

# Development of waterfront, public spaces with Mangala Corniche

Using Town Planning Scheme concept for Mangaluru Smart City

## **WATERFRONT PROMENADE DEVELOPMENT**

### **Volume I**

Detailed Project Report for Waterfront Promenade Development  
Mangaluru Smart City Limited | August 2021

# MANGALA - URU

## A post-work city

Vision to enhance the happiness quotient of people by reclaiming the city's water edge and embracing its natural and cultural heritage

Submitted by:

Sign:

Place:

Date:



## Executive Summary

The Detailed Project Report for Waterfront Promenade Development extensively covers ground on the project background, design basis, design details, socio economic impact, development proposal, development model, technical feasibility and financial feasibility for the proposed Promenade, situated in the southern part of Mangalore city of Karnataka.

Chapter One "Introduction" comprises of three parts, in which the first part gives an insight into the overall project background and roles of the consultants involved, along with project scope, methodology and limitations. The second part of the chapter details out the regional setting of the project and comprises of studies pertaining to the city culture and background, geographical factors such as topography, hydrology, surface vegetation and regional faunal characteristic. The study of existing regional context helped in formulating the vision and strategy plan for the project which in turns forms the basis for identifying the various subprojects within the region. The chapter includes various related case studies of the proposed promenade and also explores the viability of the same within the existing city network and landuse setting. The third part of the chapter comprises of socio impact assessment of the proposed promenade and site condition analysis in the existing local context.

Chapter two "Development Proposal" comprises of site area details, phasing, proposed development programs, development regulations, design intent, conceptual illustrations and design impressions.

Chapter three "Development Models" explores various options for project partnership and operation, via convergences, funding from existing development schemes and various probable public private partnership opportunities.

Chapter four "Technical Feasibility" consists of MEP design basis which comprises of detailed calculations for services such as the public health engineering, fire protection and detection system, electrical system and security systems.

Chapter five "Financial Feasibility" details out the financial model for the overall development of the project that includes project development cost based on the various operational components, capital contribution and debt funding, costs for operation and maintenance, options for revenue generation, probable profit and loss statements for the upcoming years, cash flow, financial indicators and sensitivity analyses.

Chapter six "Project Schedule" broadly illuminates the overall time frame for the construction and development of the project.

Chapter seven "Conclusion" summarizes the detailed project report with key takeaways and the consequential benefits of the proposed project.

Chapter eight "Action Plan" proposes the way forward for the overall city development and the proposed promenade.

Lastly "Annexure" comprises of all supporting data to the detailed project report, in terms of architectural drawings, structural drawings, MEP drawings, signange location plan, master plan document, proposed master plan, soil report, structural analyses and design basis report.

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01

INTRODUCTION



# i. Background

## Smart Cities Mission

Government of India has launched the Smart city mission in the year 2015 to promote sustainable and inclusive cities that provide the opportunity for rapid growth as well as enabling a digital escalation for all the sectors of infrastructure and governance.

The mission enables the redevelopment of urban areas, waterfront development, housing and infrastructure development, intelligent traffic management, and public transport thus generating various growth opportunities for the city.

Mangaluru Smart City project focuses on development of waterfronts, improvement of roads, and upliftment of economy by improving fisheries and trade. The larger aim is to connect the communities back to the water edge by providing livable spaces for the city to relax, enjoy and engage in activities which would also increase the vitality and economic activity in those areas.

## The Mangala Corniche

Karnataka's coastline stretches for a total length of around 320 km within the districts of Dakshin Kannada (62 km of coastline), UDUPI (98 km) and Uttar Kannada (120 km, providing an opportunity to develop diverse waterfront developments along the coastline.

Mangalore, a major port city as well as administrative headquarter for the Dakshin Kannada district, is situated at the confluence of Gurupura and Netravati river. Mangaluru Smart City Limited intends to develop the infrastructure, economic activities, leisure and recreational spaces, water sports, cruise and other water related activities, in tandem with the proposed ring road (referred to as Mangala Corniche), along the riverfront of the city.

The 30 km stretch of Mangala Corniche ring passing along the river front, is proposed to be developed in phases for the following segments of the road:

- Kannur to Ullal Bridge
- Ullal Bridge to Kuloor Bridge
- Kuloor Bridge to Maravoor Bridge
- Maravoor Bridge to Gurupura Bridge

The segment of Mangala Corniche passing through the ABD area (1st phase) of Mangalore city is between Ullal Bridge to Kuloor Bridge (connecting NH 66 near Ullal Bridge in the south and near Kuloor Bridge in the north) and hence it is proposed to develop this segment of Mangala Corniche along with the waterfront development.





## ii. Consultants & Role

### Urban Frame

Urban Frame, a Space Matrix Group company, headquartered in Bangalore is a KNOWLEDGE based DESIGN company. It has the wholeness of a generalist and the preciseness of a specialist. The team at Urban Frame believes in creating unique, innovative and dynamic design solutions for the benefit of People, Projects and the Planet. The projects succeed in the marketplace through a unique research-based approach to planning and designing residential, corporate, institutional, hospitality and mixed-use developments. Over the years, the firm has gained reputation for designing and delivering projects that are forward looking, sustainable and high performing.

The current focus has been to drive the aspect of POD (people-oriented design) to the hilt and to push the envelope of sustainability to its maximum.

Urban Frame offers services in key sectors - Corporate Campuses and Offices, Residential design encompassing Villa, Villaments, Row houses to High rise apartments, Mixed Use Developments, Commercial buildings encompassing Retail and multi tenanted office buildings. The team specialises in Institutional projects panning from Universities to Schools. Health Care has been another key focus area with Multi speciality Hospitals and Assisted living. Across the years the team has been involved with Master Planning works ranging from City level Comprehensive Development plans (CDP) to large scale Master Planning works for integrated townships.

**URBANFRAME**  
A Space Matrix Group Company

### Shilanyas Design Consultants

SHILANYAS (a Partnership Firm since 1989) offers consultation in Architecture, Urban Design, Landscape, Interior Design and Jewellery and is based in Ahmedabad. Shilanyas has a holistic approach to the design of built environment, meticulously integrating all scales and components of design to create an environment of rich experience and value.

PVK Rameshwar FIIA, FIUDI, AIIID, Partner-in-Charge of this project is a practicing Architect, Urban Designer and an Academician. In addition to practice, he is the Former Chairman, Graduate School and Former Professor and Head, Masters Program in Urban Design, Faculty of Architecture, CEPT University, Ahmedabad. He serves as an Advisor and Expert Member for various organisations and institutions on Urban Design.

He has worked on important public projects like- Pre-Feasibility report for Statue of Unity, Kevadia; Bhuj Restructuring or relocation (post earthquake), Action Plan Reports for 37 Towns for Gujarat Tourism, Lake Redevelopments in Ahmedabad. His work has been widely published and has been awarded nationally, and he has made critical contributions to books, and edited monograph. He has been included as one of the Luminaries in the publication: "The Luminaries: Architects and Interior Designers, Gujarat" by Divya Bhaskar Group in 2018.



### Terra Firma

Terra Firma is one of the pioneers in the field of landscape architecture in Southern India. Since its inception in 1985 it has been in the forefront of creating innovative and environmentally sensitive landscapes. The team has dealt with a wide range of projects across typologies and scales ranging from residences to regional parks. The design approach is driven by a strong understanding of the site and its context in terms of natural, socio-cultural and environmental paradigms. The work ethos is defined by a keen passion for design and innovation along with a responsible stance on environmental sensibilities.

The team comprises of 40 employees across offices at Bangalore, Chennai and Coimbatore. Our senior associates have an impressive track record in delivering several landmark and award-winning projects. Terra Firma is backed by an efficient team of engineers, landscape architects, and horticulturists and supported by specialist consultants.



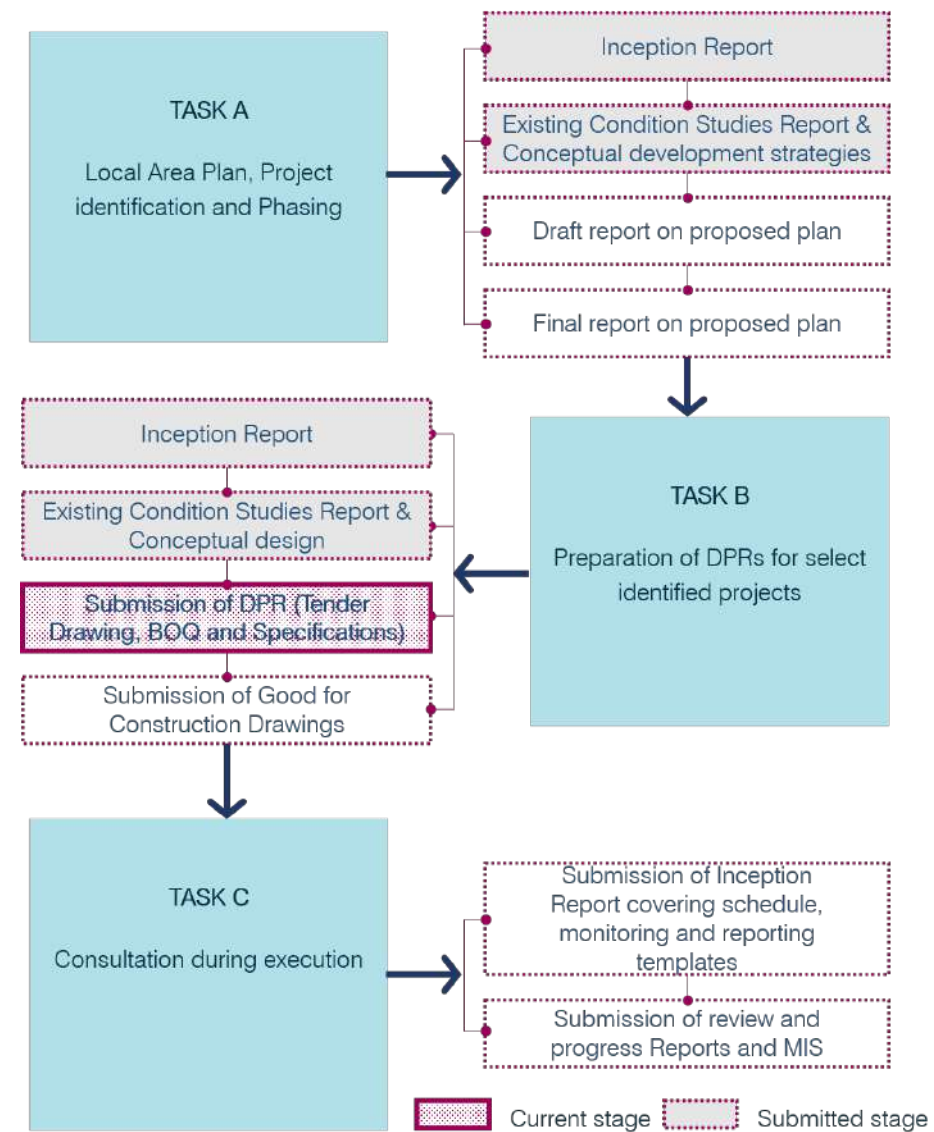
### iii. Purpose of the assignment

Mangaluru Smart City Limited intends to develop the Mangala Corniche road along with the waterfront development in the ABD area (between the Ullal Bridge to Kuloor Bridge). The ABD area is envisioned to be developed in a planned manner as per the provision of TP schemes.

This assignment is broadly categorised into:

1. TP Scheme works
2. Sub projects of Waterfront developments
  - Design Phase for Planning, designing and procurement assistance
  - Implementation Phase for Implementation assistance

### iv. Methodology



### v. Limitations

- All study and analysis have been carried out based on the desktop study, secondary data, rapid site visits, bathymetry data and drone survey
- The base map used for the study has been extracted from drone survey. Information regarding original plots, ownership, land & water edge line, high tide line, and islands & spitland have not been captured in this survey
- Mangala Corniche alignment and sub project proposals are subject to variation based on the final (and accurate) topographical, hydrological, floral and faunal surveys
- Corniche alignment and sub project proposals to be vetted out based on high flood line and latest CRZ regulations
- Ongoing projects/schemes by any other stakeholder organisation(s) to be accommodated to the study and analysis in the later stages as and when corresponding information is received
- The study excludes tourism data; this will be incorporated in the later stages as and when received



## vi. City overview

### Location

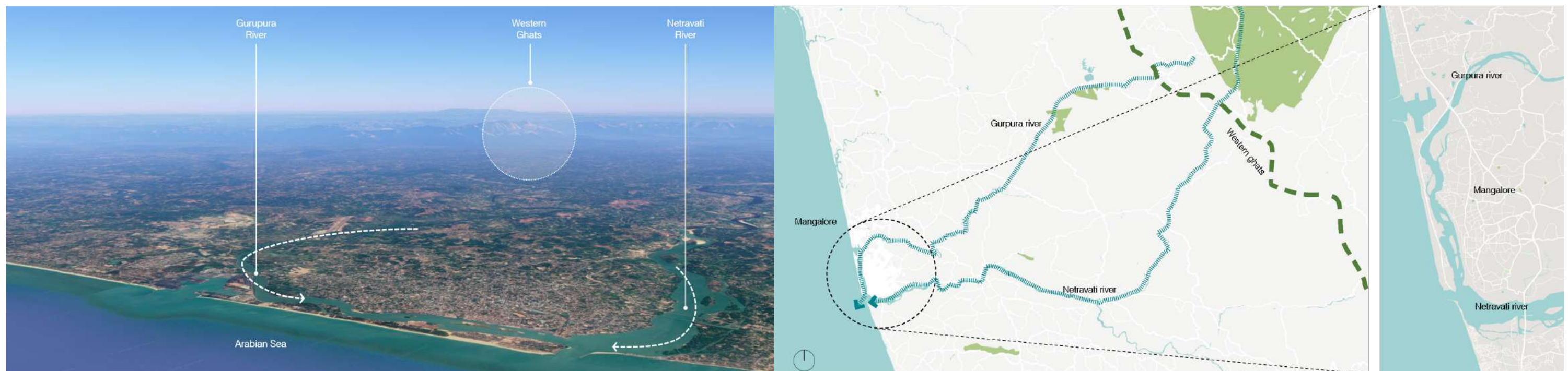
The city of Mangalore located in the Dakshin Kannada district of Karnataka, is nestled between two important west flowing rivers- Netravati and Gurupura. The Western Ghats are located towards the east, from where these rivers originate. Towards the west, the Arabian Sea lies just beyond the Gurupura River and a narrow stretch of coastal alluvium deposits.

The abundance and variety of natural resources, especially water, is a distinctive asset of the city. Be it the thodu networks which course through its undulating topography, the two rivers which form its natural extents, the expansive sea just beyond or the beauty of the pouring monsoons- the experience of Mangalore by dint of its natural resources has somehow been overshadowed with the development and urban expansion in recent times. The vision for a development project impacting the city will hence need to take in these myriad aspects into account.

### Regional context

Mangalore falls in the River Basin between the Western Ghats and the Arabian Sea, which consists of many west flowing rivers. The Netravati river has its origin in the Chikkamagaluru district of Karnataka at Bangrabalige valley, Yelaneeru Ghat in Kudremukh. The Netravati amalgamates with the Kumaradhara River near Uppinangadi village. The Kumaradhara also originates in the Western Ghats in the Subramanya range. The length of the Netravati is around 108km. The Gurupura River also originates on the Western Ghats, flows for a distance of around 87km before merging with the Netravati at the outlet of the Arabian Sea.

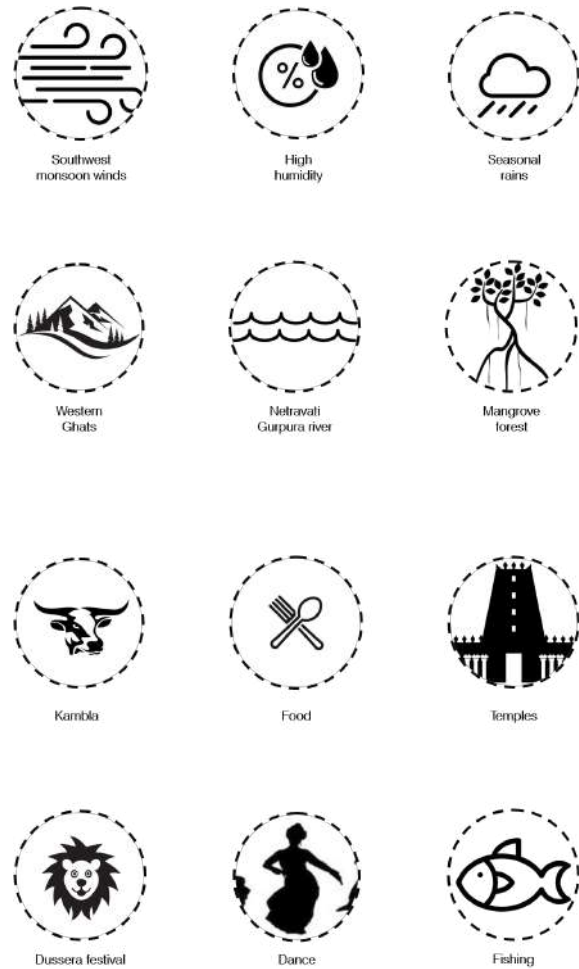
As the entire region is comprised of Netravati and Gurupura watersheds, all natural resources, human activity and development is impacted by the rivers and vice versa. A holistic and sensitive approach is to be adopted for any development initiative in context of these rivers which are the lifelines of the region.





## Geographical factors of influence

The city of Mangalore, surrounded by major geographical factors is hence a region which showcases a variety of experiences by dint of its setting. Addressing these factors is extremely important for any proposal whose impact shall be responsible for defining the image of the city in the coming times.



## Cultural factors of influence

Mangalore has various factors that have influenced from the past to present in terms of history, culture and heritage. These factors can be strengthened further with the development of Mangala Corniche. The proposal aims at highlighting the major factors that has influenced the city physically as well as culturally.

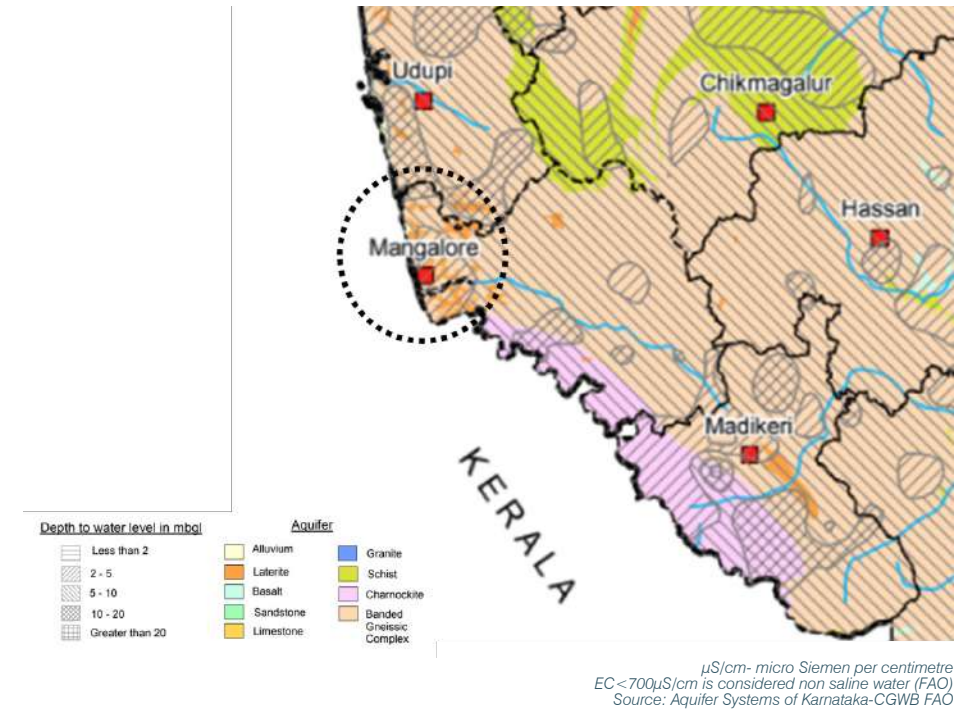
## Existing major points of interest



## Regional hydrogeology

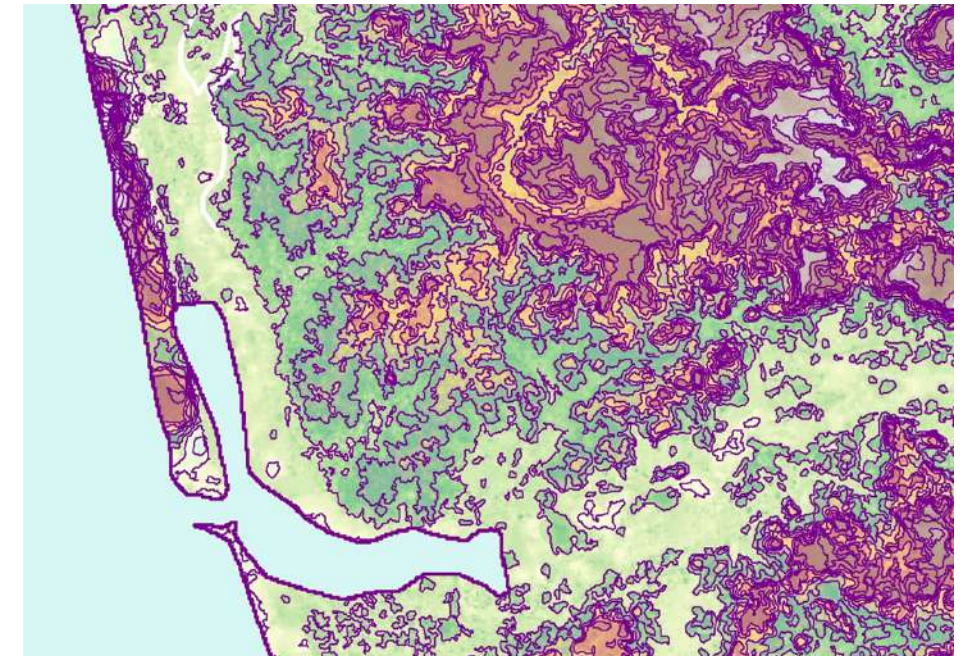
The Netravati and Gurupura Rivers flow over gneiss dominated areas along most of their length before terminating at coastal areas with some alluvium mostly to the north of Mangalore. Coastal alluvium comprises fine to medium grained sand, clay and gravels.

Thickness of alluvium is around 35-45m near the coast and gradually decreases landward up to 10m. A well defined clay layer at places has induced semi-confined to confined groundwater conditions in the alluvial aquifers. The study indicates the presence of abundant aquifer systems. Despite its proximity to the sea, the region does not have issue of saline groundwater. An understanding of this character is important for developing comprehensive water management interventions.



## Topography & soil

The city gradually slopes down from the east to the west and south into the Gurupura and Netravati rivers respectively. The gradient is steeper along the banks of the Netravati, where comparatively sparse settlement patterns are seen. The shallower gradient along the Gurupura river houses denser urban fabric. The eastern extents of the city, which is now subject to urban expansion, has undulating topography.



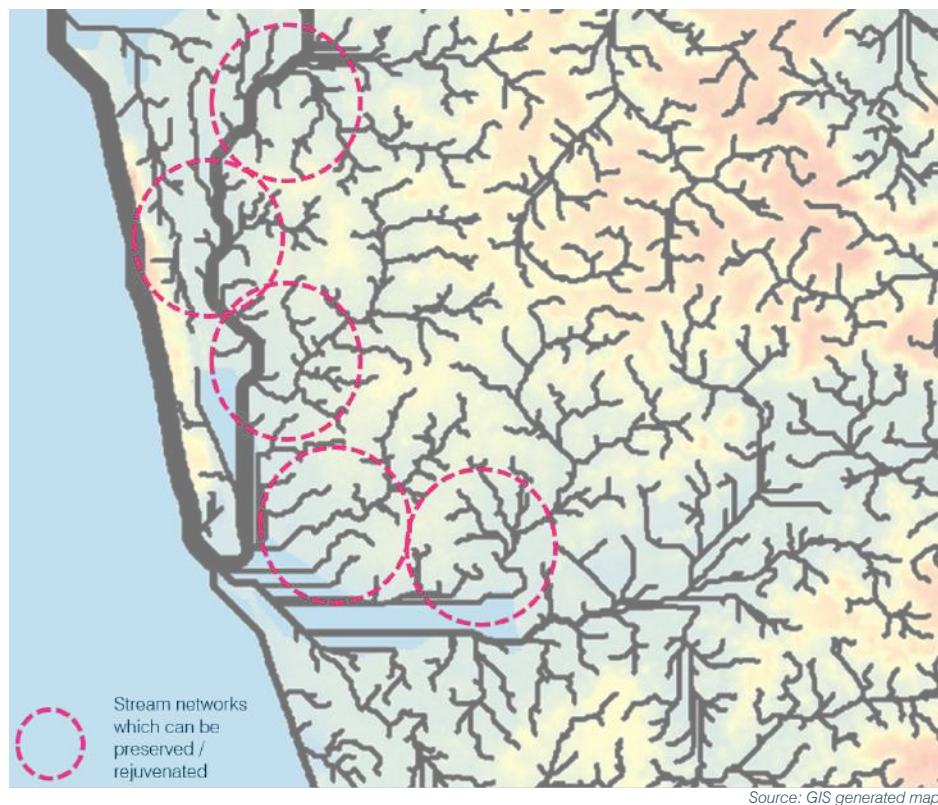
The mainland extent of Mangalore mainly comprises of lateritic soil while the strip land between the Arabian sea and Gurupura river, as well the river banks have coastal alluvial soil. The riverbanks along the Netravati River are steeper than along the Gurupura, creating a dynamic characteristic along the land water interface from Ullal to Kuloor Bridge. The terrain, which

comprises mostly of lateritic soil, becomes steeper and undulating towards the eastern extents of the city.



