Bombay100yearsago-kit1.pdf>
- The Port of Bombay
- Bombay to mumbai,changing perspective
- The Bombay Dockyard and the Wadia Master Builders,[Ardeshir Ruttonji Wadia](#), 1957

9 ANNEXURE