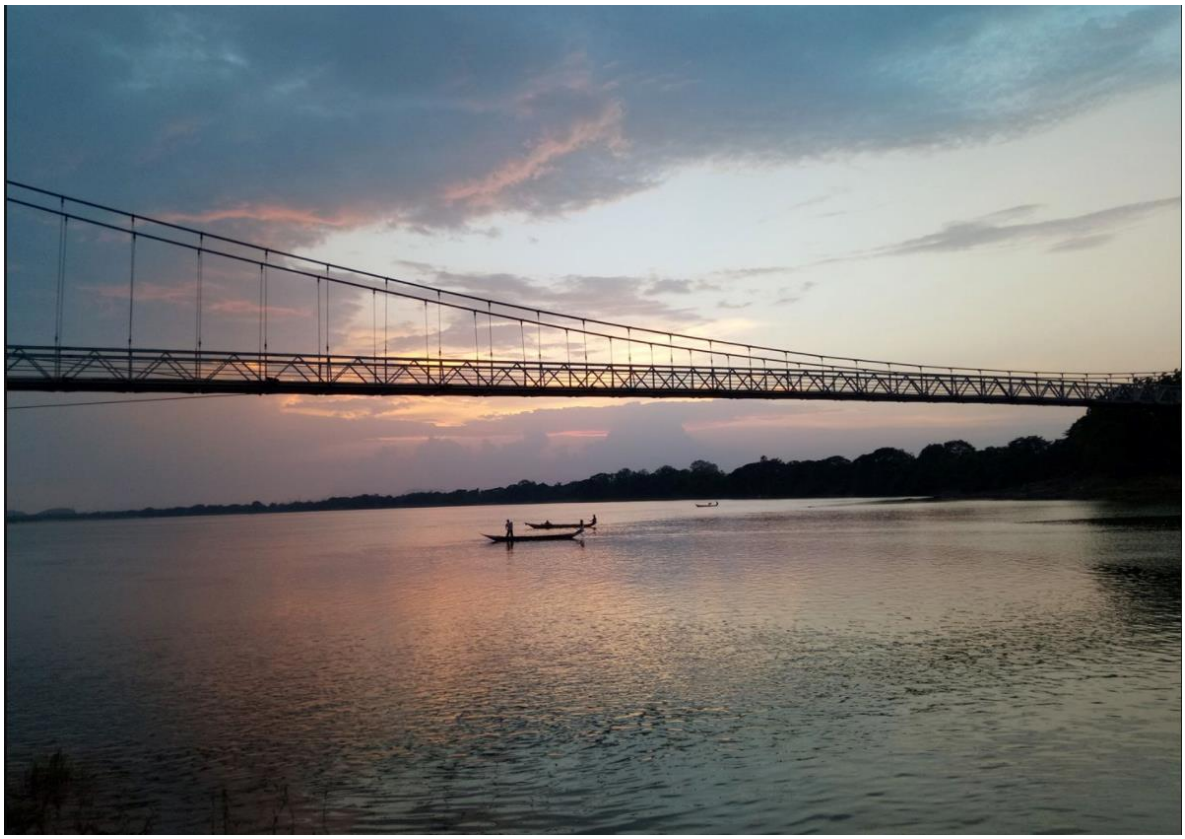
Sponsored Thesis Project Competition on

"RE-IMAGINING URBAN RIVERS"

Season- 2



Project Title : **Integrating Rivers in The City Planning Process** - A Policy Framework to Integrate Urban River Management with the City's Master Planning Process for the City of Cuttack

Creator : **Preetikrishna Panda, MURP, School of Human Settlements**

ACKNOWLEDGEMENT

I would like to thank the School of Human Settlements, XIM University, Bhubaneswar for providing us with this wonderful opportunity to enhance our planning and analysis skills of dealing with live urban wicked problems by including this dissertation project in our academic curriculum. I would like to take this opportunity to thank National Institute of Urban Affairs and National Mission on Clean Ganga for creating this platform for knowledge exchange.