## Surface hydrology

Tidal influences along the estuary along with factors like shallow riverbed depths (to be validated) in certain areas have led to the presence of flood hazard prone areas. The natural stream networks that drain the mainland of Mangalore into the rivers have been impacted by urbanisation. The stream network is an integral part of a river's functionality and rejuvenating these is an urgent requirement. The estuarine conditions also present sensitive ecological scenarios of changing water levels which impact the land-water interface as well as aquatic habitats. Interventions to mitigate damage by dint of development needs to be a primary concept driver.



## Vegetation- typology

Netravati- Gurupura estuary is one of the major estuaries of the Karnataka coastal belt. Mangroves of Karnataka are categorised as Eumangroves and Mangrove associates. Salt tolerant shrub species have also been recorded. Almost 75% of the original mangrove extent has already been damaged.

The region, which was originally conducive to evergreen forests has seen change due to human interventions. A large extent of mangrove cover which is essential for natural protection of estuarine edge conditions has also been damaged.

The sturdy root systems of mangrove trees help form a natural barrier against violent storm surges and floods. River and land sediment is trapped by the roots, which protects coastline areas

and slows erosion. This filtering process also prevents harmful sediment reaching coral reefs and seagrass meadows. Hence, further schemes need to be sensitive in managing the native species of the area which are critical to the functioning of the natural ecosystem.



## Faunal habitats

The estuarine waters of the Netravati and Gurupura are important fish breeding grounds for various fishes. The now degrading mangrove vegetation on the riverbanks host habitats for a variety of smaller fishes, insects, amphibians etc. The Arabian sea provides the catch for the fishery industry of Mangalore which is the lifeline of the city's commercial structure.

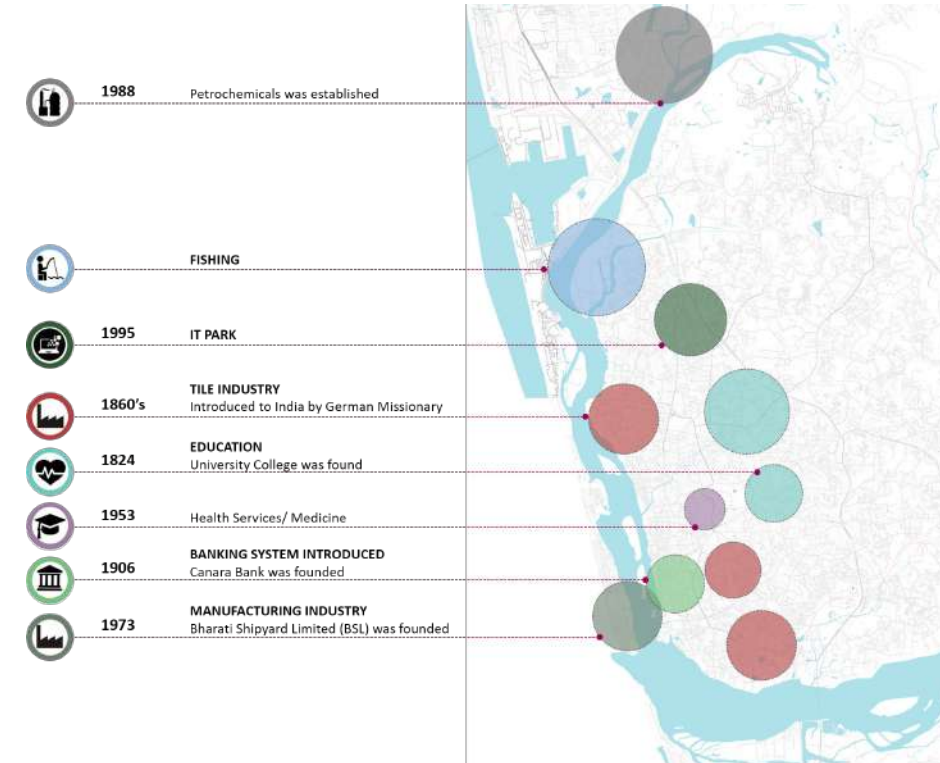
The vegetated pockets along the riverbanks are habitats of a variety of birds, including migratory ones. The fluvial systems are important biodiversity habitats and need to be conserved.



## People and economy

Tertiary and secondary sectors of employment dominate in Mangalore urban agglomeration. It is observed from the data (as on 31-3-07), furnished by the industries department, Mangalore taluk has the major share of industrial activity in the entire district, employing about 83% of the total industrial employees of the district, in various industrial units. The tertiary sector accounted for 47.03 % of the total main workers during 1991 census. Trade and commerce and other services accounted for nearly 40%. Commercial banking's share of Mangalore taluk is 67.10% and urban co-operative banking's share of deposits in Mangalore taluk is 58.17 % of the total deposits in the district. The Government has notified a Special Economic Zone (S.E.Z) in the north eastern part of the L.P.A.

Source: Master Plan 2021, Mangalore



Note: Topics like 'Temperature', 'Climate', 'Demographic Studies' and 'Existing Situation' as covered in Master Plan 2021, Mangalore has been added as an annexure to this document



# vii. Vision & Strategy plan

## Redefining the water edge

The intent of this projects is to aid the city of Mangalore to rediscover its once glorious water edge. The idea is to follow an ecological model sensitive to the water and edge conditions, thereby rendering a grey-green dynamic edge which would become the public corridor to the city. The three major aspects that categorise the programs , projects and functions of the waterfront are:



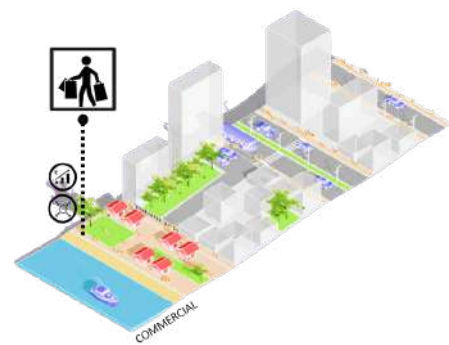
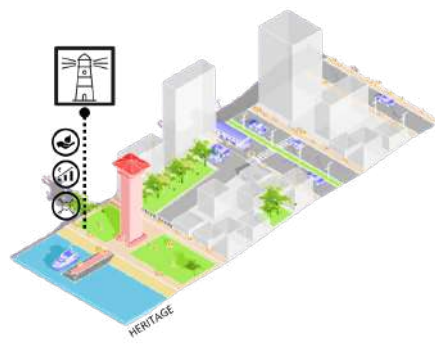
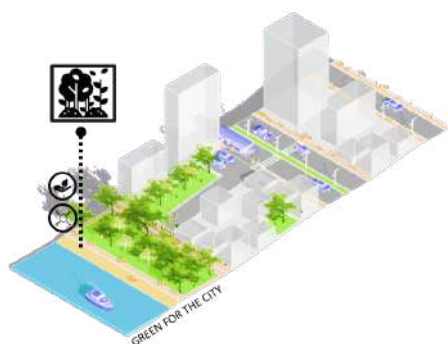
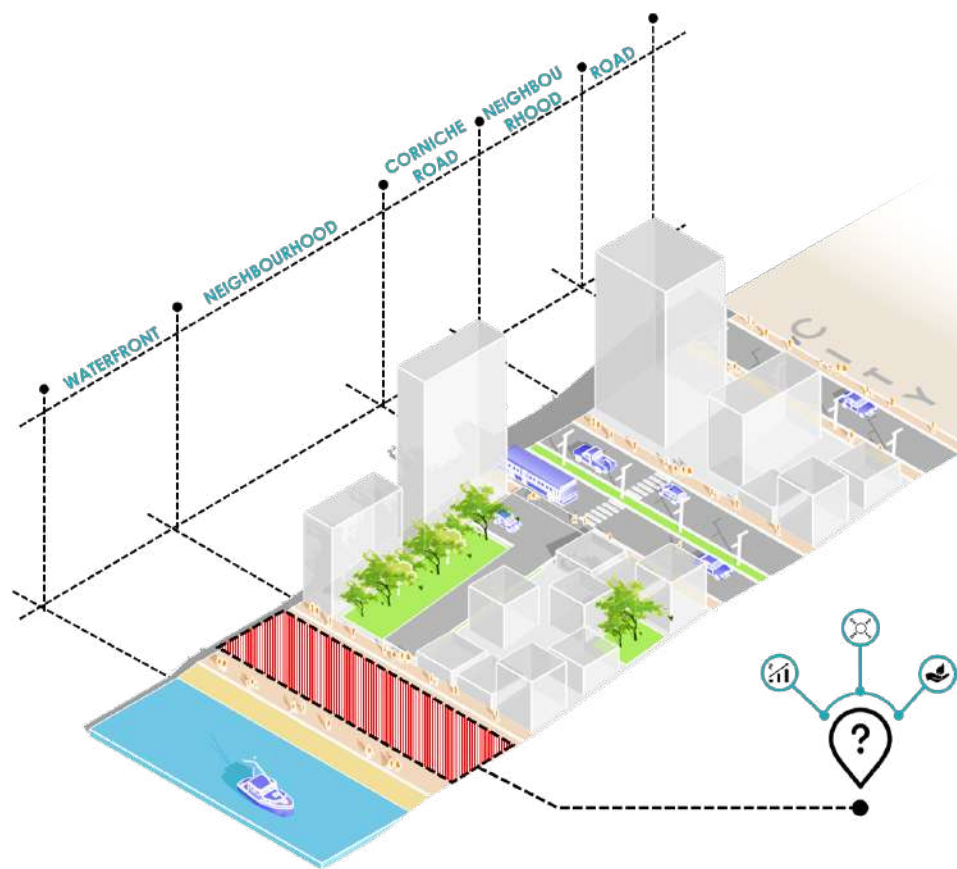
INCLUSIVITY



ECOLOGICAL SENSITIVITY



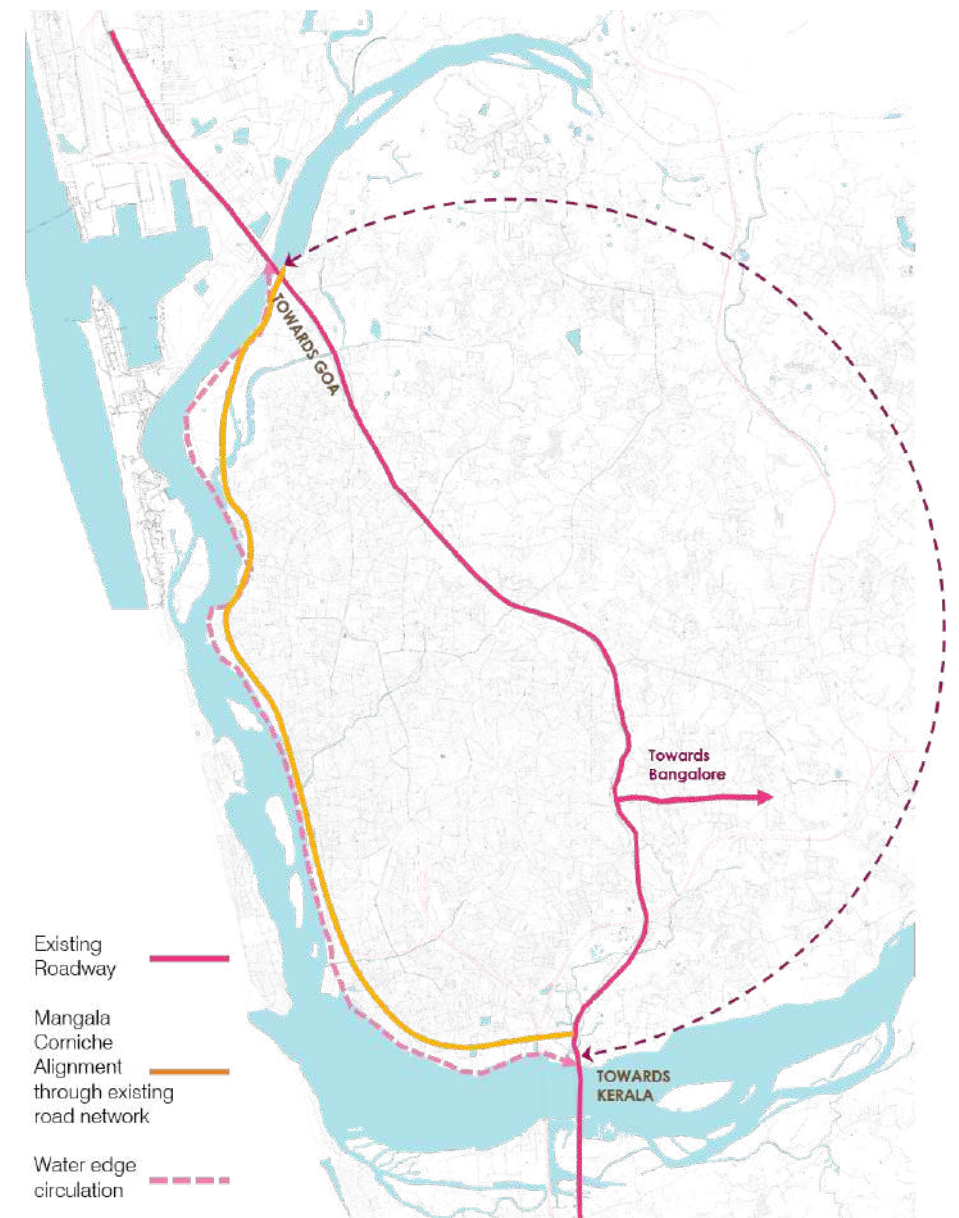
ECONOMIC VIABILITY



## Alignment of Mangala Corniche

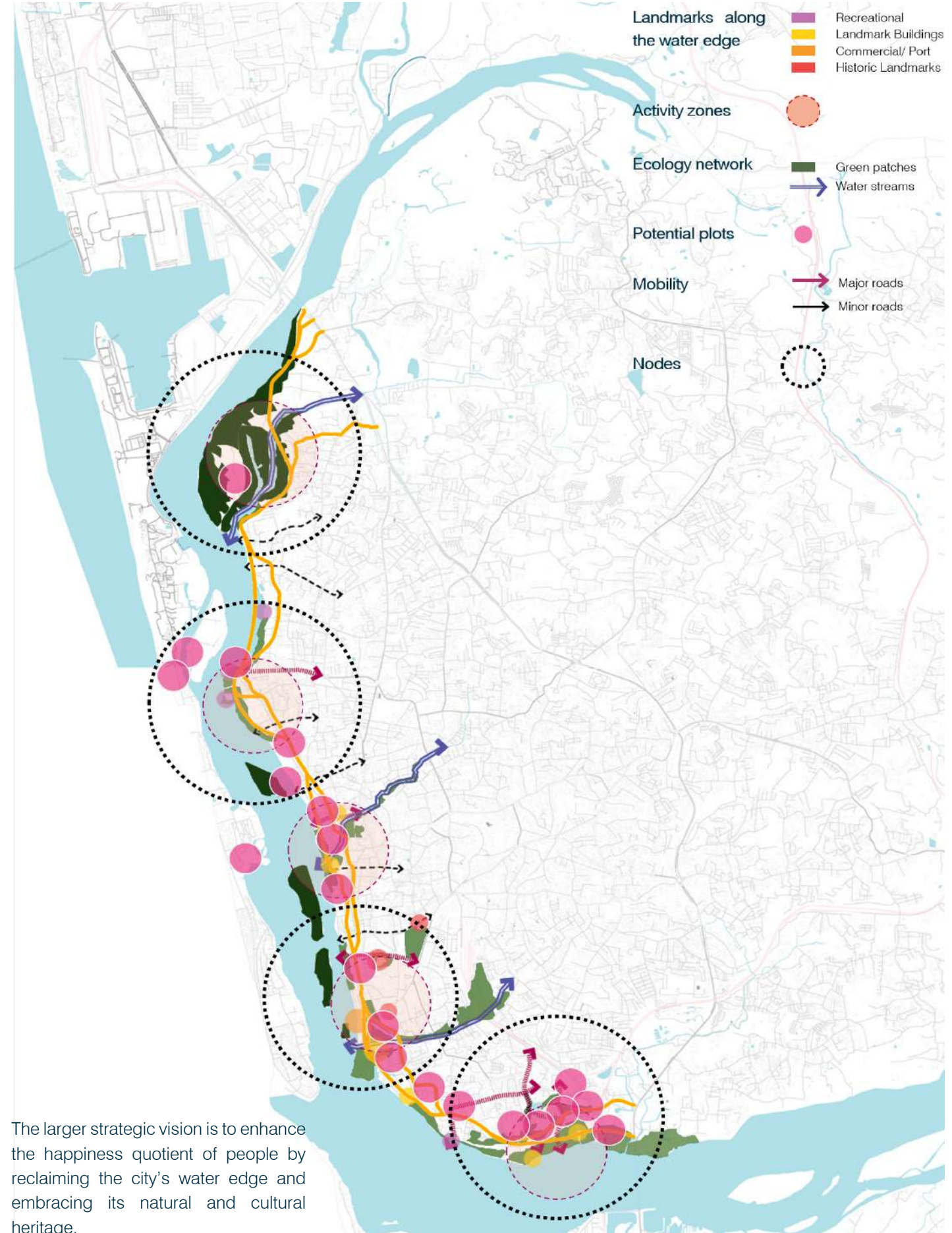
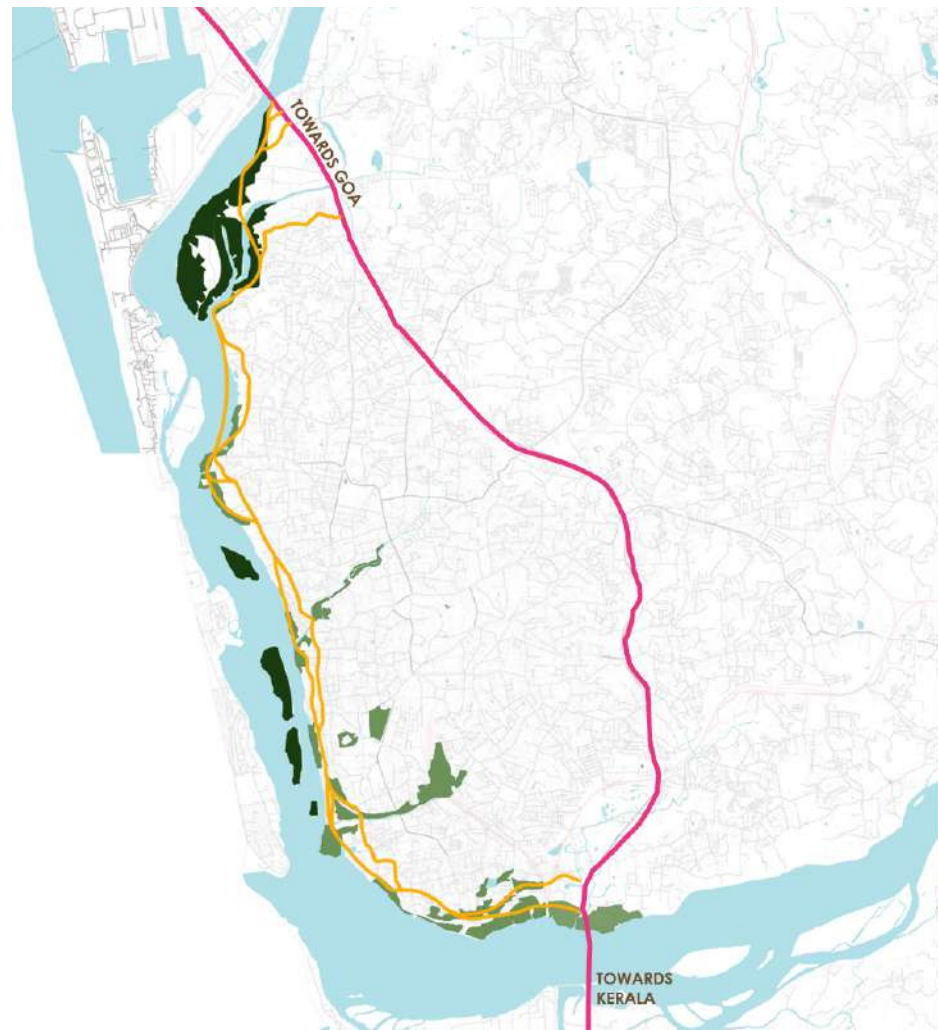
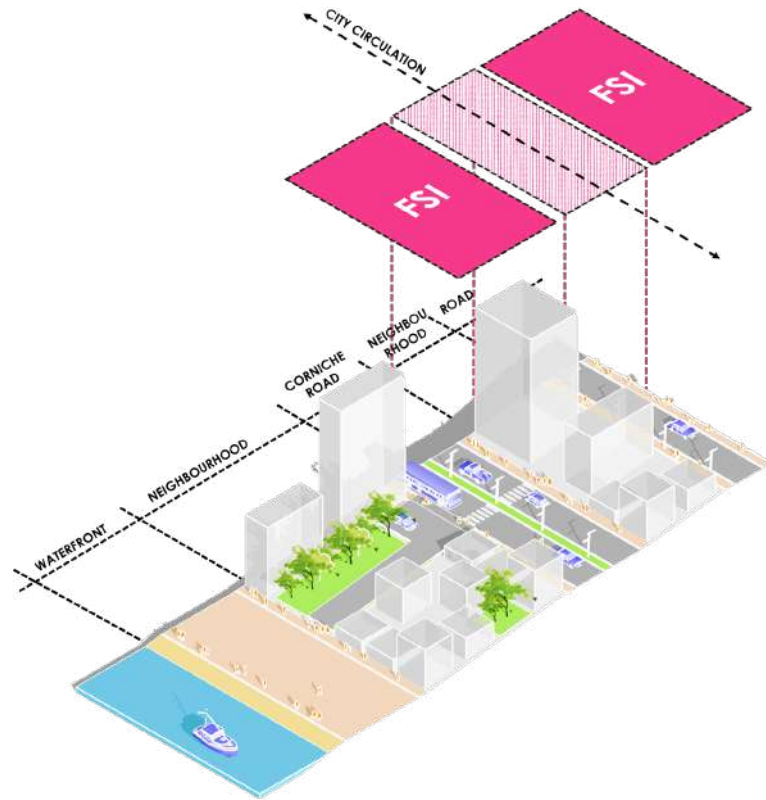
### Need and location for a mobility corridor

Growth pattern of the city suggests the need for a mobility corridor radially along the eastern side of the city. This opens out the possibility of exploring a pedestrian corridor hugging the water edge of Mangalore, while realigning the Mangala Corniche to conform to an improved ROW of existing road networks.





The Mangala Corniche has been envisioned along existing road networks wherever possible. The Corniche re-aligns to retain the green edges and pockets, proposing an ecological resilience network to the city. The Corniche being an internal 18m wide mobility corridor allows for a parallel pedestrian water edge and opens up plots/FSI on either side of the road for development



The larger strategic vision is to enhance the happiness quotient of people by reclaiming the city's water edge and embracing its natural and cultural heritage.



# viii. Identified Subprojects

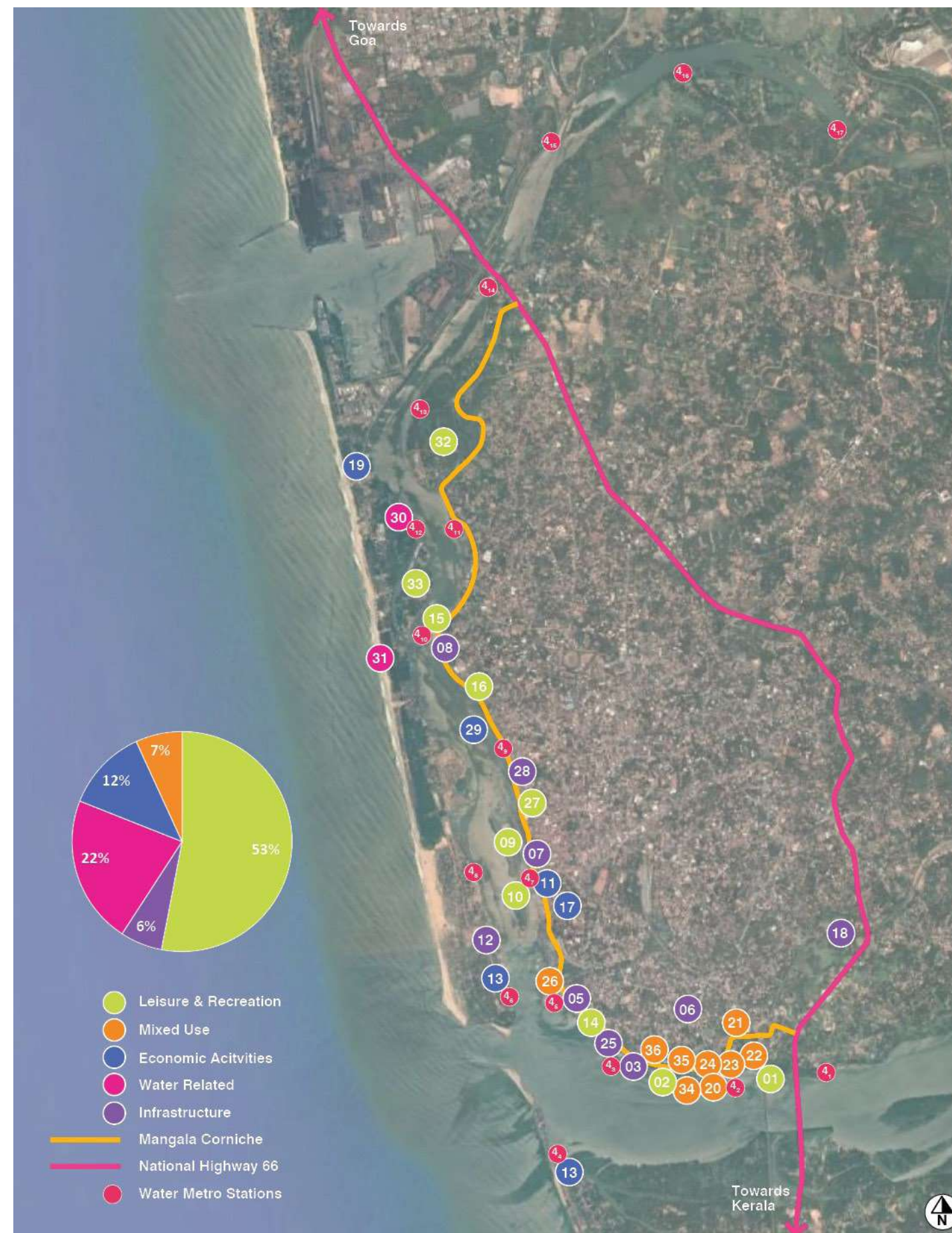
The identified sub projects along the 12km stretch from Netravti Bridge to Kuloor Bridge have been categorised into water sports, cruise & other water related activities, leisure & recreation, economic activities & infrastructure. Based on the implementation model,

land ownership, acquisition, proximity to waterfront, revenue generation and stakeholder consultation, the sub projects have been further classified into relative timelines and categorised into Phase 1, Phase 2 and Phase 3.

| No.   | Location                              | Projects   |
|---|---------------------------------------|--|
| Phase 1   |                                       |  |
| 1   | Nethravathi Bridge to Bolar Sea Face  | Promenade Development  |
| 2   | Ice factory area                      | Open Air Theatre, Sports Complex   |
| 3   | Bolar Sea Face site                   | Cultural Hub   |
| 4   | Various location along the waterfront | Water Metro  |
| 5   | Hoige Bazaar                          | Fisherman Community Rehousing  |
| 6   | Jeppu Market                          | Multi Utility Building   |
| 7   | Old Port Area                         | Sea link Development   |
| 8   | Sulthan Battery Area                  | Sea link Development   |
| 9   | Island - 1 (North)                    | Cultural Park (Yakshagana) & Light and Sound Show  |
| 10  | Island - 2 (South)                    | Traditional Sports Island (Kambala)  |
| 11  | Old Port (Commercial area)            | Box Park   |
| 20  | Near Cascia Tile Factory              | Street mall  |
| 34  | Near Cascia Tile Factory              | Incubation Centre/ Experiential Museum/ Event facility   |
| Phase 2   |                                       |  |
| 12  | Bengre Island                         | Fishing Village- PMMSY & Solar Drying Farm   |
| 13  | Bengre Island Ullal                   | Idlying port<br>Fish Landing Area for Fishmeal   |
| 14  | College Road                          | Light House Restoration  |
| 15  | Sultan Battery                        | Public Plaza for Historic Sultan Battery Fort & Wrecked Ship museum (Reconnect with History of Sultan Battery) |
| 16  | Sovereign Tile Works                  | Adaptive reuse _ Maritime Museum & Wetlands Aquamarine park to work like a Ecology Interpretation Center       |
| 17  | Old Port area                         | Revolving Restaurant   |
| 18  | Fisheries College                     | Sports Complex   |
| 33  | Island near Sulthan Battery           | Tourism Vilage   |
| 35  | Opposite Cascia Tile Fatory           | Incubation/ Start-up centre  |
| 36  | Opposite Ice Factory                  | Auditorium for performaces, & Exhibition space   |
| Multiple probable projects have been identified at various locations in Phase 3 |                                       |  |
| 19  | NMPT                                  | Oceanarium   |

|    |   |   |
|----|---|---|
| 21 | CCD Land near , Gujjark-ere                                 | <ul style="list-style-type: none"> <li>Mixed Use development - Residential &amp; Commercial</li> <li>Mangalore haat (similar to Delhi haat)</li> <li>CGH Earth experience hotel model</li> <li>Luxury plotted development</li> <li>Museum/ Art gallery</li> </ul> |
| 22 | Commonwealth tile factory area                              | <ul style="list-style-type: none"> <li>Adaptive reuse of existing Factory – Clay tile museum</li> <li>Marquee Urban space for the city</li> <li>Maritime museum</li> <li>Cafeteria/Commercial hub</li> </ul>  |
| 23 | Mangalore club area   | <ul style="list-style-type: none"> <li>Private Jetty Yard</li> <li>Convention centre</li> <li>Clubhouse Expansion</li> <li>F&amp;B facilities</li> </ul>  |
| 24 | South of Mphasis Campus                                     | <ul style="list-style-type: none"> <li>Office Campus</li> <li>Rentable event spaces</li> <li>Mini performance areas</li> <li>Public zone in the ground floor</li> </ul>   |
| 25 | Near Joyland Grounds  | <ul style="list-style-type: none"> <li>Auditorium / congregation space</li> <li>Improved sports facility</li> </ul>   |
| 26 | Albuquerque & Sons Tile Factory with green railway corridor | <ul style="list-style-type: none"> <li>Commercial adaptive reuse</li> <li>Maritime museum ( adaptive reuse )</li> <li>City green space to Public park facing sea front (wetland park)</li> </ul>  |
| 27 | Car Street End  | Car Street park connection to Sujith's play ground  |
| 28 | Karkane Mohyudeen Nagar                                     | <ul style="list-style-type: none"> <li>Development of Community Congregation space &amp; playground</li> <li>Board walk around ship</li> </ul>  |
| 29 | Kudla Kudru Island  | Development of Party Island   |
| 30 | Boat dock (Raftaar Terminal)                                | Adaptive Reuse of Boat dock for Non motorised water sport   |
| 31 | Tannirbhavi Beach   | <ul style="list-style-type: none"> <li>Beach front Development</li> <li>Island Biodiversity Park</li> </ul>   |
| 32 | Kuloor Island   | <ul style="list-style-type: none"> <li>Biodiversity Natural Heritage with core conservation zones</li> <li>Riverside public space</li> </ul>  |

Figure 4.1: Projects benefitting the fishermen





# ix. Waterfront Promenade development

## Promenade Development

The Waterfront Promenade development is proposed to re-engage the city of Mangalore with the varied water related experiences that it's settings provide. Mangalore city is surrounded by the 2 major rivers, namely Netravati river and Gurupur river. A narrow patch of land that extends further acts as a buffer between the rivers and the sea. These rivers have always been a functional aspect of the city. The Waterfront Promenade intends to connect the city to the river and the sea with the help of proposed landmarks and nodes. These landmarks and nodes are further connected to the city through a series of road network that will act as pendants between the city and the Promenade.

A sea link pedestrian connect will be created as one of the major elements connecting to the Promenade development. The landmark locations and design will depend on the detail site data, plot boundaries and ownership of land.



## Promenade Pilot stretch Strategy

The promenade development is divided into several phases. The pilot stretch includes the area from Netravati Road Bridge till the Ice Factory and additionally the Bolar Seaface. A series of landmarks, nodes are created based on the city's existing network and land use. These landmarks are connected with a "promenade" which widens at various points to larger plazas. The pedestrian pathway is accompanied by a cycling track and options for buggy movement with cycle stand and parking at regular intervals. The pilot stretch of the promenade addresses both ecological aspects of the city as well as the tourism aspect of the city, by keeping in mind the economic aspect of the development.

| No. | Location                   | Project proposal                          |
|-----|----------------------------|---|
| 1   | Netravati Road Bridge      | Mangrove Board walk                       |
| 2   | Netravati Rail Bridge      | Bird Watching area                        |
| 3   | Common Wealth Tile Factory | Multi Activity Plaza                      |
| 4   | Jeppu Ferry                | Water Metro Jetty                         |
| 5   | Lobo's River View          | Plaza with Historic Chimney as Marker     |
| 6   | Cascia tile factory        | Kiosks and Activity area                  |
| 7   | Boat building yard         | Boardwalk, River Beach, Wetland Treatment |
| 8   | Ice Factory                | OAT                                       |
| 9   | Boat building yard 2       | Experiential Boat building yard           |
| 10  | Bolar Seaface              | Cultural hub connection and landmark      |

Pilot stretch





# Case study- Singapore Jurong Lake Gardens

Jurong Lake is a 70ha freshwater lake and reservoir located in the western region of Singapore formed with the damming of Sungei Jurong further downstream. The lake serves as a reservoir contributing to the water supply of the country. Lakeside Garden concept The 90-hectare Jurong Lake Gardens comprises three segments: Lakeside Garden (Jurong Lake Gardens West/ former Jurong Lake Park) Chinese and Japanese Gardens (Jurong Lake Gardens Central) Garden Promenade (Jurong Lake Gardens East)

## Key Points of Design

- Nature
- Play
- Learn
- Venues
- Dine

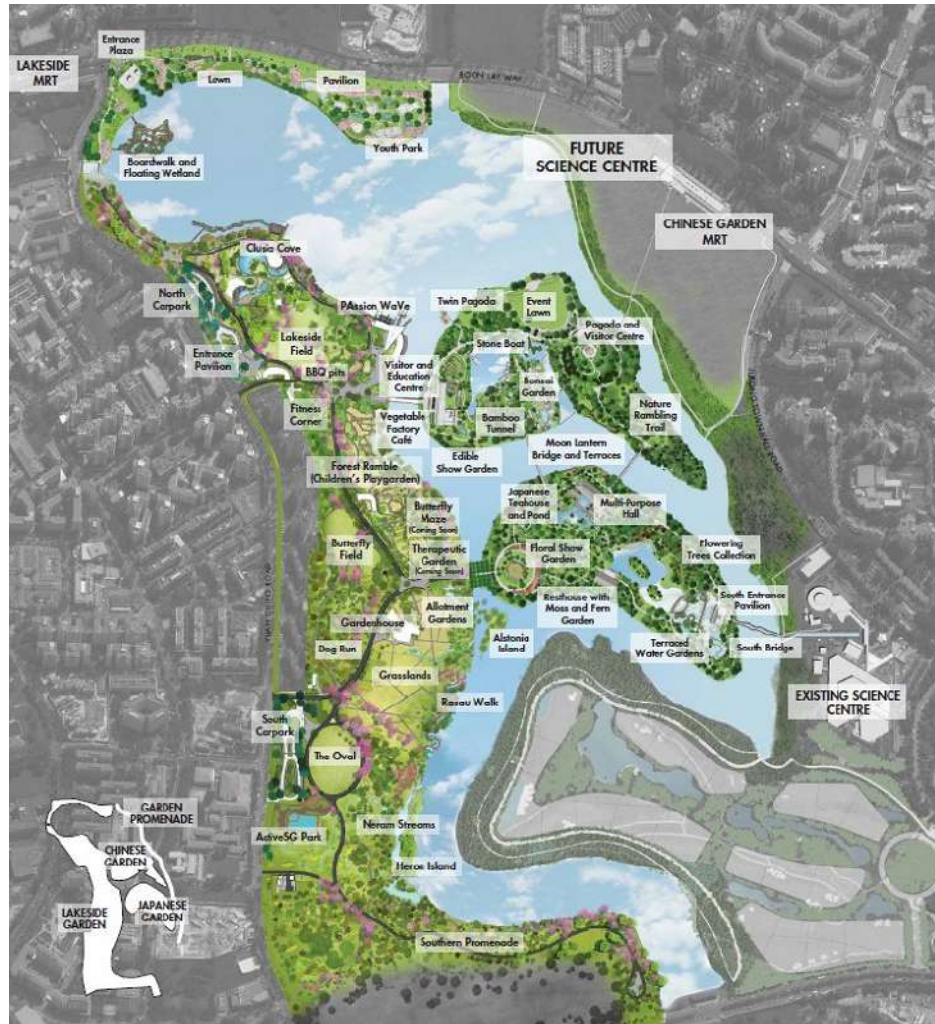
## Urban Planning



Source: <https://www.ura.gov.sg/maps/?service=MP>

- Commercial
- Residential

The Lake Gardens design strongly influenced the urban development of the area, with increase in residential and commercial buildings in the surrounding area.



Source: <https://www.nparks.gov.sg/news/2019/4/lakeside-garden,-western-section-of-jurong-lake-gardens,-opens>

## Goals of the project



**Adaptable spaces for the future economy** to cater for shorter business cycles, rapidly emerging technologies and more flexible business models



**An inclusive district for the community** with vibrant round-the-clock retail, entertainment and leisure options



**Highly connected and car-lite environment** that will facilitate seamless, efficient movement of people and goods



**Distinctive identity** shaped by natural environment such as Jurong Lake and heritage assets like the former Jurong Town Hall building



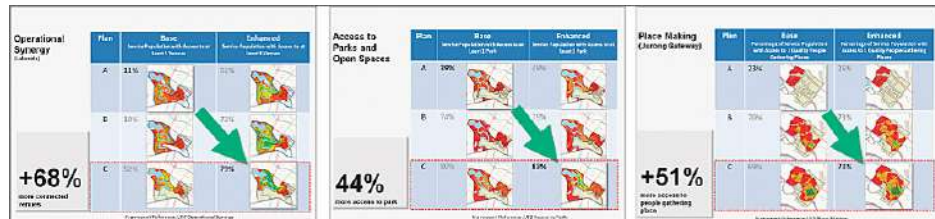
**A delightful leisure destination** anchored by Jurong Lake Gardens, current and new Science Centre and HSR terminus



**Innovative urban infrastructure** - including building underground to free up surface areas - to strengthen sustainability, productivity and manpower efficiency

Source: URA STRAITS TIMES GRAPHICS

## Impact of the project on the city



A detailed study was conducted on the masterplan that was developed to understand the impact of the large open space development on the city.

# Case study- Meishe River Greenway

## 1 Project Statement

The landscape architect lead the implementation of nature-based solutions to transforming the gray concrete river into a resilient green infrastructure that revives the river with clean water, rich lives, lush beauty, and social vitalities.

## Design Elements:

- Eco-friendly and flood resilient waterways
- Mangrove habitats have been rehabilitated
- Constructed wetlands
- Recreational facilities
- Ecological infrastructure

## 2 Site and Challenges

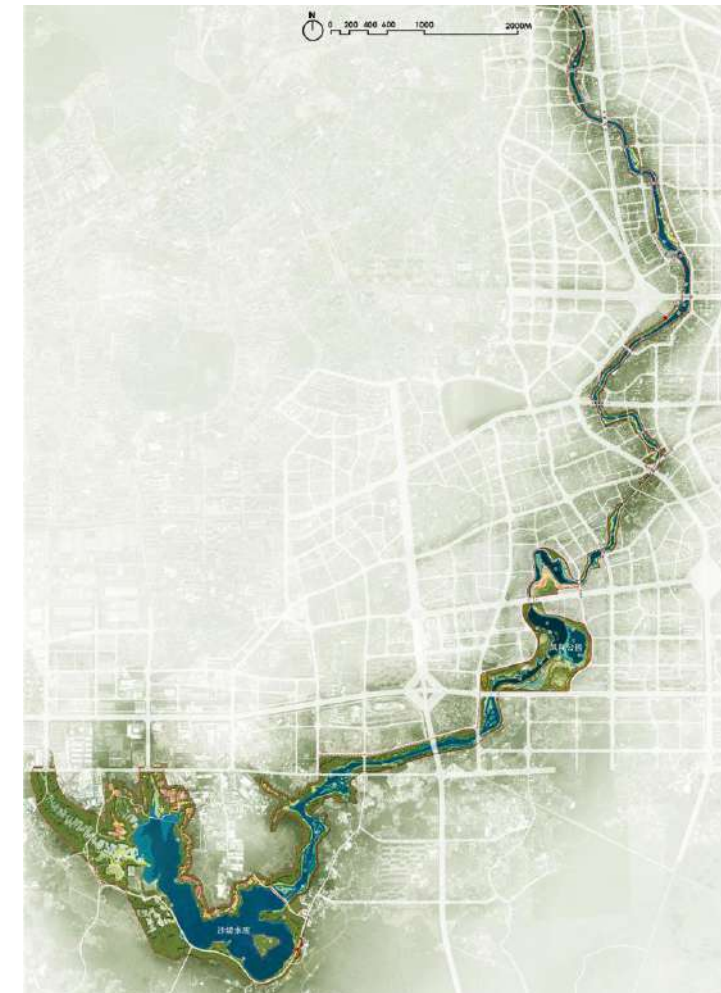
Haikou is a tourist city in South China's tropical area with a monsoon climate. In the past four decades, the city has experienced a frenzied ten-times growth in population from a quarter million to 2.3 million. The Meishe River water ways in particular, 23 kilometers long, literally meaning the "beautiful mother river" in local language, which runs through the built up area had become a nightmare for the city, for decades, a sewage dump. The single-minded counter flooding control walls had turned the river into a lifeless concrete channel that people turned their backs on.

## 3. Objectives and design Strategies

By integrating the works of civil engineering that deal with a gray drainage system of sewage pipes and treatment plants that will collect the sewage of the point sources, and cut off some major pollution sources, the landscape architect designed the river corridor as a comprehensive ecological infrastructure to solve holistically the problems of flood and pollution, recover habitats for biodiversity, create pleasant recreation opportunities, and make it beautiful.



Source: <https://www.indian-architects.com/pt/landscape-haidian-district-beijing/project/turning-gray-into-green-meishe-river-greenway-and-fengxiang-park-haikou-china>



Source: <https://www.indian-architects.com/pt/landscape-haidian-district-beijing/project/turning-gray-into-green-meishe-river-greenway-and-fengxiang-park-haikou-china>

## Three strategies were adopted:

- Planning an ecological infrastructure
- Transforming grey into green
- Integrating grey into green and the terraced wetland park
- Harvesting cultural and social services from improved landscape

## 4. Achievement and significance

The river water has become clean again, fish and birds have returned, mangrove are reestablished, and visitors are attracted to the new landscape.

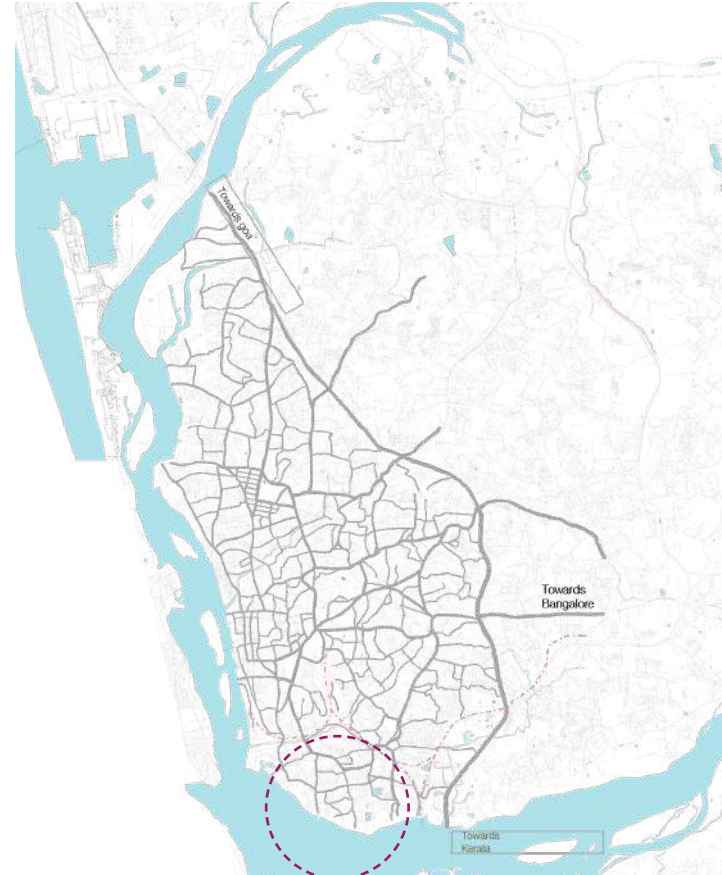
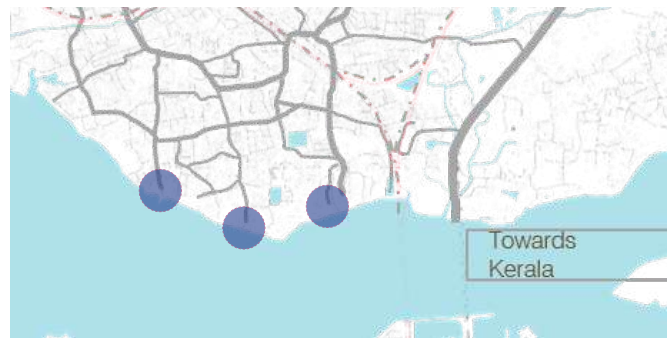


# x. Existing and projected scenarios

## City Networks

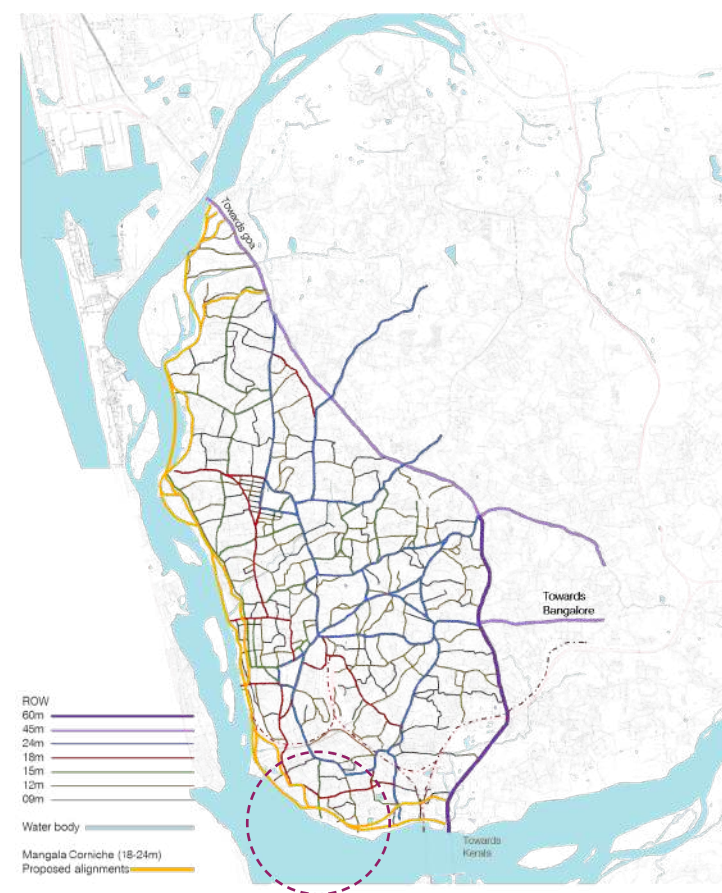
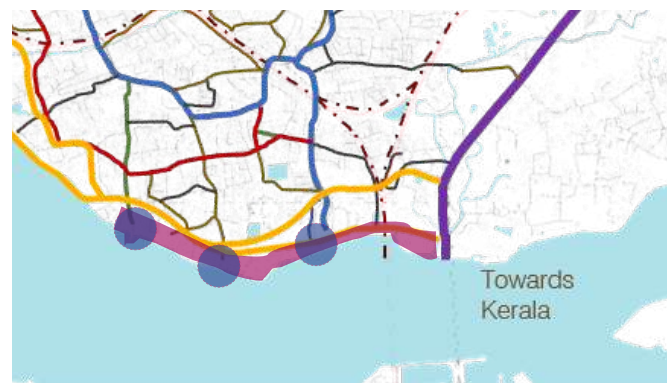
### Existing

Due to the undulating topography of the Mangalore city, the city is developed into densely populated areas with ribbon type developments along the roads. Ribbon type developments are common all along the transport corridors with narrow approaches from the main road to interior development.



### Projected/proposed

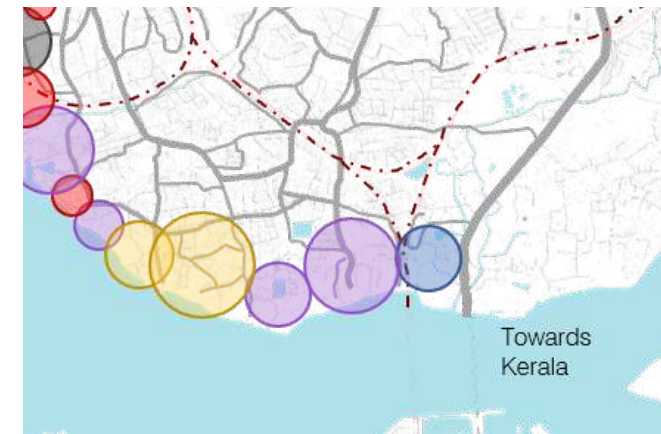
Realignment and widening of the major as well as the access roads are required in various parts of the city. The proposed water metro stations are positioned so as to connect back to these access roads which in turn will feed back into the existing city transit networks. The result is an enhanced multimodal transit system with better inter and intra city connectivity.



## Land use

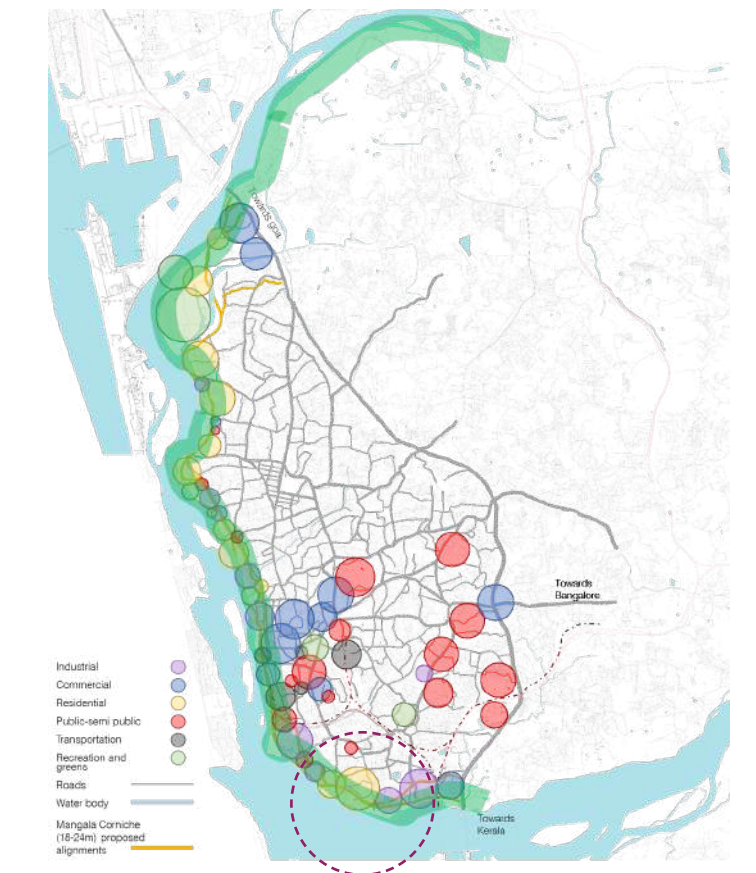
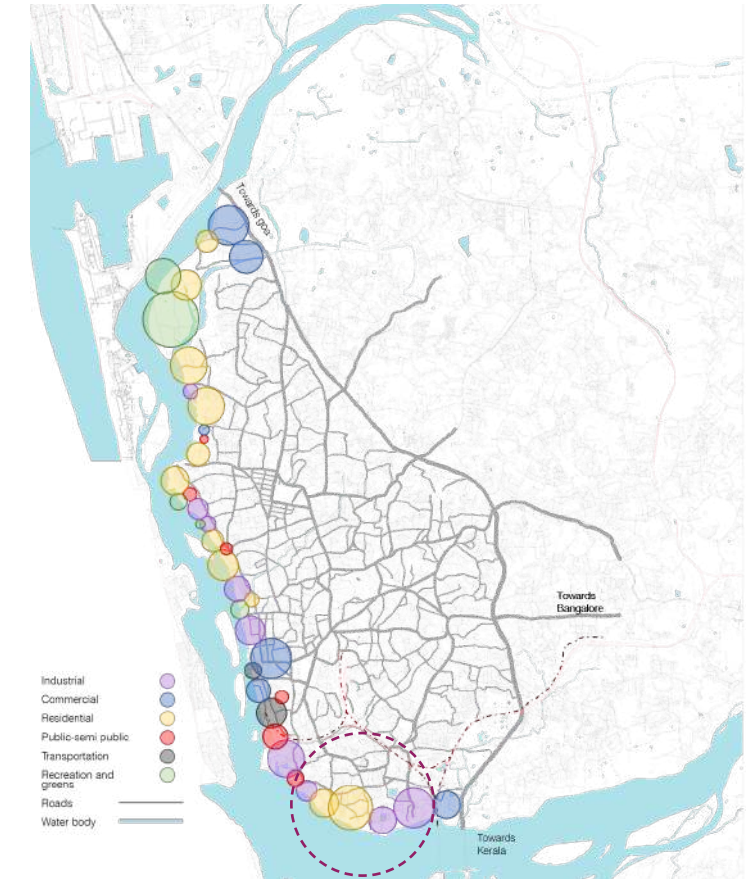
### Existing

The natural water edge of the city is marked private developments, mainly industries and residences. With a very limited option to access and no recreational space along the water edge, the city has turned its back towards the water.



### Projected/proposed

Provision of public recreational spaces along the water edge will provide a breathing space for the city. Moving from the southern edge to the north the city gives a better opportunity to be developed as a planned city with green spaces. Access roads connecting the major public landmarks and the inner city would further be connected on the water side through the proposed water metro points.





# xi. Impact assessment

## Socio-economic impacts of proposed locations for Waterfront Promenade

| No. | Location                   | Feasibility/Impact   |
|-----|----------------------------|--|
| 1   | Near Netravati Road Bridge | <ul style="list-style-type: none"> <li>• Direct connection from NH66</li> <li>• Proposed mangrove protection area with Interpretation centre to educate the public</li> <li>• Potential for tourism</li> <li>• Ecological zone, will attract educational and nature enthusiasts</li> <li>• Scope for improved biodiversity with increase in birds and mangrove species.</li> </ul> |
| 2   | Near Netravati Rail Bridge | <ul style="list-style-type: none"> <li>• Pedestrian and cycling pathway</li> <li>• Provision for cycle stand</li> <li>• Bird watching activates the zone,</li> <li>• Visual experience enhanced at the entry to the city</li> <li>• Potential point for View Decks</li> <li>• In close proximity to proposed public plazas and promenade</li> </ul>                                |
| 3   | Commonwealth tile factory  | <ul style="list-style-type: none"> <li>• Highlighting the oldest tile factory of Mangalore</li> <li>• Board walk for educational and recreational viewing point</li> <li>• Rain shelters and seating area</li> </ul>   |



| No. | Location          | Feasibility/Impact  |
|-----|-------------------|---|
| 4   | Jeppu Ferry       | <ul style="list-style-type: none"> <li>• Etymology of the place name suggests a ferry point at this location in history</li> <li>• Potential for private jetty/yacht docking</li> <li>• Feeder to existing city bus route and proposed Mangala Corniche alignment</li> <li>• In close proximity to proposed public plazas and promenade</li> <li>• Increase in land value and rentable property for public/private use</li> </ul> |
| 5   | Lobo's River view | <ul style="list-style-type: none"> <li>• Enhance the historic landmark of the tile factory</li> <li>• Historic Plazas that will educate the people</li> <li>• Improved access to the river front</li> <li>• Existing ruins of tile factories dating to 1874, acts as a potential historic destination</li> </ul>  |



## Socio-economic impacts of proposed locations for Waterfront Promenade

| No. | Location            | Feasibility/Impact   |
|-----|---------------------|--|
| 6   | Cascia Tile factory | <ul style="list-style-type: none"> <li>• In proximity to the proposed idyllic port</li> <li>• Potential for commercial and public developments due to improved access</li> <li>• Potential for commercial and public developments in the proximity, and better employment opportunities for local communities</li> <li>• Destination for riverside picnic kiosks</li> <li>• Ruins recreated wedding destinations</li> <li>• Informative and Educational</li> </ul> |



| No. | Location           | Feasibility/Impact   |
|-----|--------------------|--|
| 7   | Boat Building yard | <ul style="list-style-type: none"> <li>• Development of a major waterfront view point</li> <li>• Huge potential for public/private developments around this public plaza</li> <li>• Direct pedestrian/vehicular connect to and from Mangala Devi temple</li> <li>• Potential cultural development point</li> <li>• Development of a River Beach front</li> <li>• Direct view point of the river and sea connection</li> <li>• Commercial development along the waterfront as a revenue generating point</li> </ul> |
| 8   | Ice Factory        | <ul style="list-style-type: none"> <li>• Natural Wetland system to act as a Major water cleansing point for existing drains</li> <li>• Allows better quality of water from inner city to the river</li> <li>• Potential for commercial and public developments in the proximity, and better employment opportunities for local communities</li> </ul>  |





## Socio-economic impacts of proposed locations for Waterfront Promenade

**No. Location Feasibility/Impact**

- 9 Boat Building yard 2
- Existing Boat Building yard which can be developed as an experiential area
  - Connection to the Mangaladevi Temple
  - Potential for commercial and public developments in the spitland due to improved access
  - Better employment opportunities for local communities of the city



**No. Location Feasibility/Impact**

- 10 Bolar Seaface
- Enhancing of the existing landmarks of the waterfront
  - Adding additional seating spaces and recreational spaces to attract the tourists and local visitors
  - Pedestrian and cycling connection along the promenade
  - Feeder to existing city bus route and proposed Mangala Corniche alignment
  - Enhancing the Cultural Hub development that is proposed as another project in the Phase 1 development



## Site images





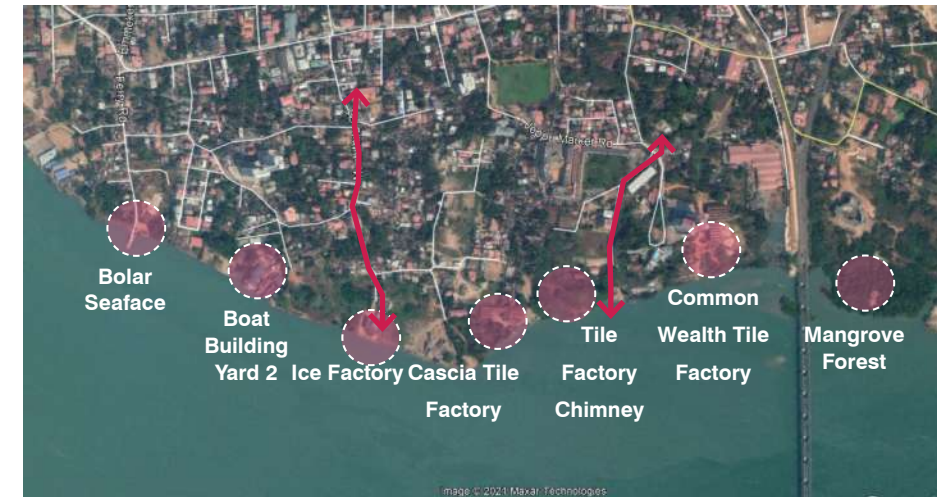
Site images



## xii. Site condition analysis

### Major landmarks & connectivity

Promenade development intends to connect to all major existing and proposed landmarks/nodes. It also will connect to the other major landmarks within the inner city.



### Bathymetry data analysis

At locations where the water depth is shallow, some tangible experiences can be developed. Areas like sandbars which are impacted by fluctuating water levels can be potential conservation sites for flora and fauna



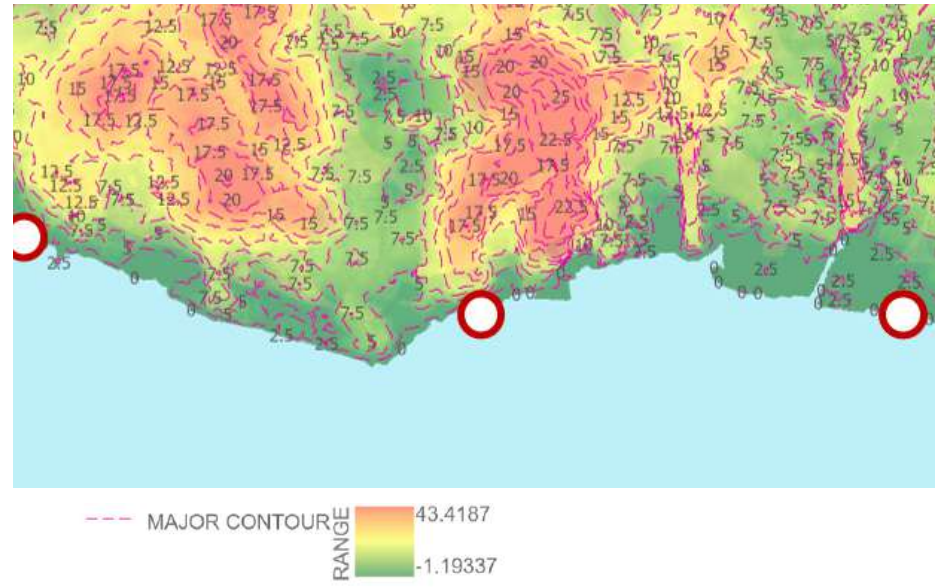
*Note: Bathymetry data from Hoige Bazar to Bunder area has not been made available for analysis*





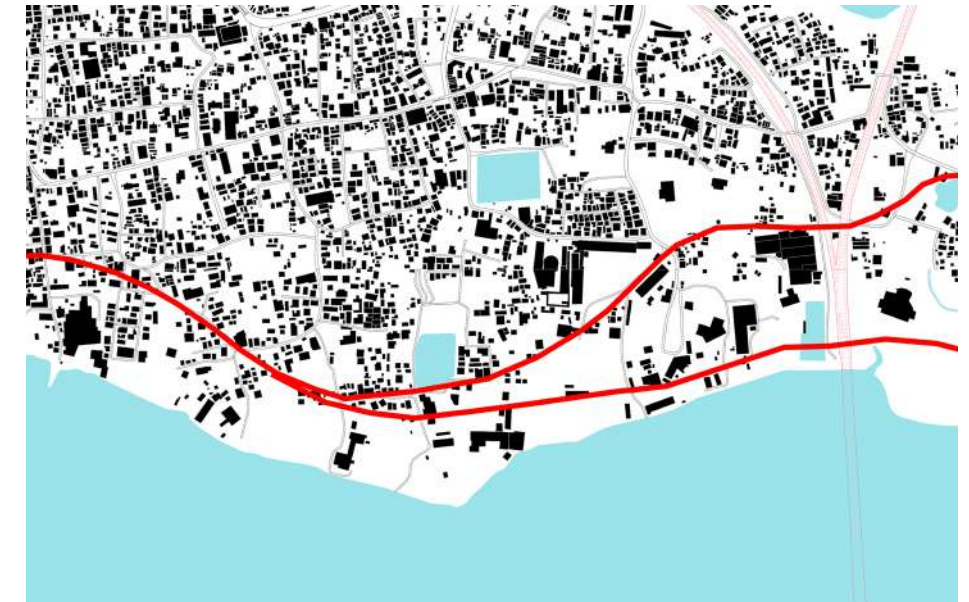
**Contour and DEM analysis**

The city slopes down towards the River allowing for varying experiences due to the changing topography



**Figure Ground**

The figure ground study along the waterfront helps understand the buildings that pose as opportunities and challenges



**CRZ Regulation**

The entire water edge comes under CRZ regulation. The major activities are developed at nodal points considering the CRZ norms.



**Open Space Structure**

The open space structure analysis helps to integrate the open spaces on land with the borrowed expanse of the river.



02

DEVELOPMENT  
PROPOSAL

# i. Assumptions made

- The Waterfront Promenade Development will be finalised after feasibility analysis and OD Survey study.
- The landmarks and nodes will be finalised after the inputs from the final feasibility study and analysis
- The land from the HTL(High tide line) owned by Port Authority/private owner would be made available/acquired to accommodate the waterfront Promenade design
- The minimum width of promenade is based on the Port Authority Land marking, data subjected to cross verification; any further extension will be finalised based on the ownerships and plot boundary determination.

| No. | Location                   | Project proposal for phase 1              |
|-----|----------------------------|---|
| 1   | Netravati Railway Bridge   | Mangrove Board walk                       |
| 2   | Kanara wood Industry       | Bird Watching area                        |
| 3   | Common Wealth Tile Factory | Multi Activity Plaza                      |
| 4   | Jeppu Ferry                | Water Metro Jetty                         |
| 5   | Lobo's River View          | Plaza with Historic Chimney as Marker     |
| 6   | Cascia tile factory        | Kiosks and Activity area                  |
| 7   | Boat building yard         | Boardwalk, River Beach, Wetland Treatment |
| 8   | Ice Factory                | OAT                                       |
| 9   | Boat Building yard 2       | Experiential Boat building yard           |
| 10  | Bolar Sea face             | Public Plaza and landmark development     |

 Pilot stretch

# iii. Land requirement

- In Pilot Stretch Phase, land owned by Port Authority is proposed to be a major aspect for the Waterfront Promenade design.
- Availability of plots/area occupied by individual owners are subject to confirmation.



# iv. Promenade design proposal

## Proposed development & programs

The Promenade design aims to provide better open space infrastructure and activated public spaces for the city along the river edge. The promenade will act as a front yard of the mainland & connect the river to the city. The landmarks and nodes connect back to the city through pendant connections. This will integrate with the network system of the city. The landmarks and nodes will have the following programs:

- Mangrove Park
- Bird Watching area
- Ticketing counters
- Shop/cafe area
- Toilets
- Cycle track
- Pedestrian Pathway
- Car Park
- Plazas
- Board walks
- Rain Shelter
- Outdoor Gym

## Statutory regulations applicable

### Master Plan 2021 Mangalore

The Master Plan provides planning and development guidelines for the perspective population of 2021 of Mangalore city. The Zonal Regulations and their enforcement stipulated in the master plan ensure proper land use and development control and form an integral part of the Master plan for Mangalore. It also ensures solutions to problems of developments under local conditions.

### NBC, India

The standardised norms in the NBC guide construction of most types of buildings and lead to safe and orderly development of buildings. A building code is a set of norms that govern construction of buildings by stipulating minimum standards. The codes are intended to further safety, welfare and health of the residents of a building. According to NBC India, workmanship and the materials used in construction should confirm to the Bureau of Indian Standards specification. Buildings should be certified for safety against natural disasters by architects and structural engineers. The building code of India also promotes the usage of new and innovative materials and methods in building technology.

### Coastal Regulation Zone Notification 2019

The the purpose of this regulation is to conserve and protect the coastal areas and marine waters. Mangalore has regulation zones that fall under the classification of CRZ IA, CRZ IB, CRZ II, CRZ IVA and CRZ IVB. The detailed CRZ notification has been attached as an annexure to this document.



## Conceptual drawings

The Promenade development is envisioned as a public open space which will host a series of activities that will act as landmarks and nodes along the river front. A pedestrian and cycling network will flow throughout the Waterfront development. The promenade will not only be the first open space structure development in the city, it will also improve the connect to the river and the sea. This will result in greater revenue generation as the area surrounding the waterfront development will be subjected to improved surroundings and the reconnect to the river can open the city to a healthier urban lifestyle.



Programmes are arranged based on the geographical, ecological and socio economical conditions. The programmes are chosen based on the secondary data collected, about the city and its infrastructure. Commercial rentable spaces, experience centres, historic centres, parking lots and other recreational space along the promenade would help generate revenue from the waterfront development.



The "promenade" is 4m - 6m wide which can accommodate pedestrian movement and buggy system. The cycling track is along the pedestrian pathway with parking facility at regular intervals and connects back to the cycling routes proposed within the city.

The activities identified act as landmarks and nodes at various intervals along the waterfront development. These are directly accessible from the pedestrian and cycling paths along the promenade. The provided parking area facilitates the city to access the waterfront. Further the pendant connects a commuter back into the inner city.





## Conceptual design development



| No. | Location                   | Project proposal for phase 1              |
|-----|----------------------------|---|
| 1   | Netravati Railway Bridge   | Mangrove Board walk                       |
| 2   | Kanara wood Industry       | Bird Watching area                        |
| 3   | Common Wealth Tile Factory | Multi Activity Plaza                      |
| 4   | Jeppu Ferry                | Water Metro Jetty                         |
| 5   | Lobo's River View          | Plaza with Historic Chimney as Marker     |
| 6   | Cascia tile factory        | Kiosks and Activity area                  |
| 7   | Boat building yard         | Boardwalk, River Beach, Wetland Treatment |
| 8   | Bolar Sea face             | Public Plaza and landmark development     |

In pilot phase the promenade development will include several functions that will not only attract tourism but also help in generating revenue, The project proposal for phase 1 includes a series of points of interests along the promenade. These landmarks will bring out the character of the city of Mangalore along with making the river as the face of the city.

Following are a series of mood images representing the promenade proposal design intent



Pedestrian pathway



Jetty



Cycling track



Plazas



Pavilion



Food Kiosks

## Conceptual design development - Waterfront Promenade



### PROMENADE STRUCTURE PLAN PROPOSED NODES

- 01.MANGROVE PARK
- 02.BIRD WATCHING AREA
- 03.JEPPU FERRY
- 04.TILE FACTORY
- 05.SOUTH POINT
- 06.WETLANDS
- 07.BOLAR SEA FACE

### EXISTING LANDMARKS

- 08.NETRAVATI RAIL BRIDGE
- 09.KANARA PLYWOOD FACTORY
- 10.COMMONWEALTH TILE FACTORY
- 11.MANGALORE CLUB
- 12.TVS FACTORY
- 13.JEPPU TILE WORKS RUINS
- 14.CASCIA TILE FACTORY
- 15. ICE FACTORY

- KML PORT AUTHORITY BOUNDARY
- ETS PORT AUTHORITY BOUNDARY
- HIGH TIDE LINE



Netravati Rail Bridge area - Proposed Mangrove park



Netravati Rail Bridge area - Proposed Mangrove park



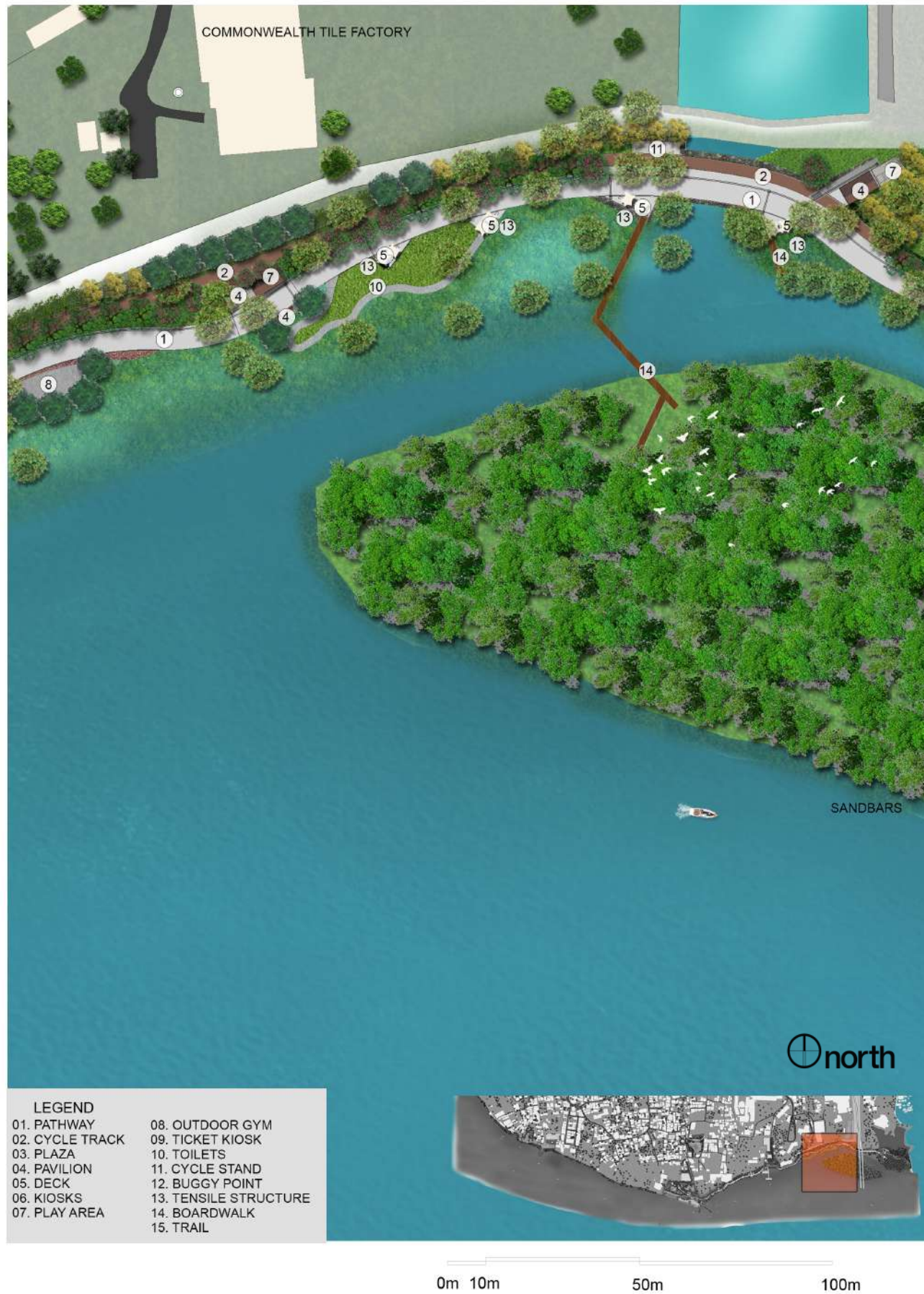
VIEW - 5



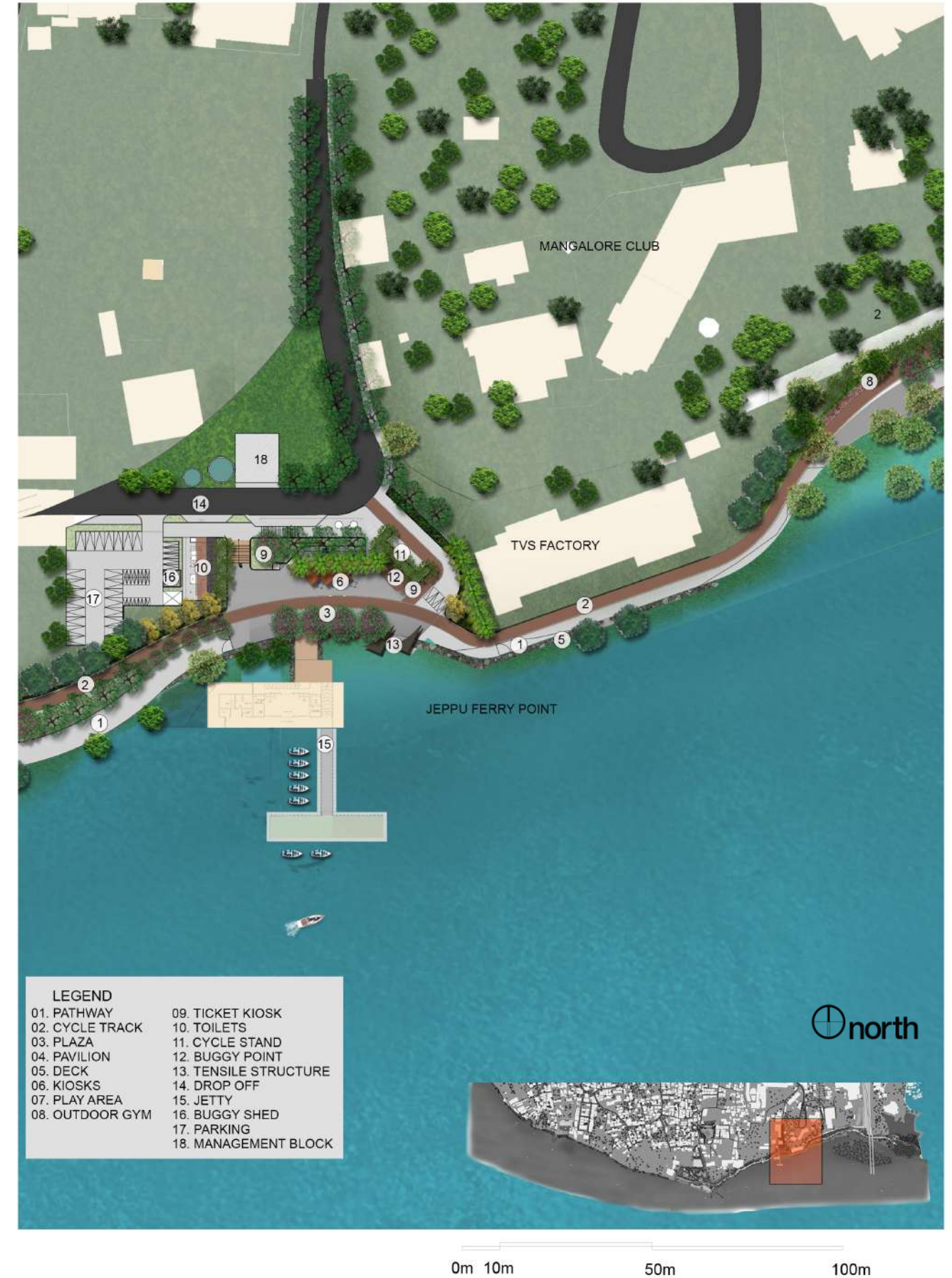
VIEW - 6



Commonwealth tilefactory area - Proposed bird watching zone



Jeppu Ferry point - Proposed plaza around ferry point





Jeppu Ferry point - Proposed plaza around ferry point

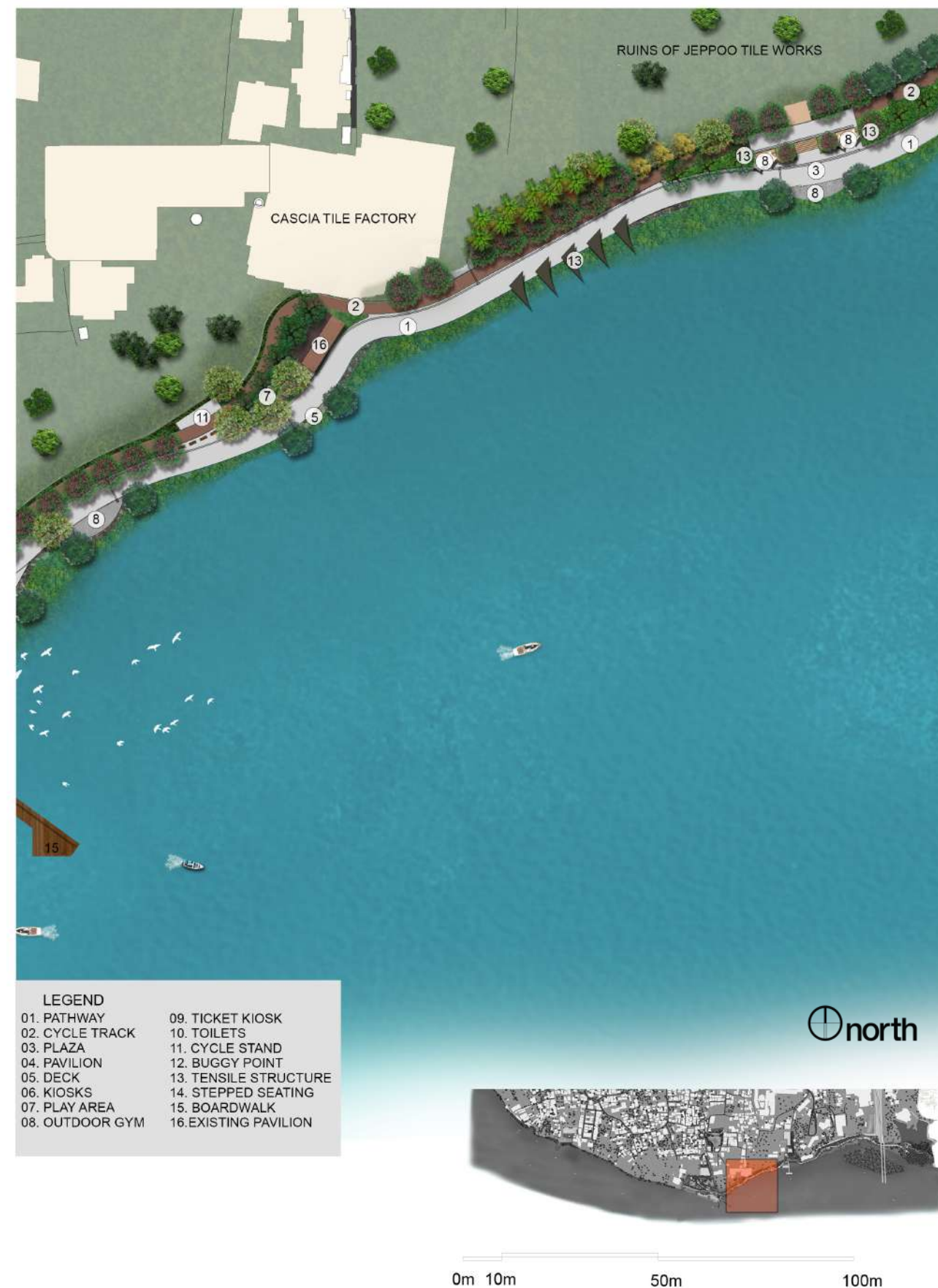


VIEW - 3



VIEW - 4

Cascia Tile factory area - Proposed recreational spaces with Near Historic Markers





## Boat building yard - Mangaladevi Connect to South point and Major recreational hub



## Boat building yard - Mangaladevi Connect to South point and Major recreational hub



VIEW - 1



VIEW - 2



## Bolar Seaface - Extending the cultural hub into pedestrian plazas



- LEGEND**
- 01. PATHWAY
  - 02. DROP OFF
  - 03. PLAZA
  - 04. PAVILION
  - 05. TOILETS
  - 06. KATTE
  - 07. BOLAR CULTURAL CENTRE
  - 08. PARKING



03

DEVELOPMENT  
MODEL



## i. Options available

### Development Options

| <b>SL NO:</b> | <b>Operating Model / Project Component</b> | <b>Development and Operations by Authority – Selective Landlord Model</b>                                 |
|---------------|--|---|
| 1             | Infrastructure development                 | Scope of Government Authority   |
| 2             | Operations and Management                  | Government Authority at its cost  |
| 3             | Revenue Sources to Authority               | Entry Fees, Parking Fees, Fees from Cyclists and Morning walkers, Advertising, Leasing of Space for Shops |
| 4             | Stipulating User fee                       | Government Authority  |
| 5             | Role of Private Sector                     | Can be given branding rights if they contribute substantially for upkeep and maintenance of the facility  |

The financial feasibility has been undertaken on the basis of the above approach.

## ii. Suggested model for development

For the promenade project, the model of operation considered is similar to how open spaces are managed by the ULB Administration. However, for the purpose of financial analysis, this project has been considered as a standalone entity.



04

TECHNICAL  
FEASIBILITY



# MEP Design Brief Report



**MAPLE Engg-Design Services (India) Pvt. Ltd.**  
\_ Extract

## Project Brief

The Smart city development in Mangalore for Promenade, consists of multiple building, Kiosks at Ground floor all the building heights of maximum below 15.0Mtrs. from Ground level

| Floors       | Details   |
|--------------|---|
| Ground Floor | Multiple Kiosks, Staff Office, Assemble Areas, Buggy Station, Electrical Rooms, UPS Room, Activity zone, Cycling Track, Cycle Parking areas, Park & open Spaces etc., |

## Public Health Engineering

### • Water Supply And Distribution System

1. Source Of Water
2. Water Requirement
3. Storage
4. Treatment
5. Distribution
6. Green Building Requirements
7. Materials Used

### • Sewerage System

1. Concept
2. Estimation Of Sanitary Sewage
3. Sewage Collection
4. Sewage Disposal
5. Sewage Treatment
6. Basement Drainage

### • Storm Water Management

## Watersupply and Distribution system

### SOURCE OF WATER

Source of water supply is from Municipal / Tanker water to fulfill the water requirement for the resource.

### WATER REQUIREMENT

The water requirement for the Block has been worked out as per National Building Code (NBC - 2016). The requirement is enclosed Water requirement of 15 lts / capita / day demand (5 lts for domestic and 10 lts for Flushing) will be basis for working out for water demand and occupant load of 1 person / 1.5 sq.m shall be considered. (As per NBC)

### STORAGE

The water for domestic usage and firefighting (As per NBC - 2016) is stored in underground sump.

In addition to the underground sump, the domestic and firefighting water (As per NBC-2016).

Underground sump will be 2.0-day demand.

### TREATMENT

Water treatment would be designed based on quality of water. However, it is proposed to treat the water with pressure sand filter, Activated carbon filter, softener and disinfections by chlorine dosage or UV as treatment facility. Based on actual water quality available on campus, further treatment would be suggested during project progressive period.

### DISTRIBUTION

- The water storage is centralized at below ground level with common pump room. It is proposed to have hydro pneumatic system water supply.
- Distribution of domestic and Flushing Water Supply to various Fixtures is by Hydro pneumaticsystem for buildings near Water metro station & gravity system for near ice factor and near Mangrove park interpretation center with minimum pressure of 1.0 bar and maximum of 3.5 bar shall be maintained at Fixture.
- The requirement of distribution system may be classified as Functional and hydraulic. The sizing of the entire distribution network is based on the simultaneous use of fixture unit's demand. A shut off valve is provided within the battery limit of each block, which serves for the purpose of
- Maple Engg-Design Services Pvt. Ltd.,maintenance of any utility. Individual toilets will be provided with main control valve for isolation and maintenance of the same.
- Domestic & flushing water supply to building nearby ice factory will be catered through gravity system.
- Domestic and flushing water supply to building nearby water metro station will be catered through hydro pneumatic system placed in water metro station.
- Domestic & flushing water supply to building nearby Mangrove Park Interpretation Center will be catered through gravity system.
- Air release valve shall be provided as per requirement of the design.

- Flush tank for WC flushing is considered with flushing line form STP.
- Urinals are considered as sensor based flush with domestic water.

### MATERIAL PROPOSED TO USE

Water distribution pipes and fittings shall be CPVC – SDR 11 or SCH-80 for internal areas and SCH 80 PVC pipe will be used in shaft, basement and terrace areas. Valves 50mm dia and below shall be gun metal or brass or CI screwed type ball valve. Valve 65mm dia. and above shall be of double flange type CI or gun metal butterfly valves.



## Sewerage System:

### CONCEPT

The sewerage system of the project is designed as separate sanitary sewer concept, separating the storm water. Two stack systems has been followed with stack venting

### ESTIMATION OF SANITARY SEWAGE

The estimation of sanitary sewage is based on the per capita sewage flow. Although the entire used water from the buildings should contribute to the total flow in sanitary sewer, generally about 85% – 90% of water supply is expected to reach the sewers/STP.

### SEWAGE COLLECTION

- The sewerage system shall be designed as two pipe system as per NBC standards and UIPC-I, with ventilating the soil stack separately.
- All pipes for sewer will be taken up to terrace floor and will be vented at least 1.0 m above occupant level.

### SEWAGE DISPOSAL

- The sewage from the soil stack and waste stack will be taken separately through inspection chamber, gully trap and finally connected modular sewage treatment plant through a network of pipes.
- The minimum diameter of the vertical stack shall be 75 mm for waste and 110 mm for soil lines.
- All fixtures and appliances shall be fully trapped to prevent back flow of foul gases and odor into the toilets.
- The sewer header will be provided with adequate slope (self-cleaning velocity) to achieve the smooth flow in the system.

### SEWAGE TREATMENT:

The sewage treatment plant with Membrane Bio Reactor shall be designed to treat combined sewage (i.e. soil and waste water). The treatment plant shall be compact type housed below ground completely.

The process of treatment shall be divided into three parts.

- Primary Treatment
- Secondary Treatment
- Tertiary Treatment

After the tertiary treatment treated effluent is used for flushing and landscaping purpose. The bypass connection shall be provided from domestic water in case of malfunction of STP to full fill the flushing demand.

The quality of the effluent before and after the treatment process is as follows:

Before Treatment  
 BOD – 300 – 350 mg /lit  
 COD – 600 – 700 mg/lit  
 TSS – 400 mg /lit  
 PH – 6.5 to 7.5

After Treatment for Flushing and Landscaping  
 BOD – less than 10 mg / lit  
 COD – less than 50 mg/lit  
 TSS – less than 10 mg / lit  
 Total Nitrogen – less than 10 mg/lit  
 PH-6.5–8.5

STP proposed for building near Mangrove park interpretation center. Sewerage from building nearby Ice factory, soil and waste pipe network will be connecting to manhole nearby ice factory. Sewerage from building nearby water metro station, soil & waste pipe network will be connected to water metro station STP

### SUBSOIL DRAINAGE

Subsoil drainage system will be provided based on the structural consultant's report.

### STORM WATER DISPOSAL

Roof rain water: The storm water from sloped roof is free discharge to landscape area.

External Rain water tank:

### SYSTEM DESIGN – Storm water system

- External storm water network will be rcc box drain along the road with openable perforated top slab with recharge well at approximately 35m to 40m c/c.
- Overflow will be connected to the nearby by river.

### Organic waste convertor

For Promenade organic waste will be collected in nearby water metro stations.

## Electrical System

### INDEX

#### SECTION I - ELECTRICAL SYSTEM

- GENERAL
- CODES & STANDARDS
- DESIGN CONCEPTS
- INTENT & SCOPE
- DESIGN CONSIDERATIONS
- SIZING, SELECTION & PROTECTION OF SWITCHGEARS & CABLES
- LOAD ESTIMATION
- GRID POWER
- HT SWITCHGEARS
- HT CABLES
- 11 KV/415 VOLTS TRANSFORMERS
- GENERATORS
- SWITCHBOARDS AND DISTRIBUTION BOARDS
- SHORT CIRCUIT CURRENT & VOLTAGE DROP CALCULATION
- POWER FACTOR IMPROVEMENT & POWER QUALITY ANALYSIS
- TRANSIENT VOLTAGES
- CABLE AND CABLE TRAYS
- SINGLE LINE DISTRIBUTION NETWORK
- LIGHTING SYSTEM DESIGN
- WIRING AND SOCKET PROVISIONS
- EARTHING SYSTEMS
- LIGHTNING PROTECTION SYSTEM

#### SECTION II - SECURITY SYSTEMS

- IP BASED CLOSED CIRCUIT TELEVISION SYSTEMS
- BIOMETRIC ACCESS CONTROL SYSTEM
- BAGGAGE SCANNER - OPTIONAL
- WALK THROUGH METAL DETECTOR – OPTIONAL



## Section 1 - Electrical System

### 1.0 GENERAL

The Smart City Development of Promenade at Mangalore consists Multiple Kiosks & building at Ground Floor.

### 2.0 CODES & STANDARDS

The Electrical system design will conform to the requirements of the following Standards:

- Indian Electricity Rules (Central Electricity Authority).
- National Electrical Code of India.
- National Building Code of India (NBC-2016).
- Applicable standards issued by Bureau of Indian Standards (BIS).
- Energy conservation building code (ECBC 2017).
- Regulations of local fire authorities.
- Requirements stipulated by Pollution Control Board for Noise, Air & Water Pollution.

| Sl.no. | Description                         | IS /IEC Codes  |
|--------|-------------------------------------|--|
| 1      | RMU                                 | IEC : 62271-200                                      |
| 2      | SF6 / VCB circuit Breaker           | IEC : 62271-100                                      |
| 3      | HT Isolators                        | IEC : 62271-102                                      |
| 4      | Metering cubicle                    | IS : 3427  |
| 5      | Dry type Transformer                | IS : 11171, 1985                                     |
| 6      | Oil Type transformer                | IS : 2026, IS : 1180 Part-1, 2014                    |
| 7      | CSS                                 | IEC : 62271-202                                      |
| 8      | Air circuit Breaker                 | IEC : 60947  |
| 9      | Moulded circuit Breaker             | IEC : 60947 -2                                       |
| 10     | Switch Disconnections               | IEC : 60947 -3                                       |
| 11     | Motor protection Circuit Breakers   | IEC : 60947 -1-2-4                                   |
| 12     | Power contactors                    | IEC : 60947-4-1                                      |
| 13     | Distribution Board                  | IS : 13032 ; IEC : 60439-3                           |
| 14     | Protective Devices                  | IS/IEC : 60947-2 ; IS/IEC : 60898 ; IS/IEC : 60947-3 |
| 15     | Miniature Circuit Breaker(MCB)      | IS : 8828- / IEC : 60898                             |
| 16     | Residual Current Protective Devices | IS/IEC : 61009 ; IS/IEC : 61008                      |
| 17     | Degree of Protection (IP)           | IEC : 60529 , IS : 12063                             |

|    |   |  |
|----|---|--|
| 18 | Switchboards assembly   | IEC : 61439(1 & 2) & IS : 8623(1 & 2) IS : 13947 part 1 to 5                                 |
| 19 | Sandwich Bus duct / Rising Main   | IEC : 61439(1 & 6) & IS : 8623( 2), BS : 5486 part 2, IEC : 439-2                            |
| 20 | Phase Cap Energy HD PFC Capacitors & Phase Cap Super Heavy Duty PFC Capacitors  | IEC : 60831-1/2  |
| 21 | Phi Cap PFC Capacitors  | IS : 13340/41  |
| 22 | Square Cap PFC Capacitors   | IS : 13340/41 IS : 13340/41  |
| 23 | capacitor Duty Contactor  | IEC : 60070 and 60831  |
| 24 | Active Harmonic Filters   | IEEE : 519, ER G5/4  |
| 25 | DLM   | IEC : 62053-22 / 21  |
| 26 | Voltmeter/ammeter/Frequency meter   | CE compliance  |
| 27 | Current Transformers  | IS : 2705  |
| 28 | Voltage transformers  | IS : 3156  |
| 29 | Material data for Aluminum  | IS : 5082  |
| 30 | Control Switches (switching devices for control and auxiliary circuit including contactor relays) for voltages upto and including 1000V AC and 1200VDC. | IS : 6895  |
| 31 | HT cables : XLPE-AL&Cu, armoured & unarmoured   | IS : 7098 : Part : 2, 1985   |
| 32 | LT cables : XLPE-AL&Cu, armoured & unarmoured   | IS : 7098 : Part : 1, 1988   |
| 33 | Heavy duty PVC insulated cables   | IS : 1554  |
| 34 | Conductors for cables   | IS : 8130  |
| 35 | Wires & flexible cables   | IS : 694, 2010   |
| 36 | Fire Survival Cables  | IEC : 60331-21, BS : 6387  |
| 37 | Perforated & Ladder cable tray  | cable trays are fabricated out of steel sheets conforming to IS 1079 : 1973 & IS 513 : 1994. |
| 38 | LED Light fixture   | IS : 10322-Part-5/Sec-1  |
| 39 | FRLS PVC conduits   | IS : 9537 Part 3, BS : EN61386 -1 : 2008   |
| 40 |   | IS : 3419 with latest amendment, BS : 4607   |
| 41 |   | IS : 14927 Part 2, BS : EN 50085-2-1 : 2006  |
| 42 | Ceiling Fan   | IS : 374, 1993   |
| 43 | Earthing  | IS : 3043  |
| 44 | Electrical Layouts for Building   | IS : 4648, 1997, NBC-2016  |



|    |   |                                      |
|----|---|--------------------------------------|
| 45 | Lighting for Roads  | IS : 1944 ( Part : I To VII ) - 1981 |
| 46 | Day Lighting of Building  | IS : 2440 - 1875                     |
| 47 | Industrial Building   | IS : 6665, 1997                      |
| 48 | Energy Efficient Street Lighting Guidelines   | BIS : 1981                           |
| 49 | Lightning Protection System   | IS/IEC : 62305-3 & NBC-2016          |
| 50 | Safety procedure and Practices in electrical system   | IS : 5216_Part-1,2, 1995             |
| 51 | Electrical Wiring Installations   | IS : 732, 1995                       |
| 52 | SN4/ SN8 Class Double Wall Corrugated Pipes   | IS: 16098 [Part - II]                |
| 53 | Double Wall Corrugated Pipes  | IS: 14930 [Part - II]                |
| 54 | Switches  | IS : 3854:1997                       |
| 55 | Sockets Upto 25A  | IS : 1293:2005                       |
| 56 | Fan Regulators & Lighting Dimmers   | IS : 11037:1984                      |
| 57 | UPS   | IEC : 62040-3                        |
| 58 | DG set  | IS/IEC : 60034-1, IS : 1460          |
| 59 | Expanding Fire Stop Foam & Fire Stop Motor  | BS : 476-20                          |
| 60 | High voltage insulation mat for 3.3KV,11KV,33KV Voltage   | IS : 15652, 2006                     |
| 61 | Medium voltage circuit breaker  | IEC : 62271-100                      |
| 62 | All relays  | IEC : 255/IS:3231                    |
| 63 | All meters  | IEC : 62053/IS:1248                  |
| 64 | AC metal enclosed switchgear and control gear for rated voltages above 1 kV and up to and including 52 kV | IS : 3427                            |
| 65 | Classification of degrees of protection provided by enclosures of electrical equipment                    | IS : 12063                           |
| 66 | High Voltage Switches   | IS : 9920 (Parts 1 to 4)             |
| 67 | Specification for AC disconnections and earthing switches for voltages above 1000 V                       | IS : 9921 (Parts 1 to 5)             |
| 68 | HV AC Circuit Breakers  | IS : 13118                           |
| 69 | Dimensions of terminals of HV Switchgear and Control gear   | IS : 10601                           |
| 70 | General requirements of switchgear and control gear for voltages exceeding 1000V                          | IS : 12729                           |

|    |   |                                  |
|----|---|----------------------------------|
| 71 | High voltage/Low voltage prefabricated substations            | IEC : 1330                       |
| 72 | Common clauses for MV switchgear standards                    | IEC : 60694                      |
| 73 | Monitoring and control  | IEC : 6081                       |
| 74 | Specification for Static Protective Relays                    | IS : 8686                        |
| 75 | Standards for high voltage metal clad switchgear up to 52 KV. | IEC 62271-200                    |
| 76 | Air cooled reactors   | IEC 60076 / IS 5553              |
| 77 | Thyristor Switching Module Vibration & Shock proof            | IEC 60068-2-6 and IEC 60068-2-27 |

### 3.0 DESIGN CONCEPTS (PERMANENT ELECTRICAL POWER SUPPLY): POWER SUPPLY REGULATIONS AT MANGALORE, KARNATAKA STATE:

Prevailing power supply regulations applicable to this project are as follows:

The peak demand and service voltage at which power supply is made available if drawn from a common feeder servicing more than one installation:

| Sl.No | Peak demand in KVA | Service Line voltage      |
|-------|--------------------|---------------------------|
| a     | Up to 3000 kVA     | 11 kV, 3 Phase, 3 Wires.  |
| b     | Up to 10,000 kVA   | 33 kV, 3 Phase, 3 Wires.  |
| c     | Up to 20,000 kVA   | 66 kV, 3 Phases, 3 Wires. |



INTENT & SCOPE

The design basis report is to highlight the Electrical services considered in the project to meet the best in class design & to meet client needs as enumerated in the brief.

SCOPE OF WORK

- Selection & Sizing of Transformers & with protection switchgears & relays
- Selection & Sizing of Generators and panels with AMF relays
- Selection & Design of LT Switchgear and Motor control centres
- Selection of protection relays and metering arrangements
- Short circuit level calculations to precisely select switchgears
- Voltage drop calculations to ensure the cumulative voltage drop is < 5%
- Maple Engg-Design Services Pvt. Ltd.,
- Selection & Sizing of Bus ways / cables for power distribution
- Selection of light fixtures with lux level calculation
- Selection and provision of utility sockets
- Designing of Emergency lighting through UPS/Inverter Systems
- Selection of system with Harmonic distortion
- Implementation of Transient voltages surge suppressers & surge protection devices
- Selection & Sizing of Effective Grounding system
- Selection of Lightning protection system
- External services with proper trench, DWC pipe, RCC Hume Pipe provisions

DESIGN CONSIDERATIONS

- Voltage system from substation will be 11kV, 3 Ph., 3 Wire, 50 Hz (fault level considered is 350MVA) for the Infrastructure design load of 107KVA load. Secondary voltage system - 415V, 50 Hz, 3 Phase, 4 Wire.
- Sanction/contract demand shall be approx. load is 107kVA.
- Power distribution & substation arrangement as per relevant standards and also as per Power supply company norms.
- HT Isolator as prescribed by Power supply company regulations.
- HT power connectivity using XLPE (E) Aluminium conductor cables of 11 kV to withstand fault levels.
- Oil type transformers to meet norms to work at a loading factor of 90%.
- Diesel generators to provide 100% back up to suit application with variable loads for continuous running.
- IP42/52 switchboards with aluminium bus for power distribution with breakers of suitable kA levels. Also The panels shall suit for high humidity & coastal area requirements.
- Form 3B – For Main LT Panels, AMF Panel & Sub Panels/ Form 3A - MCCs
- Switch gears selection to achieve fault level with discrimination & coordination study
- Armoured and un armoured Aluminium and copper conductor cables for LT distribution to meet fault level and voltage drop <5%.
- Automatic power factor correction close to the loads or centralised based on type of load with detuned filters to improve the power factor.

- APFCR Panels shall be envisaged with active filters to mitigate harmonic distortions.
- Lighting LUX level as per codes and standards.
- Lighting power density and luminous intensity will be designed as per NBC, ECBC and industry standard.
- LED Light fixtures with drivers.
- Emergency Lighting with UPS/ Inverter systems covering 10-15% of the total parking area as well as common utilities.
- Transient voltage suppression using TVSS/SPD's in different distribution levels.
- TNS Earthing systems as per IS & IEEE codes with relevant bonding arrangement of electrodes and electrode sizing & PE conductor to meet fault level.
- Lightning protection system - conventional type technology as per NBC-2016.
- Closure of openings, wall crossing using fire seal material.
- Lighting and power wiring using FRLS wires.
- Industrial and modular type of power receptacles to suit area of use.
- Lighting controls manual/complete automatic with day light sensors.
- Power requirement is considered based on the load matrix shared along with this document.
- Non-conventional sources of Power (Solar) for lighting loads. Solar PV has been planned for approx. 50kW load which will be utilised for common area loads. This is vendor based design the suitable provisions will be made in electrical system
- Total of 2 to 3no's of Electric Car Charging station of 3.5kW each will be provided for EV's.

SIZING, SELECTION & PROTECTION OF SWITCHGEARS & CABLES

- Each circuit is studied in detail, from the rated current of the loads, the level of short-circuit current, and the type of protective device, the cross-sectional area of circuit conductors will be determined, taking into account the nature of the cableways and their influence (de-rating factor) on the current rating of conductors.
- Before adopting the conductor size indicated above, the following requirements are satisfied:
- The voltage drop complies with the relevant standard and it is limited to < 5%
- Motor starting is satisfactory and recommended to use energy efficient IE2 & IE3 motors to reduce losses and save energy.
- Protection against electric shock is assured by providing RCCB & ELR
- Voltage Transient issues are addressed by providing TVSS
- Capacitors with APFCR are envisaged to improve the PF up to 0.99. PF improvement will enable to reduce the power losses in cables & equipment's almost to the tune of 25% - 30% loss reduction. Also improvement in voltage level at load tail end.

7.0 LOAD ESTIMATION

| Sl.No        | Description  | Connected load in kW | Demand Factor | Demand load in kW | Demand load in kVA |
|--------------|--|----------------------|---------------|-------------------|--------------------|
| 1.0          | Internal EB/DG Lighting & General Power Under Lighting Loads   | 19.8                 | 0.8           | 16                | 19                 |
| 2.0          | External/Landscape EB/DG Lighting Loads                        | 30                   | 0.8           | 24                | 28                 |
| 3.0          | Raw Power, for KIOSK loads                                     | 60                   | 0.6           | 36                | 42                 |
| 4.0          | Internal Lighting & Workstation Loads, Printer on UPS/Inverter | 4.5                  | 1.0           | 5                 | 5                  |
| 5.0          | The Misc. Loads (Car Charging, External Driveway Lighting)     | 25.0                 | 0.5           | 12.5              | 13.2               |
| <b>Total</b> |  | <b>120</b>           |               | <b>77</b>         | <b>107</b>         |

GRID POWER

It is intended to bring in 11KV Power to the facility from the nearest substation provisioned by local Power supply company. The tapping substations and routing, route length, cable sizes will be detailed & feasibility report to be prepared by local Power supply company upon making application Present regulation restricts power supply on 11kV up to 107kVA which needs to be drawn at 11kV.

HT SWITCHGEARS

- A. 11KV RING MAIN UNIT with GOS
- The DP Spun Pole Structure unit proposed is with Isolator as incomer and outgoing.

HT CABLES

Based on Local Power supply company feasibility study and recommendation, HT cable size of 3Cx95.0Sq.mm will be considered.

The cable selection will be based on system fault level (in MVA), this is generally confirmed by the power supply company under feasibility study, else standard fault level will be considered.

11 KV, XLPE (E), Aluminium conductor cables are proposed to be laid underground protected with Trench / RCC Hume pipes/DWC Pipes.



(TYPICAL IMAGE OF HT XLPE CABLE)





**11 kV/415 VOLTS TRANSFORMERS**

The proposed transformer shall be 11KV/433V, Oil type, high efficient, oil cooled Transformers having

Off Load Tap Changing arrangement is recommended to cater complete building as indicated in the load matrix.

The Losses & Impedance of Distribution Transformer selected as per ECBC / IS:1180.

Transformer shall be 5 Star rated as per IS 1180.

The Transformer will be sized to operate @ 90% load or lower to ensure lower load losses.

The total number of Transformers and Rating envisaged are as follows

| Description                      | Numbers                                 |
|----------------------------------|---|
| Transformer Capacity and numbers | 2 Nos of 63 kVA at difference locations |
| Primary voltage System           | 11 KV                                   |
| Secondary voltage system         | 415 V                                   |

**Note: During Detailed design & Tender Stage we shall cross check if the power is fed from nearby water metro station or Bolar Sea Face, as per the requirement the transformers & its locations will be considered.**

**CEIG/MESCOM Requisites:**

CEIG/MESCOM\_Requisites:

1. The transformer can be oil filled or dry type depending on requirements. In indoor installations, installations under stilts, rooftop and underground installations the transformer shall be only dry type.
2. The transformer shall conform to relevant IS.
3. The transformers shall be suitable for continuous operation at rated MVA on any taps with voltage variation to meet the system requirement.
4. The maximum losses of oil filled distribution transformers shall not exceed as that for at least BEE-III (5star rated) transformer specified by Bureau of Energy Efficiency (BEE)

| Standard losses in watts up to 11 KV Class (For ratings above 200 kVA) |                     |                   |                    |                   |                    |                   |                    |                   |                    |                   |                    |
|--|---------------------|-------------------|--------------------|-------------------|--------------------|-------------------|--------------------|-------------------|--------------------|-------------------|--------------------|
| Rating (kVA)   | Per Cent. Impedance | Star 1            |                    | Star 2            |                    | Star 3            |                    | Star 4            |                    | Star 5            |                    |
|  |                     | 50 Per Cent. Load | 100 Per Cent. Load | 50 Per Cent. Load | 100 Per Cent. Load | 50 Per Cent. Load | 100 Per Cent. Load | 50 Per Cent. Load | 100 Per Cent. Load | 50 Per Cent. Load | 100 Per Cent. Load |
| 250  | 4.5                 | 980               | 2930               | 920               | 2700               | 864               | 2488               | 811               | 2293               | 761               | 2113               |
| 315  | 4.5                 | 1025              | 3100               | 955               | 2750               | 890               | 2440               | 829               | 2164               | 772               | 1920               |
| 400  | 4.5                 | 1225              | 3450               | 1150              | 3330               | 1080              | 3214               | 1013              | 3102               | 951               | 2994               |
| 500  | 4.5                 | 1510              | 4300               | 1430              | 4100               | 1354              | 3909               | 1282              | 3727               | 1215              | 3554               |
| 630  | 4.5                 | 1860              | 5300               | 1745              | 4850               | 1637              | 4438               | 1536              | 4061               | 1441              | 3717               |
| 1000   | 5                   | 2790              | 7700               | 2620              | 7000               | 2460              | 6364               | 2310              | 5785               | 2170              | 5259               |
| 1250   | 5                   | 3300              | 9200               | 3220              | 8400               | 3142              | 7670               | 3066              | 7003               | 2991              | 6394               |
| 1600   | 6.25                | 4200              | 11800              | 3970              | 11300              | 3753              | 10821              | 3547              | 10363              | 3353              | 9924               |
| 2000   | 6.25                | 5050              | 15000              | 4790              | 14100              | 4543              | 13254              | 4309              | 12459              | 4088              | 11711              |
| 2500   | 6.25                | 6150              | 18500              | 5900              | 17500              | 5660              | 16554              | 5430              | 15659              | 5209              | 14813"             |

**GENERATORS**

415V, LT Generators are considered to cater 100% power back up during EB power failure.

107 kVA DG sets, (With enclosure) will be considered with Outdoor Type acoustic. These are proposed and located in Site Plan Level. DG Power distribution scheme is designed to operate DG sets with AMF Logic. DG Sets shall be specified below to cater power to the proposed facility in the event of grid failure.

The total number of DG's and Rating envisaged are as follows

| Description             | Numbers                               |
|-------------------------|---------------------------------------|
| DG Capacity and numbers | 63kVA x 2 No's at different locations |
| Voltage system          | 415 Volts                             |
| DG configuration        | N                                     |

**Note: During Detailed design & Tender Stage we shall cross check if the backup power is fed from nearby water metro station or Bolar Sea Face, as per the requirement the DG's & its locations will be considered.**



**(TYPICAL IMAGE FOR DG SET WITH ACOUSTIC ENCLOSURE)  
EXHAUST PIPE STACK**



The DG exhaust/Flue pipes will be routed through the dedicated standalone stack. These DG exhaust pipes will be terminated at 10-12 Mtrs. from Finish Ground level as prescribed in latest CPCB/KSPCB norms.

**VENTILATION SYSTEM**

Since DG sets are located in Site level which is open to air, hence no problem for fresh air & hot air ventilation system.

**13.0 SWITCHBOARDS AND DISTRIBUTION BOARDS**

LT panels are planned to be located in Main Electrical Room at Ground Floor. Switchgear selection will be made after making curve simulation and considering relevant features viz., metering, communication, harmonics analysis etc.,

- Selection of switchgear based on discrimination and co-ordination.
- Short circuit level study from secondary of the Transformer up to all loads.
- Curve simulation before selection of switchgear to understand the setting and selection.
- Characteristics of breaker while selection.
- Selection of switchgears based of protection and releases
- Selection of switchgears based on Short circuit current ratings
- Selection of switchgears based on applications and type of loads viz, Motor, lighting, UPS.
- Form 3B – Main panels, AMF Panels, Sub Panels/ Form 3A – MCCs, All Panels shall suit the Costal area requirements.

Switchboards and DB's are planned to be locate in Electrical Room at ground floor for common area

Lighting, Emergency Lighting & Raw Power distribution.

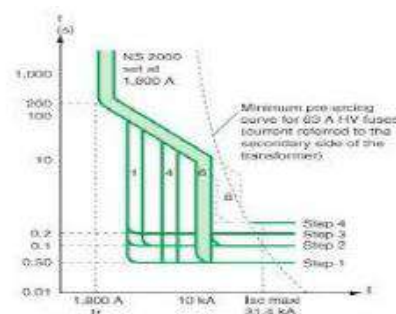
Switchboards envisaged are with Aluminium bus bar for lighting, HVAC and utility feed.

Switch boards are Compact, Indoor type with max IP42/52.

All Panels are provided with Digital Multi Meters to record kWh, kVA, kVAR and other parameters including line and phase current and voltages. Main LT Panel & Tenant feeders will have Dual kilo watt hour meters. Voltage reference cable shall be bought to the DKWH Meters from the DG panel



Upon Coordination and discrimination study we understand whether the co-ordination is partial or complete. Based on this the feeder / outgoing breakers ratings will be finalised / concluded.



**DISTRIBUTION BOARDS**

Distribution boards are envisaged for final distribution. The selection of distribution boards will be based on type of loads and number of final circuits.

Phase segregated distribution boards will be used for Power and lighting applications with different curve MCB's.

- RCCB's with 100mA with suitable current ratings are proposed for power socket sub distribution
- RCCB's with 30mA with suitable current ratings are proposed for lighting sub distribution
- MCB's with Curve "C" with suitable current ratings are proposed for lighting loads
- MCB's with Curve "C" with Suitable current ratings are proposed for power and motor loads
- MCB's with Curve "D" with suitable current ratings are proposed for UPS and Emergency lighting loads.
- Type-A RCBO shall be considered for Lift motors (For Machine Room Less lifts).



TYPICAL IMAGE FOR DISTRIBUTION BOARD

**SHORT CIRCUIT CURRENT & VOLTAGE DROP CALCULATION**

Load flow, Short circuit & voltage drop will be calculated based on the connected load/maximum demand and length of the feeder. Design will be done such that at the farthest point or load tail end level voltage drop will be limiting to 5%. Discrimination & coordination study will be done for each &

every circuit and panels by using software and ensure to achieve total / partial discrimination & coordination based on criticality in circuit distribution Upon study we understand whether the coordination is partial or complete. Short circuit and voltage drop study considering lengths of bus ways and cables will be made and settings for each breaker are arrived to ensure the network is healthy and only the faulty zone trips in the event of short circuit. Circuit breakers selected will be with inbuilt over current, short circuit and earth fault protection and settable. Switchgear co-ordination will address higher continuity of power supply. Microprocessor based switchgear will be selected to ensure higher bandwidth for setting and higher features protection. Plug-in type circuit breakers will be selected for UPS input and output panels for easy maintenance.

**15.0 POWER FACTOR IMPROVEMENT & POWER QUALITY ANALYSIS**

To ensure users get good quality of power and better voltage regulation the below mentioned system is envisaged

- Power factor improvement
- Containing Harmonic Distortion
- Transients

Power factor will be improved at final circuit levels / load end to contain the effects lower power factor on network from the load point.



TYPICAL IMAGE FOR CAPACITOR BANKS AND FILTERS

Capacitor switching is envisaged with capacitor duty contactor and not through Thyristor based as the loads are almost constant & there would not be major fluctuation, dynamic (Thyristor) switching is not envisaged.

Capacitor banks of different rating to operate at 415 V and to withstand up to 500 V will be envisaged.

Switching relays will be used for auto switching of capacitor banks. Capacitor banks will be operating only during grid power availability. Capacitor banks will be sized on highest and lowest inductive loads to ensure precise switching. Active filters are envisaged to mitigate harmonic distortion to possible extent of 95%. Also only the following loads will have power factor improvement.

- AHU loads – if not provided with VFD's
- PHE pumps with VFD
- Motor loads
- Ventilation system if not with VFD's
- STP loads
- External Lighting – if with LPF ballasts

3. Use of Surge and lightning protection.
4. Minimizing the voltage drop by choosing higher size conductor.

**TRANSIENT VOLTAGES**

The power supply equipment may consist transients over / under voltages for short time which may result from faults, motor starting, switching operations, lightning disturbances etc., As such it is intended to provide TVSS (Transient voltage surge suppressor) or Surge protection devise in the circuit.

Transient voltage surge suppressors will be envisaged at different levels in distribution arrangement to safe guard the capital and sophisticated equipment's.

It is suggested to conduct power quality audit, thermal imaging to understand and carryout the improvement wherever necessary after occupation.



There are two main methods to improve the power quality

1. Passive method
2. Active Method.

Passive Method employees following devices.

1. Passive Shunt LC filters
  2. Power factor correction capacitors
- Maple Engg-Design Services Pvt.Ltd.,  
Active Method employees following devices.

1. Active filters.

Some of the General methods to improve P.F are:

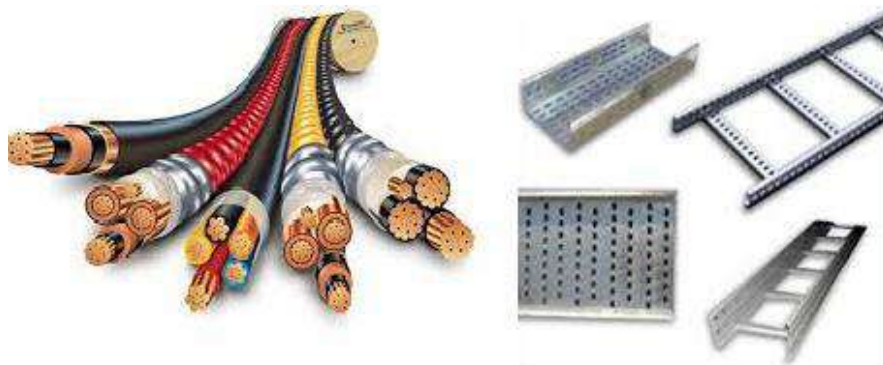
1. Segregation of sensitive load on separate branch circuit to be fed from separate feeders.
2. Use of harmonic rated circuit breakers.
3. Use of Surge and lightning protection.
4. Minimizing the voltage drop by choosing higher size conductor.



TYPICAL IMAGE FOR TVSS FOR DIFFERENT APPLICATIONS

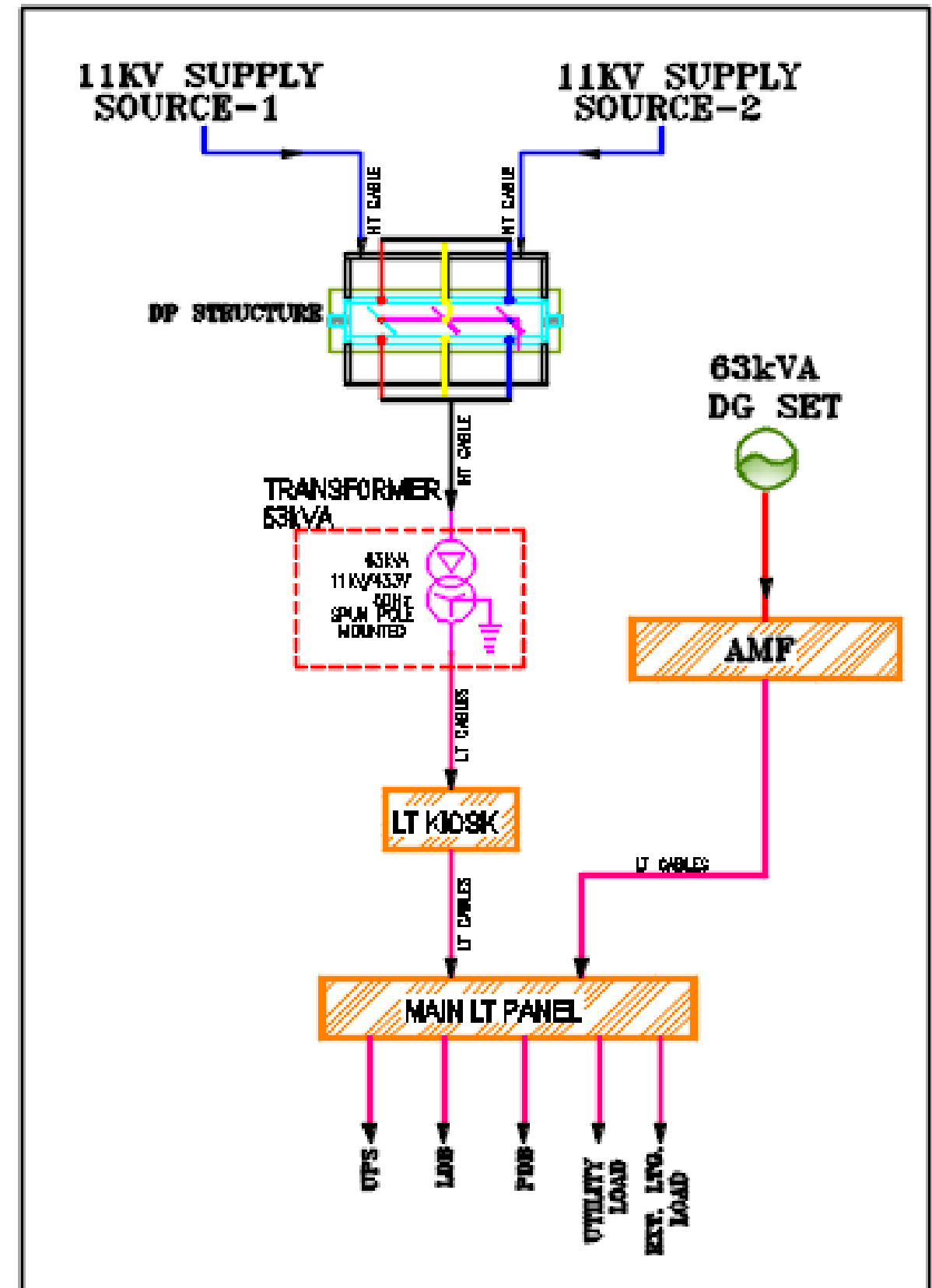
CABLE AND CABLE TRAYS

The power distribution from Main LT panel all sub panels/ Feeders and for distribution boards shall be connected through Armoured Al/Cu conductors laid through Ladder / Perforated type cable trays. Sizing of the cable is based on load, voltage drop and short circuit current carrying capacity. Hot dip galvanised cable trays will be used for running the cables for connectivity.



SINGLE LINE DISTRIBUTION NETWORK – BLOCK DIAGRAM

**SCHEMATIC BLOCK DIAGRAM FOR PROMENADE**





LIGHTING SYSTEM DEISGN

It is quite difficult to maintain the switching operations in multiple areas of the building. As such it is intended to opt for day light sensors which shall be address the auto switching operation of lights.

Based on zoning – override switches will be envisaged for ease of operation. With this arrangement it is possible to achieve different percentage of lighting. Lighting system design is based on the guidelines and LUX range given in the following matrix.

| Sl. No: | Area                             | Lux level |
|---------|----------------------------------|-----------|
| 1       | Parking area                     | 20-30     |
| 2       | Entry Area                       | 200-250   |
| 3       | Kiosks                           | 150-200   |
| 4       | Landscape, Pathways              | 30 - 50   |
| 5       | Cycle Track                      | 50 - 80   |
| 6       | Office, Ticket Counter,          | 300       |
| 7       | Toilets / Rest room              | 150-200   |
| 8       | Electrical Panel /Services Rooms | 250-300   |
| 9       | External Driveway lighting       | 15- 20    |

Following are the illumination levels as per standards

LIGHTING CONTROL SYSTEMS

Lighting control will be done through modular switches and MCB Control OR Switch Control. Occupancy sensors shall be provided on all rest rooms; other areas will be included based on the client requirements for specified areas. Following are the type of control based on area.

- Corridors – Lighting control with day Light Sensors & Switches.
- Cafeteria – Lighting control with day Light Sensors & Switches
- Service areas / Kitchen /Store rooms – Modular switches
- Rest Rooms – Switches / Occupancy sensors

A. EMERGENCY LIGHTING DESIGN

Emergency lighting will be envisaged by centralised inverter with minimum backup.

In the event of grid failure and delay in generator starting around 10-15% of overall common area lighting will be envisaged through inverters for emergency condition.

Considering the 100% DG Backup, the Backup considered for inverter is 15 minutes.

EXTERNAL LIGHTING

External lighting and landscape lighting will be engineered (distribution, cable sizing based voltage drop calculations etc.,) as per the design requirements of landscape design consultants.

Either programmable controllers / timers will be envisaged to have auto control / switching operations.



(TYPICAL IMAGE FOR INVERTER)

WIRING AND SOCKET PROVISIONS

Multi strand, PVC insulated FRLS copper conductor flexible wires of 1100V grade will be used in 2mm thick FRLS PVC conduits for lighting circuits, power circuits and light point wiring.

Based on type of light fixtures / connectivity the point wiring will be terminated to suitably rated terminals or terminated to holders. Cable end connection and proper cable notation will be done as per the wiring regulations.

GENERAL POWER SOCKETS FOR OFFICE AREA & COMMON AREAS

General power sockets outlets are considered for below applications.

- Hand driers in Toilets / Wash areas
- Sensor based urinals – if any
- Control rooms and electrical rooms
- Corridor Area– for cleaning purposes will be considered.
- Facade cleaning system – If found necessary
- External landscape area - If found necessary
- For building maintenance needs – based on specific requirements.

21.0 EARTHING SYSTEMS

TNS system of earthing will be followed which will be suitable for coastal areas. Neutral at service entrance will be bonded and grounded as per IS 3043. The grounding system electrode mass at base build design shall be designed to meet / address fault level for 1 Sec.

- Grounding system will be envisaged as per IS 3043, confirming to TNS system, connecting to existing earthing system.
- The system will be suitable for derived neutral system wherever the Isolation transformers have been used.
- Protective conductors shall be sized to cater to calculated fault levels. Dedicated earth pits shall be provided for following equipment's & All the pits design shall be as per IS 3043
- Transformer yard - Body & Neutral earthing
- Diesel generator - Body & Neutral earthing
- Communication / EPABX earthing
- Lightning arrestor
- Body earthing for various other electrical equipment's shall be considered.

In India TNS system is widely recommended and used. But in most of the cases we end up doing TT system which leads to creating earth potentials. Also in TNS system the exposed conductive parts are bonded with neutral at service entrance to ensure the adequate current flows and trips the distribution devices.

Wherever the system is DERIVED will have dedicated electrodes, for all NON-DERIVED systems there shall not be provided with dedicated electrode either for body or neutral.

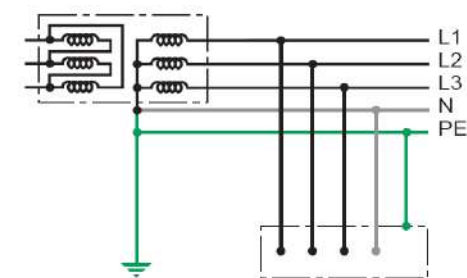


Diagram 1a - "TN-S system"

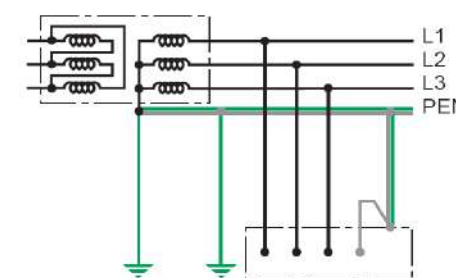


Diagram 1b - "TN-C system"

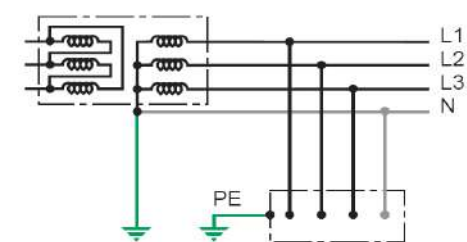


Diagram 2 - "TT system"

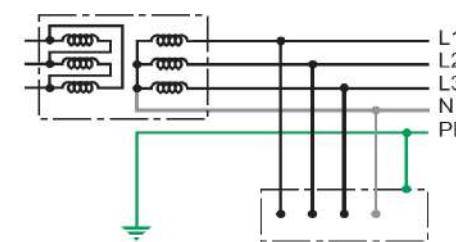
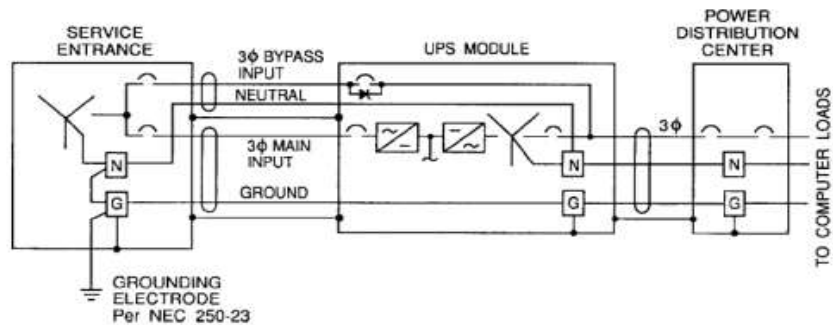


Diagram 3 - "IT system"

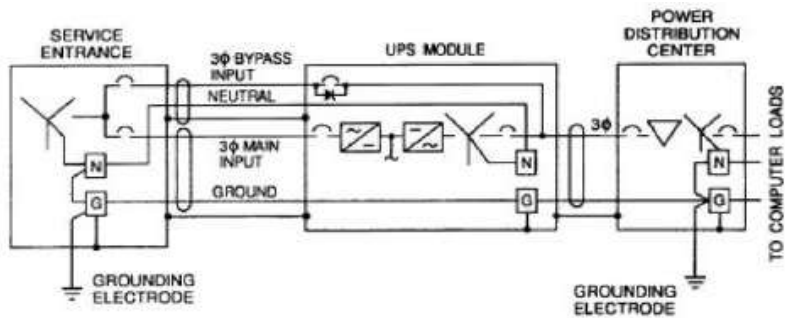


NON-DERIVED SYSTEM



In this system the end user is using the service entrance Neutral through static switch by enabling the bypass, as such there is no need to have a dedicated neutral. Only the PE (protective earth) is extended to UPS system and connected to the body of the UPS system.

DERIVED SYSTEM



In this system – the user is having an Isolation Transformer and is using the service entrance Neutral, as such a local electrode shall be installed as indicated in the diagram. With this TNS and IS 3043 recommended practice it is possible to reduce number of dedicated electrodes for each user. This would make the earth practice and system very healthy and provides least resistive path for all fault currents.

LIGHTNING PROTECTION SYSTEM

FARADAY CAGE TYPE

Need for lightning protection is established as per the guidelines in IEC: 62305. The risk assessment is where type of damage is distinguished as the consequence of lighting.

- Injury to living beings
- Physical damage
- Failure of internal systems.

The Risk management will be carried out and need of protection will be calculated.

The External LPS system consists of

- Air termination system
- Down conductor system
- Earth termination system

Air termination system: The role of air termination system is to capture the lightning protection discharge current and dissipate it harmlessly to earth termination system. The three basic methods recommended for determining the position of the air termination system.

- The rolling sphere method
- The protective angle method
- The mesh method

As per mesh method for different air termination mesh sizes are defined.

| Class of LPS | Mesh size |
|--------------|-----------|
| I            | 5 x 5     |
| II           | 10 x 10   |
| III          | 15 x 15   |
| IV           | 20 x 20   |

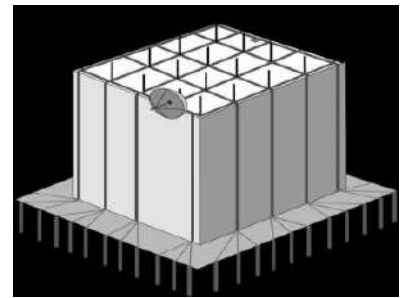
The vertical air conductors or strike plates should be mounted above the roof and connected to the conductor system beneath. The air rods should be spaced not more than 10m apart.

Down Conductors:

The down conductors spacing should correspond with the relevant class of LPS. The minimum size of horizontal and down conductors envisaged with 25x3 mm GI flat. Down conductors shall be concealed through peripheral columns & will be dropped in appropriate locations and further interconnected with structural /foundation earthing.

Earth termination system:

The earth termination system is a vital for the dispersion of lightning current safely and effectively into the ground.



Conventional lightning protection system

Approvals and Sanctions

The list of approvals, sanctions & NOCs required for the installation and operation of various electrical systems are given below:

- Electrical Inspectorate approval for substation.
- Electrical Inspectorate approval for building electrification.
- Electrical inspectorate approval for standby DG sets.
- Pollution Control Board's consent for installation of DG sets
- Inspectorate approval for the lift installation.
- Power Sanctions from Utility
- Power supply sanction from Local Electricity Board.

Material Description:

| Sl.no | Item Description            | Material  |
|-------|-----------------------------|---|
| 1     | HT Cable                    | 11kV, XLPE Aluminium, flat/round armoured   |
| 2     | LT Cables                   | 1.1kV, XLPE Aluminium, flat armoured  |
| 3     | Control Cables              | 600 Volts , XLPE armoured/Unarmoured Copper   |
| 4     | Wires                       | 600 Volts, Flexible FRLS wires / Flexible ZHFR wires  |
| 5     | MCB DB                      | Double door, MS powder coated   |
| 6     | Cable Trays                 | GI - Pregalvanized  |
| 7     | Earthing                    | Conventional & maintenance Free Earth Pits  |
| 8     | Lightning arrestor system   | Integrated type lightning arrestor system exposed in periphery of the building with copper bonded steel conductor |
| 9     | UPS                         | Conventional Type : IGBT rectifier  |
| 10    | Switchgear : MCB, MCCB, ACB | Standard features- NON IOT  |
| 11    | LT Panels                   | Aluminium Bus Bar, enclosure MS powder coated   |
| 12    | Distribution Transformer    | Copper Wound, enclosure MS powder coated  |
| 13    | Conduits                    | FRLS PVC Conduits   |



SECTION II - SECURITY SYSTEMS  
(Conduit Provisions Only)

The facility shall be envisaged with the following for security of the users, building and equipment's.

IP BASED CLOSED CIRCUIT TELEVISION SYSTEMS (CCTV)

The primary objective of implementing a CCTV system is to ensure effective surveillance of complete Site, reception, Lift lobby, entry and exits for 24-hour surveillance/deterrence, real time recording and viewing.

The closed circuit television system (CCTV system) shall provide an on-line display of video images on monitor. Cameras with suitable lenses shall be used to view specific areas of interest. It is considered to integrate CCTV system with IBMS system.

Provisions for Fixed Cameras at Lobby, entry & exit gates are provided for continuous operation.

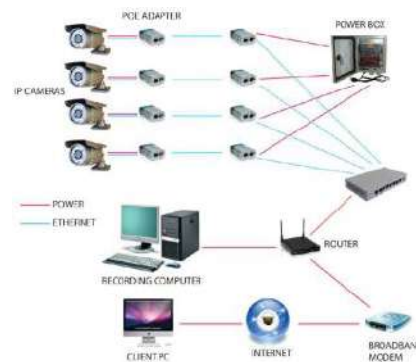
The system will be placed in security room or in control room for easy monitoring, the system includes,

- Dome Cameras
- Network Video recorders
- Servers
- Monitors
- Network switches
- Racks
- Keyboard controllers and other associated accessories.

For all the above said the required electrical provisions will be made. Video management software will be installed in the computer which monitors and controls the camera will have the following features.

- Record Video streams, and audio continuously
- Trigger recording based on alarm input, motion detection
- Set Record time interval for each day of a week
- Recorded information on the entire network
- Password protected access to recorded video based on the authorization level
- Simple integration of cameras and storage media
- Simple integration to various systems in the application platform
- Following areas shall be considered for CCTV surveillance.

- Main Entrance Lobby.
- DG and Transformer Yard.
- Entry and Exit Points.
- Staircases and all lift lobbies.
- Terrace area.



BIOMETRIC ACCESS CONTROL SYSTEM

BIOMETRIC ACCESS CONTROL SYSTEM

Today biometric access control system is widely used in areas where entry is restricted to few.

Finger print identification type biometric is envisaged for controlling the access since card-based access system will control the access of authorized pieces of plastic, but not who is in possession of the card. Systems using PINs require an individual only know a specific number to gain entry, but who actually entered the code cannot be determined.

Hence the finger print identification type biometric is envisaged at Main entry, because biometric property is an intrinsic property of an individual, it is extremely difficult to duplicate or share. Biometric identification can provide extremely accurate, secured access to information. For the same Provisions shall be made.



BAGGAGE SCANNER - OPTIONAL

The X-Ray Baggage Scanners located at entrance lobby or reception. Baggage scanner detects organic and inorganic items such as weapons, explosives and narcotics using unique 6 colour software which significantly enhances the operator's ability to identify suspicious items. It uses a high-resolution x-ray detector array that increases detection sensitivity, improves image resolution. For the same Provisions shall be made.

WALK THROUGH METAL DETECTOR - OPTIONAL

The system proposed will be single & multi zone metal detectors for high degree of metal detection. Walk through metal detectors will detect both ferrous & nonferrous metals concealed on a person in any possible manner including metals concealed in ferrite containers. The system gives audio & visual indications. For the same Provisions shall be made





05

FINANCIAL  
FEASIBILITY



## i. Project development cost

The project involves development of the promenade with the following components.

| Sl. No.    | Description of work   | Amount<br>INR Lakh |
|------------|---|--------------------|
| <b>I</b>   | <b>LANDSCAPES</b>   |                    |
| 1          | Dismantling structure & Jungle cleaning   | 4                  |
| 2          | Promenade - 1.2 km & Jeppu ferry  | 990                |
| 3          | South point   | 630                |
| 4          | Mangroves   | 111                |
| 5          | Bolar sea face & OAT  | 266                |
| 6          | Non Schedule Item   | 59                 |
| 7          | Softscape   | 722                |
| 8          | Irrigation  | 90                 |
| <b>II</b>  | <b>ELECTRIFICATIONS &amp; PHE</b>   |                    |
| 9          | Electrical works  | 611                |
| 10         | Plumbing works & STP  | 77                 |
| <b>III</b> | <b>ANCILLARY BUILDINGS</b>  |                    |
| 11         | 1) Cycle Parking - 7 nos<br>2) Food Kiosk ( 3m x 3m ) - 6 nos<br>3) Kiosk at Jeppu - 1 nos<br>4) Toilet Block - 4 nos<br>5) Mangrove Interpretation centre - 1 nos<br>6) Buggy shed - 1 nos<br>7) Facility Management office - 1 nos<br>8) Pavilion 3mx 9m - 5 nos<br>9) Ticket counter - 5 nos | 422                |
|            | <b>TOTAL - I + II + III</b>   | <b>3,982</b>       |
|            | GST @ 12% (except Sl.No.6)  | 471                |
|            | GST @ 18% (NSR only Sl.No.6)  | 11                 |
|            | Contingency @ 3%  | 119                |
|            | Tender premium @ 10%  | 398                |
|            | <b>GRAND TOTAL</b>  | <b>4,980</b>       |
|            | <b>ROUND OFF</b>  | <b>4,980</b>       |

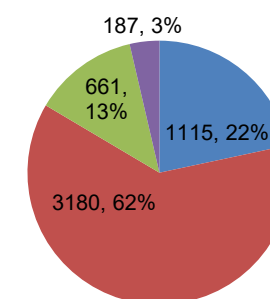
The overall project cost for development of the above elements in all the three stations cumulatively has been estimated at INR 4980 lakhs including GST. As stated earlier, the option considered here is that of an Operations and Management of this facility would be handled by the Government Authority itself similar to how public spaces are managed under its ambit.

## iv. Capital contribution & debt funding

The project cost has been assumed to be funded through budgetary allocation. As a result, the model assumes 100% equity financing. The Construction period has been considered as 1 year commencing in October 2021.

## iii. O&M details

O&M Cost - INR Lakh



■ Asset Maintenance ■ Manpower ■ Power ■ Insurance

The Operations and Maintenance period has been assumed for a period of 15 years post commercial operation. The main heads of operations and maintenance cost are provided in the chart below. Asset maintenance is assumed at 1% of initial capital cost, manpower rates aligned to minimum wages notified by Government of Karnataka, power at 60 kW connection and insurance at 0.25% of asset value. The increase in unit cost is assumed at 4% per annum and wages at 7% per annum. The figures represent the total cost for each of the segments over the 15 year operating period.

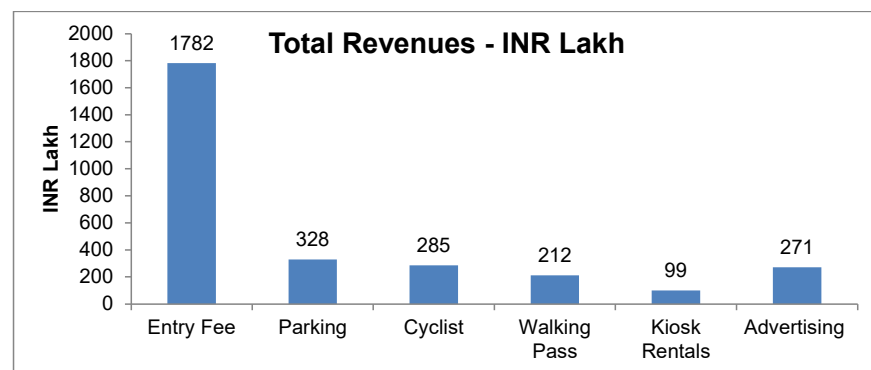
## ii. Revenue generation

Revenue estimates for the Authority under this model have been arrived based on the assumptions for footfalls (different over weekdays and weekends, children and adults), cycling, walking pass, tariffs, escalation in footfalls and tariffs, revenue from let out of space etc. The following table summarises revenue assumptions

| S. No. | Revenue Source | Basis for Revenue Collection  |
|--------|----------------|---|
| 1      | Footfall Entry | <ul style="list-style-type: none"> <li>Assumed 400 persons per day on weekdays and 1000 persons per day on weekends</li> <li>Number of daily entrants Growth assumed at 5% per annum</li> <li>Tariff increases at 5% per annum</li> </ul>   |
| 2      | Parking        | <ul style="list-style-type: none"> <li>100 slots each for car and 2 wheeler</li> <li>Assumed that 5% and 10% of daily entrants to the promenade on weekdays and weekends respectively would come in a car</li> <li>Assumed that 15% and 20% of daily entrants to the promenade on weekdays and weekends respectively would come in a 2 wheeler</li> </ul> |
| 3      | Cyclist        | <ul style="list-style-type: none"> <li>Assumed 100 cyclists per day with growth rate at 5% per annum</li> </ul>   |
| 4      | Walking Pass   | <ul style="list-style-type: none"> <li>Assumed 100 persons per day with growth rate at 5% per annum</li> </ul>  |
| 5      | Kiosks         | <ul style="list-style-type: none"> <li>A total of 11 kiosks and 1 flea market area - Rentals assumed at INR 200 per sq.m.</li> </ul>  |
| 6      | Advertising    | <ul style="list-style-type: none"> <li>Considered at 10% of revenue from all other sources</li> </ul>   |

All the above revenue streams would accrue to the Government Authority. The following chart provides a snapshot of revenue projections to the Authority over the 15 year period.





Source: Financial Model

The cumulative revenue to the Authority is estimated at INR 2977 lakh over the 15 year period.

## v. Profit & loss

The following table represents the profit and loss of the project considered as a standalone entity in the baseline scenario. The statement is represented at regular intervals. It may be observed that under the stated assumptions, the project makes a revenue deficit of nearly INR 1.37 crores per annum in the first year of operation. Cumulative revenue deficit over the 15 year period is about INR 20.7 crores which is assumed to be funded from additional budgetary allocation.

| P&L                 | 31-Mar-24   | 31-Mar-28   | 31-Mar-33   | 31-Mar-38   |
|---------------------|-------------|-------------|-------------|-------------|
| <b>Revenue</b>      | 97          | 140         | 225         | 304         |
| <b>O&amp;M</b>      | 230         | 285         | 375         | 349         |
| <b>EBITDA</b>       | -133        | -144        | -150        | -45         |
| <b>Depreciation</b> | 195         | 195         | 195         | 163         |
| <b>EBT</b>          | -327        | -339        | -345        | -208        |
| <b>Taxes</b>        | 0           | 0           | 0           | 0           |
| <b>PAT</b>          | <b>-327</b> | <b>-339</b> | <b>-345</b> | <b>-208</b> |

## vi. Cash flow

From the above table, it may be observed that there is no cash loss under the baseline circumstances. Any material changes to revenue assumptions could lead to similar changes to cash flow position.

| Cash inflows                | 31-Mar-22   | 31-Mar-23   | 31-Mar-24   | 31-Mar-28   | 31-Mar-33   | 31-Mar-38  |
|-----------------------------|-------------|-------------|-------------|-------------|-------------|------------|
| <b>Equity inflow</b>        | 1122        | 3859        | 0           | 0           | 0           | 0          |
| <b>Net Cash accruals</b>    | 0           | 8           | -133        | -144        | -150        | -45        |
| <b>Total inflows</b>        | <b>1122</b> | <b>3867</b> | <b>-133</b> | <b>-144</b> | <b>-150</b> | <b>-45</b> |
| <b>Cash outflows</b>        |             |             |             |             |             |            |
| <b>Investment in assets</b> | 1122        | 3859        | 0           | 0           | 0           | 0          |
| <b>Total outflows</b>       | <b>1122</b> | <b>3859</b> | <b>0</b>    | <b>0</b>    | <b>0</b>    | <b>0</b>   |

## vii. Financial indicators - IRR, NPV & DSCR

Since there is deficit at operating level, calculation of Project or Equity IRR is not possible. Since there is no debt financing considered, DSCR is not applicable owing to the same reason. Sensitivity analysis was performed to understand the cash deficit at operating level under different scenarios and presented hereunder.

|                                       | Cash Deficit (INR Lakh) |
|---------------------------------------|-------------------------|
| <b>Baseline</b>                       | <b>2069</b>             |
| <b>No. of Daily Entrants up 10%</b>   | <b>1782</b>             |
| <b>No. of Daily Entrants down 10%</b> | <b>2356</b>             |
| <b>O&amp;M Cost up by 10%</b>         | <b>2555</b>             |

## viii. Revenue sharing

It may be noted that the revenue assumptions in particular for demand has been considered on based on reasonable judgment in the absence of an independent assessment. Further, the tariff assumptions considered herein could undergo change in the event that a willingness to pay assessment is undertaken with prospective users. Independently, adoption of O&M through CSR (from corporates) for branding rights could impact positively or adversely, the revenue projections from advertisements. Each of the above alterations to assumptions could (either on a standalone basis or in aggregate) lead to material changes to the above assessment outcomes and financial indicators. In addition, any delay in construction could lead to increase in project costs which have not been subject to this sensitivity analysis.



06

PROJECT  
SCHEDULE



# Schedule for proposed landscape development work at Waterfront Promenade Development

(8 MONTH DURATION OF PROJECT)

## SCHEDULE FOR PROPOSED LANDSCAPE DEVELOPMENT WORK AT MANGALA CORNICHE LOOP, MANGALORE (8 MONTH DURATION OF PROJECT)

| Sl. NO | Description  | Status Of Work | 1st month |        |        |        | 2nd month |        |        |        | 3rd month |        |        |        | 4th month |        |        |        | 5th month |        |        |        | 6th month |        |        |        | 7th month |        |        |        | 8th month |   |   |   |
|--------|--|----------------|-----------|--------|--------|--------|-----------|--------|--------|--------|-----------|--------|--------|--------|-----------|--------|--------|--------|-----------|--------|--------|--------|-----------|--------|--------|--------|-----------|--------|--------|--------|-----------|---|---|---|
|        |  |                | 1 week    | 2 week | 3 week | 4 week | 1 week    | 2 week | 3 week | 4 week | 1 week    | 2 week | 3 week | 4 week | 1 week    | 2 week | 3 week | 4 week | 1 week    | 2 week | 3 week | 4 week | 1 week    | 2 week | 3 week | 4 week | 1 week    | 2 week | 3 week | 4 week |           |   |   |   |
| 1      | <b>Dismantling structure &amp; Jungle cleaning</b> |                |           |        |        |        |           |        |        |        |           |        |        |        |           |        |        |        |           |        |        |        |           |        |        |        |           |        |        |        |           |   |   |   |
|        | Promenade - 1.2 km & Jeppu ferry                   |                | █         | █      | █      | █      |           |        |        |        |           |        |        |        |           |        |        |        |           |        |        |        |           |        |        |        |           |        |        |        |           |   |   |   |
|        | South point  |                | █         | █      | █      | █      |           |        |        |        |           |        |        |        |           |        |        |        |           |        |        |        |           |        |        |        |           |        |        |        |           |   |   |   |
|        | Cultural centre - OAT                              |                |           |        |        |        | █         | █      | █      | █      |           |        |        |        |           |        |        |        |           |        |        |        |           |        |        |        |           |        |        |        |           |   |   |   |
| 2      | <b>Promenade - 1.2 km &amp; Jeppu ferry</b>        |                |           |        |        |        |           |        |        |        |           |        |        |        |           |        |        |        |           |        |        |        |           |        |        |        |           |        |        |        |           |   |   |   |
|        | pathway promenade                                  |                | █         | █      | █      | █      | █         | █      | █      | █      | █         | █      | █      | █      | █         | █      | █      | █      |           |        |        |        |           |        |        |        |           |        |        |        |           |   |   |   |
|        | cycle track  |                |           |        |        |        | █         | █      | █      | █      | █         | █      | █      | █      |           |        |        |        |           |        |        |        | █         | █      | █      | █      | █         | █      | █      | █      | █         | █ | █ | █ |
|        | play area  |                |           |        |        |        | █         | █      | █      | █      |           |        |        |        |           |        |        |        | █         | █      | █      | █      |           |        |        |        | █         | █      | █      | █      | █         | █ | █ | █ |
|        | seating plaza                                      |                |           |        |        |        | █         | █      | █      | █      | █         | █      | █      | █      |           |        |        |        |           |        |        |        | █         | █      | █      | █      | █         | █      | █      | █      | █         | █ | █ | █ |
|        | pavilion   |                |           |        |        |        |           |        |        |        | █         | █      | █      | █      |           |        |        |        |           |        |        |        |           |        |        |        | █         | █      | █      | █      | █         | █ | █ | █ |
|        | water metro plaza                                  |                |           |        |        |        | █         | █      | █      | █      | █         | █      | █      | █      | █         | █      | █      | █      |           |        |        |        | █         | █      | █      | █      | █         | █      | █      | █      | █         | █ | █ | █ |
|        | parking lot  |                | █         | █      | █      | █      |           |        |        |        |           |        |        |        | █         | █      | █      | █      | █         | █      | █      | █      |           |        |        |        |           |        |        |        |           |   |   |   |
|        | buggy parking lot                                  |                | █         | █      | █      | █      |           |        |        |        |           |        |        |        | █         | █      | █      | █      | █         | █      | █      | █      |           |        |        |        |           |        |        |        |           |   |   |   |
| 3      | <b>South point &amp; Bolar sea face</b>            |                |           |        |        |        |           |        |        |        |           |        |        |        |           |        |        |        |           |        |        |        |           |        |        |        |           |        |        |        |           |   |   |   |
|        | parking lot - levelling and lowering               |                | █         | █      | █      | █      |           |        |        |        |           |        |        |        |           |        |        |        |           |        |        |        |           |        |        |        |           |        |        |        |           |   |   |   |
|        | ghat steps foundation                              |                | █         | █      | █      | █      | █         | █      | █      | █      | █         | █      | █      | █      | █         | █      | █      | █      |           |        |        |        | █         | █      | █      | █      |           |        |        |        |           |   |   |   |
|        | ghat steps finishing                               |                |           |        |        |        |           |        |        |        |           |        |        |        |           |        |        |        | █         | █      | █      | █      | █         | █      | █      | █      | █         | █      | █      | █      | █         | █ | █ | █ |
|        | pedestrian bridges                                 |                |           |        |        |        |           |        |        |        | █         | █      | █      | █      | █         | █      | █      | █      |           |        |        |        |           |        |        |        |           |        |        |        |           |   |   |   |
|        | plaza area - sub base work                         |                | █         | █      | █      | █      | █         | █      | █      | █      |           |        |        |        |           |        |        |        |           |        |        |        |           |        |        |        |           |        |        |        |           |   |   |   |
|        | plaza area - finishing work                        |                |           |        |        |        |           |        |        |        |           |        |        |        | █         | █      | █      | █      | █         | █      | █      | █      |           |        |        |        | █         | █      | █      | █      | █         | █ | █ | █ |
|        | Cycle track base work                              |                |           |        |        |        | █         | █      | █      | █      | █         | █      | █      | █      |           |        |        |        |           |        |        |        |           |        |        |        |           |        |        |        |           |   |   |   |
|        | Cycle track finishing work                         |                |           |        |        |        |           |        |        |        |           |        |        |        |           |        |        |        | █         | █      | █      | █      | █         | █      | █      | █      | █         | █      | █      | █      | █         | █ | █ | █ |
|        | play area base work                                |                |           |        |        |        |           |        |        |        | █         | █      | █      | █      | █         | █      | █      | █      |           |        |        |        |           |        |        |        |           |        |        |        |           |   |   |   |
|        | fixing of play equipments                          |                |           |        |        |        |           |        |        |        |           |        |        |        | █         | █      | █      | █      | █         | █      | █      | █      |           |        |        |        | █         | █      | █      | █      | █         | █ | █ | █ |
|        | swale excavation                                   |                |           |        |        |        | █         | █      | █      | █      | █         | █      | █      | █      |           |        |        |        |           |        |        |        |           |        |        |        |           |        |        |        |           |   |   |   |
|        | wet land development                               |                |           |        |        |        | █         | █      | █      | █      | █         | █      | █      | █      | █         | █      | █      | █      |           |        |        |        |           |        |        |        |           |        |        |        |           |   |   |   |
|        | Pavilion with tile roof structure                  |                |           |        |        |        |           |        |        |        |           |        |        |        | █         | █      | █      | █      |           |        |        |        |           |        |        |        | █         | █      | █      | █      | █         | █ | █ | █ |
|        | Tensile structure                                  |                |           |        |        |        |           |        |        |        |           |        |        |        | █         | █      | █      | █      | █         | █      | █      | █      |           |        |        |        | █         | █      | █      | █      | █         | █ | █ | █ |
|        | Pre fabricated seaters                             |                |           |        |        |        |           |        |        |        |           |        |        |        | █         | █      | █      | █      | █         | █      | █      | █      |           |        |        |        | █         | █      | █      | █      | █         | █ | █ | █ |
|        | Tree guard   |                |           |        |        |        |           |        |        |        |           |        |        |        | █         | █      | █      | █      | █         | █      | █      | █      |           |        |        |        | █         | █      | █      | █      | █         | █ | █ | █ |



07

CONCLUSION

# i. Summary statement

## Design takeaways

The larger intent of the waterfront development project are the following:

- Pedestrian friendly corridors
- City resilience plan
- Reclaiming city's water edge
- Celebratory spaces for the city
- Water metro for public movement
- Intra-city mobility improvement
- Connecting the city to the sea
- Adaptive reuse of heritage buildings
- Water sports and recreation zones
- Community centric planning and design
- City's identity

## Benefits of Waterfront Promenade project

- Access to the river from the city
- Tourism potential
- Better employment opportunities to the local communities
- Improved biodiversity
- Pedestrian pathways and cycling tracks
- Reduced carbon footprint providing a green mobility corridor

## Area statement

### Total Project Area

Total area - 28.1 Acres

Port area - 7.42 Acres

Extended beyond port authority area - 20.7 Acres. This is private ownership subject to verification

### Promenade Development

Hardscape Development - 12 Acres

Softscape Development - 16 Acres



08

ACTION  
PLAN

## i. Way forward

### Way forward for the city

Over the years, Mangalore has expanded radially, and then along the north-south directions beyond the rivers as newer establishments came up. Within the landmass circuted by the Netravati and Gurupura Rivers, city is gradually expanding towards the eastern extents which are hilly, with changing topography.

While the riverfront development towards the western side shall harness and conserve the city's natural and manmade resource networks, the concept needs to extend further towards the eastern direction as the settlements expand gradually into more critical terrain.

Ecologically sensitive areas like Pilikula also need be integrated into the larger strategy of the development such that the urban extents can manage its resources holistically in the future with newer developments coming up.



### Way forward for the proposed promenade beyond the Bolar seaface

- On approval of the DPR, the project will proceed for tendering with the drawings submitted alongwith as annexures.
- On approval of the tender drawings, Good for Construction (GFC) drawings will be submitted for the start of construction
- After analysis of the public response on the promenade and the activities proposed at various landmarks and nodes, feasibility study for extension of the promenade further from Bolar seaface needs to be initiated with the inputs from Port Authority and other stakeholders.
- In the event of finalisation of waterfront promenade extension, a series of adjacent landmarks can be integrated with the pedestrian pathway and cycling track. This will help in realising the vision of the waterfront promenade throughout the length of the river.
- Stakeholder consultations will be conducted with various stakeholders to ensure a smooth convergence of ideas and vision.
- All the city resources and knowledge from city & state administration, planners, urban designers, architects and environmentalists should be brought together for proper execution of the waterfront project as envisioned by Mangaluru Smart City Limited



# 09

## ANNEXURES

# i. Annexure 1 - Landscape Drawings

| PROJECT NAME                             | PROMENADE DEVELOPMENT (MANGALA CORNICHE LOOP)   |
|--|---|
| STAGE                                    | TENDER DRAWINGS                                 |
| DWG. NO.                                 | DRAWING DESCRIPTION                             |
| <b>SITE PLAN</b>                         |   |
| <b>GENERAL</b>                           |   |
| LG-004                                   | GENERAL ARRANGEMENT PLAN                        |
| <b>MATERIAL PLAN</b>                     |   |
| L-101DD                                  | MATERIAL PLAN- PART-DD                          |
| L-101EC                                  | MATERIAL PLAN- PART-EC                          |
| L-101ED                                  | MATERIAL PLAN- PART-ED                          |
| L-101FC                                  | MATERIAL PLAN- PART-FC                          |
| L-101FD                                  | MATERIAL PLAN- PART-FD                          |
| L-101GC                                  | MATERIAL PLAN- PART-GC                          |
| L-101GD                                  | MATERIAL PLAN- PART-GD                          |
| L-101HC                                  | MATERIAL PLAN- PART-HC                          |
| L-101HD                                  | MATERIAL PLAN- PART-HD                          |
| L-101HE                                  | MATERIAL PLAN- PART-HE                          |
| L-101JD                                  | MATERIAL PLAN- PART-JD                          |
| L-101JE                                  | MATERIAL PLAN- PART-JE                          |
| L-101KC                                  | MATERIAL PLAN- PART-KC                          |
| L-101KD                                  | MATERIAL PLAN- PART-KD                          |
| L-101KE                                  | MATERIAL PLAN- PART-KE                          |
| L-101KF                                  | MATERIAL PLAN- PART-KF                          |
| L-101LC                                  | MATERIAL PLAN- PART-LC                          |
| L-101LD                                  | MATERIAL PLAN- PART-LD                          |
| L-101LE                                  | MATERIAL PLAN- PART-LE                          |
| L-101LF                                  | MATERIAL PLAN- PART-LF                          |
| L-101ME                                  | MATERIAL PLAN- PART-ME                          |
| L-101QC                                  | MATERIAL PLAN- PART-QC                          |
| L-101QD                                  | MATERIAL PLAN- PART-QD                          |
| L-101RC                                  | MATERIAL PLAN- PART-RC                          |
| L-101RD                                  | MATERIAL PLAN- PART-RD                          |
| <b>FORMATION LEVEL AND DRAINAGE PLAN</b> |   |
| L-102DD                                  | FORMATION LEVEL PLAN AND DRAINAGE PLAN- PART-DD |
| L-102EC                                  | FORMATION LEVEL PLAN AND DRAINAGE PLAN- PART-EC |
| L-102ED                                  | FORMATION LEVEL PLAN AND DRAINAGE PLAN- PART-ED |
| L-102FC                                  | FORMATION LEVEL PLAN AND DRAINAGE PLAN- PART-FC |
| L-102FD                                  | FORMATION LEVEL PLAN AND DRAINAGE PLAN- PART-FD |
| L-102GC                                  | FORMATION LEVEL PLAN AND DRAINAGE PLAN- PART-GC |
| L-102GD                                  | FORMATION LEVEL PLAN AND DRAINAGE PLAN- PART-GD |
| L-102HC                                  | FORMATION LEVEL PLAN AND DRAINAGE PLAN- PART-HC |
| L-102HD                                  | FORMATION LEVEL PLAN AND DRAINAGE PLAN- PART-HD |
| L-102HE                                  | FORMATION LEVEL PLAN AND DRAINAGE PLAN- PART-HE |
| L-102JD                                  | FORMATION LEVEL PLAN AND DRAINAGE PLAN- PART-JD |
| L-102JE                                  | FORMATION LEVEL PLAN AND DRAINAGE PLAN- PART-JE |
| L-102KC                                  | FORMATION LEVEL PLAN AND DRAINAGE PLAN- PART-KC |
| L-102KD                                  | FORMATION LEVEL PLAN AND DRAINAGE PLAN- PART-KD |
| L-102KE                                  | FORMATION LEVEL PLAN AND DRAINAGE PLAN- PART-KE |
| L-102KF                                  | FORMATION LEVEL PLAN AND DRAINAGE PLAN- PART-KF |
| L-102LC                                  | FORMATION LEVEL PLAN AND DRAINAGE PLAN- PART-LC |
| L-102LD                                  | FORMATION LEVEL PLAN AND DRAINAGE PLAN- PART-LD |
| L-102LE                                  | FORMATION LEVEL PLAN AND DRAINAGE PLAN- PART-LE |
| L-102LF                                  | FORMATION LEVEL PLAN AND DRAINAGE PLAN- PART-LF |
| L-102ME                                  | FORMATION LEVEL PLAN AND DRAINAGE PLAN- PART-ME |
| L-102QC                                  | FORMATION LEVEL PLAN AND DRAINAGE PLAN- PART-QC |
| L-102QD                                  | FORMATION LEVEL PLAN AND DRAINAGE PLAN- PART-QD |
| L-102RC                                  | FORMATION LEVEL PLAN AND DRAINAGE PLAN- PART-RC |
| L-102RD                                  | FORMATION LEVEL PLAN AND DRAINAGE PLAN- PART-RD |
| <b>BASIC MARKING PLAN</b>                |   |
| L-104DD                                  | BASIC MARKING PLAN- PART-DD                     |
| L-104EC                                  | BASIC MARKING PLAN- PART-EC                     |
| L-104ED                                  | BASIC MARKING PLAN- PART-ED                     |
| L-104FC                                  | BASIC MARKING PLAN- PART-FC                     |

|                         |                             |
|-------------------------|-----------------------------|
| L-104FD                 | BASIC MARKING PLAN- PART-FD |
| L-104GC                 | BASIC MARKING PLAN- PART-GC |
| L-104GD                 | BASIC MARKING PLAN- PART-GD |
| L-104HC                 | BASIC MARKING PLAN- PART-HC |
| L-104HD                 | BASIC MARKING PLAN- PART-HD |
| L-104HE                 | BASIC MARKING PLAN- PART-HE |
| L-104JD                 | BASIC MARKING PLAN- PART-JD |
| L-104JE                 | BASIC MARKING PLAN- PART-JE |
| L-104KC                 | BASIC MARKING PLAN- PART-KC |
| L-104KD                 | BASIC MARKING PLAN- PART-KD |
| L-104KE                 | BASIC MARKING PLAN- PART-KE |
| L-104KF                 | BASIC MARKING PLAN- PART-KF |
| L-104LC                 | BASIC MARKING PLAN- PART-LC |
| L-104LD                 | BASIC MARKING PLAN- PART-LD |
| L-104LE                 | BASIC MARKING PLAN- PART-LE |
| L-104LF                 | BASIC MARKING PLAN- PART-LF |
| L-104ME                 | BASIC MARKING PLAN- PART-ME |
| L-104QC                 | BASIC MARKING PLAN- PART-QC |
| L-104QD                 | BASIC MARKING PLAN- PART-QD |
| L-104RC                 | BASIC MARKING PLAN- PART-RC |
| L-104RD                 | BASIC MARKING PLAN- PART-RD |
| <b>LIGHTING PLAN</b>    |                             |
| L-106DD                 | LIGHTING PLAN- PART-DD      |
| L-106EC                 | LIGHTING PLAN- PART-EC      |
| L-106ED                 | LIGHTING PLAN- PART-ED      |
| L-106FC                 | LIGHTING PLAN- PART-FC      |
| L-106FD                 | LIGHTING PLAN- PART-FD      |
| L-106GC                 | LIGHTING PLAN- PART-GC      |
| L-106GD                 | LIGHTING PLAN- PART-GD      |
| L-106HC                 | LIGHTING PLAN- PART-HC      |
| L-106HD                 | LIGHTING PLAN- PART-HD      |
| L-106HE                 | LIGHTING PLAN- PART-HE      |
| L-106JD                 | LIGHTING PLAN- PART-JD      |
| L-106JE                 | LIGHTING PLAN- PART-JE      |
| L-106KC                 | LIGHTING PLAN- PART-KC      |
| L-106KD                 | LIGHTING PLAN- PART-KD      |
| L-106KE                 | LIGHTING PLAN- PART-KE      |
| L-106KF                 | LIGHTING PLAN- PART-KF      |
| L-106LC                 | LIGHTING PLAN- PART-LC      |
| L-106LD                 | LIGHTING PLAN- PART-LD      |
| L-106LE                 | LIGHTING PLAN- PART-LE      |
| L-106LF                 | LIGHTING PLAN- PART-LF      |
| L-106ME                 | LIGHTING PLAN- PART-ME      |
| L-106QC                 | LIGHTING PLAN- PART-QC      |
| L-106QD                 | LIGHTING PLAN- PART-QD      |
| L-106RC                 | LIGHTING PLAN- PART-RC      |
| L-106RD                 | LIGHTING PLAN- PART-RD      |
| <b>PLANTING PALETTE</b> |                             |
| LT-100DD                | PLANTING PALETTE- PART-DD   |
| LT-100EC                | PLANTING PALETTE- PART-EC   |
| LT-100ED                | PLANTING PALETTE- PART-ED   |
| LT-100FC                | PLANTING PALETTE- PART-FC   |
| LT-100FD                | PLANTING PALETTE- PART-FD   |
| LT-100GC                | PLANTING PALETTE- PART-GC   |
| LT-100GD                | PLANTING PALETTE- PART-GD   |
| LT-100HC                | PLANTING PALETTE- PART-HC   |
| LT-100HD                | PLANTING PALETTE- PART-HD   |
| LT-100HE                | PLANTING PALETTE- PART-HE   |
| LT-100JD                | PLANTING PALETTE- PART-JD   |
| LT-100JE                | PLANTING PALETTE- PART-JE   |
| LT-100KC                | PLANTING PALETTE- PART-KC   |
| LT-100KD                | PLANTING PALETTE- PART-KD   |
| LT-100KE                | PLANTING PALETTE- PART-KE   |
| LT-100KF                | PLANTING PALETTE- PART-KF   |
| LT-100LC                | PLANTING PALETTE- PART-LC   |
| LT-100LD                | PLANTING PALETTE- PART-LD   |
| LT-100LE                | PLANTING PALETTE- PART-LE   |



|                                  |  |
|----------------------------------|--|
| LT-100LF                         | PLANTING PALETTE- PART-LF                                    |
| LT-100ME                         | PLANTING PALETTE- PART-ME                                    |
| LT-100QC                         | PLANTING PALETTE- PART-QC                                    |
| LT-100QD                         | PLANTING PALETTE- PART-QD                                    |
| LT-100RC                         | PLANTING PALETTE- PART-RC                                    |
| LT-100RD                         | PLANTING PALETTE- PART-RD                                    |
| <b>LANDSCAPE PROFILE SECTION</b> |  |
| LS-001                           | SECTION KEYPLAN  |
| LS-101                           | PROFILE SECTIONS-01 (S1-S4)                                  |
| LS-102                           | PROFILE SECTIONS-02 (S5-S10)                                 |
| LS-103                           | PROFILE SECTIONS-03 (S11)                                    |
| LS-104                           | EXISTING PROFILE SECTIONS (S1-S4)                            |
| LS-105                           | EXISTING PROFILE SECTIONS (S5-S11)                           |
| <b>LANDSCAPE DETAILS</b>         |  |
| LD-101                           | LANDSCAPE DETAILS-1  |
| LD-102                           | LANDSCAPE DETAILS-2  |
| <b>ARCHITECTURAL DRAWINGS</b>    |  |
| MWF-PR-A-3.3-201                 | 3M X 3M KIOSK  |
| MWF-PR-A-3.3-202                 | 3M X 3M KIOSK  |
| MWF-PR-A-3.9-201                 | 3M X9M FOOD KIOSK  |
| MWF-PR-A-3.9-202                 | 3M X9M FOOD KIOSK  |
| MWF-PR-A-BS-201                  | BUGGY SHED   |
| MWF-PR-A-CS-201                  | CYCLE STATION  |
| MWF-PR-A-IC-201                  | INTERPRETATION CENTRE:GROUND FLOOR PLAN: ROOF PLAN           |
| MWF-PR-A-IC-202                  | INTERPRETATION CENTRE:SECTIONS 01, 02, 03                    |
| MWF-PR-A-IC-203                  | INTERPRETATION CENTRE:ELEVATIONS 01,02,03,04                 |
| MWF-PR-A-IC-204                  | INTERPRETATION CENTRE:RAMP & RAILING DETAIL                  |
| MWF-PR-A-IC-205                  | INTERPRETATION CENTRE:TOILET DETAIL                          |
| MWF-PR-A-IC-206                  | INTERPRETATION CENTRE:DOOR & WINDOW SCHEDULE                 |
| MWF-PR-A-IC-207                  | INTERPRETATION CENTRE:FLOORING DETAIL                        |
| MWF-PR-A-IC-208                  | INTERPRETATION CENTRE:COLUMN CLADDING DETAIL                 |
| MWF-PR-A-IC-209                  | INTERPRETATION CENTRE:GUTTER WITH RAIN CHAIN DETAIL          |
| MWF-PR-A-OF-201                  | OFFICE :GROUND FLOOR PLAN: ROOF PLAN                         |
| MWF-PR-A-OF-202                  | OFFICE :SECTIONS   |
| MWF-PR-A-OF-203                  | OFFICE :ELEVATIONS   |
| MWF-PR-A-OF-204                  | OFFICE RAMP & RAILING DETAIL                                 |
| MWF-PR-A-OF-205                  | OFFICE :TOILET DETAIL  |
| MWF-PR-A-OF-206                  | OFFICE :DOOR & WINDOW SCHEDULE                               |
| MWF-PR-A-OF-207                  | OFFICE :DOOR & WINDOW SCHEDULE                               |
| MWF-PR-A-OF-208                  | OFFICE :FLOORING DETAIL                                      |
| MWF-PR-A-OF-209                  | OFFICE :COLUMN CLADDING DETAIL                               |
| MWF-PR-A-OF-210                  | OFFICE :GUTTER WITH RAIN CHAIN DETAIL                        |
| MWF-PR-A-SK-201                  | SOUTH POINT KIOSK :GROUND FLOOR PLAN                         |
| MWF-PR-A-SK-202                  | SOUTH POINT KIOSK :ROOF PLAN                                 |
| MWF-PR-A-SK-203                  | SOUTH POINT KIOSK :SECTIONS 01, 02, 03                       |
| MWF-PR-A-SK-204                  | SOUTH POINT KIOSK :ELEVATIONS 01,02,03,04                    |
| MWF-PR-A-SK-205                  | SOUTH POINT KIOSK :RAMP & RAILING DETAIL                     |
| MWF-PR-A-SK-206                  | SOUTH POINT KIOSK :DOOR & WINDOW SCHEDULE                    |
| MWF-PR-A-SK-207                  | SOUTH POINT KIOSK :FLOORING DETAIL,GUTTER DETAIL             |
| MWF-PR-A-SK-208                  | SOUTH POINT KIOSK :COLUMN CLADDING DETAIL                    |
| MWF-PR-A-TC-201                  | CYCLE STAND:3M X 3M FOOD KIOSK 01 ,3M X 3M PAVILION          |
| MWF-PR-A-T-201                   | TYPICAL TOILETS : PLAN , SECTION , FLOORING PLAN ,DETAILS    |
| MWF-PR-A-T-202                   | TYPICAL TOILETS : ELEVATION, TILE LAYOUT                     |
| MWF-PR-A-T-203                   | TYPICAL TOILETS : DOOR WINDOW DETAILS                        |
| <b>ELECTRICAL DRAWINGS</b>       |  |
| MEDS-MM-PR-EL-01                 | ELECTRICAL LAYOUT: CYCLE STAND (7nos)                        |
| MEDS-MM-PR-EL-02                 | ELECTRICAL LAYOUT: TOILET BLOCK (4nos)                       |
| MEDS-MM-PR-EL-03                 | ELECTRICAL LAYOUT: KIOSK AT SOUTH POINT                      |
| MEDS-MM-PR-EL-04                 | ELECTRICAL LAYOUT: FOOD KIOSK AT JEEPU ROAD(3nos)            |
| MEDS-MM-PR-EL-05                 | ELECTRICAL LAYOUT: FOOD KIOSK -MANGROVE PARK AREA            |
| MEDS-MM-PR-EL-06                 | ELECTRICAL LAYOUT: BUGGY SHED AT JEEPU POINT                 |
| MEDS-MM-PR-EL-07                 | ELECTRICAL LAYOUT: INTERPRETATION CENTRE AT MANGROVE PARK    |
| MEDS-MM-PR-EL-08                 | ELECTRICAL LAYOUT: SECURITY CABIN / BUGGY TICKET POINT(5nos) |
| MEDS-MM-PR-EL-08                 | ELECTRICAL LAYOUT: OFFICE SPACE AT JEEPU POINT               |
| MEDS-MM-PR-EL-12                 | PROMENADE ELECTRICAL POWER SCHEMATIC LAYOUT                  |
| MEDS-MM-PR-EL-09                 | ELECTRICAL LAYOUT:PROMENADE SITE PLAN :PART-1                |

|                            |   |
|----------------------------|---|
| MEDS-MM-PR-EL-11           | ELECTRICAL LAYOUT:PROMENADE SITE PLAN :PART-3 |
| <b>IRRIGATION DRAWINGS</b> |   |
| IR-100DD                   | IRRIGATION PLAN: PART-DD                      |
| IR-100EC                   | IRRIGATION PLAN: PART-EC                      |
| IR-100ED                   | IRRIGATION PLAN: PART-ED                      |
| IR-100FC                   | IRRIGATION PLAN: PART-FC                      |
| IR-100FD                   | IRRIGATION PLAN: PART-FD                      |
| IR-100GC                   | IRRIGATION PLAN: PART-GC                      |
| IR-100GD                   | IRRIGATION PLAN: PART-GD                      |
| IR-100HC                   | IRRIGATION PLAN: PART-HC                      |
| IR-100HD                   | IRRIGATION PLAN: PART-HD                      |
| IR-100JD                   | IRRIGATION PLAN: PART-JD                      |
| IR-100JE                   | IRRIGATION PLAN: PART-JE                      |
| IR-100KE                   | IRRIGATION PLAN: PART-KE                      |
| IR-100LD                   | IRRIGATION PLAN: PART-LD                      |
| IR-100LE                   | IRRIGATION PLAN: PART-LE                      |
| IR-100ME                   | IRRIGATION PLAN: PART-ME                      |
| IR-100QC                   | IRRIGATION PLAN: PART-QC                      |
| IR-100RC                   | IRRIGATION PLAN: PART-RC                      |
| IR-100RD                   | IRRIGATION PLAN: PART-RD                      |

Note: All drawings are attached as a package.