I would like to thank my guide Prof. Tathagata Chatterji and Prof. Atanu Chatterjee in a special way as this project would not have been possible without their constant guidance, and encouragement. Additionally, I would express my heartfelt gratitude to Prof. Chatterji for his constant motivation and support without which representing my dissertation work at a National Platform was nearly impossible.

I would like to express my deepest gratitude to Shri. Lovlesh Sharma, Senior Infrastructure Planner and Coordinator - Student Thesis Competition, for his constant guidance over this platform and motivation to strive for better.

I would like to express my sincere gratitude to all the faculties of the School of Human Settlements, XIM University, Bhubaneswar for their valuable suggestions after every review which has helped me in getting a clearer idea about some of the concepts which I have applied in this project that helped in enriching the quality of this project. Last but not least I would like to thank all the government officers and the respondents of my interview and survey for providing me with the required data for my dissertation project.

Preetikrishna Panda
MURP, XIM University, Bhubaneswar

ABSTRACT

Urban Rivers have time and again been exploited by human settlements and anthropogenic activities as the rivers passing through the city have a lot to offer. Many ancient civilizations have evolved alongside the rivers and our observations from the past experiences have led us to believe that urban rivers are continually polluted, reshaped, abused, and suffer severe environmental degradation. Each location is characterized by the topography and morphology of the surrounding shore, and this diversity reflects the many diverse ways of living and managing urban riverside regions, as well as the various possible links between land and water. Anthropogenic activities have a negative impact on a river's watershed throughout its course. As a result, an urban river becomes a section where the water resource's function is changed from its natural state. River Kathajodi and Mahanadi, like most rivers in the State are a victim of manmade hazards, climate change and mismanagement.

Cuttack has expanded into the river, burying every possibility to improve it. Unpredictable rainfalls and the development of flood plains without any buffer measures cause flash floods to often overrun the city-side. Furthermore, pouring waste and untreated sewage into the river are significant concerns that are steadily killing the biodiversity that the river supports. Even the Government's and the Cuttack Development Authority's attempts have been futile due to a lack of institutional ability to enforce specific measures and instil behavioural changes in individuals.

There is a need for fresh river-centric thinking in river-bank development; the city master plan, as it stands, does not sufficiently address this. River health must be integrated into the urban planning process through the creation of Urban River Management Plans. Cities should be in charge of revitalising their waterways. It must be done not only with a regulatory perspective, but also with a growth and facilitative mindset.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

Chapter 1 : INTRODUCTION

1.1 BACKGROUND:

Rivers have always been the lifeblood of any civilization throughout history. The pattern has continued to the present day. However, as a result of modern socioeconomic growth, rivers are experiencing increasing challenges from a variety of sources, including unsustainable withdrawals, pollution, and habitat destruction. Anthropogenic activities are to blame for much of the current unfavourable state of rivers. These are, in some ways, more common in cities. As a result, any improvement in the river's health must first address the challenges in metropolitan areas. While cities that have grown along rivers have been mostly responsible for the river's deterioration, they will play a critical part in its rehabilitation. Urban areas are home to around 34% of India's population. The number and size of Indian cities have grown over time. According to the Census of India (2011), there were almost 8,000 towns and cities in India, with several experiencing fast expansion over the previous decade. According to UN DESA (2018), this tendency is projected to continue in the future. This interdependence between rivers and cities creates a multidisciplinary approach in the development sector. Rivers have guided the development of cities along their banks. Simultaneously, development within a city reshapes its rivers, urban landscapes, and river ecosystems. Furthermore, the cities rely heavily on their rivers for a variety of infrastructure and development demands. Cities have obviously exploited, manipulated, and altered their rivers during this period, altering ecologies and generating new landscapes while progressing toward urbanisation.

Furthermore, while the basic requirement for river systems for human settlements has been established globally, the critical difficulty resides in economies and societies' repeated failure to value rivers for their entire spectrum of advantages. Rivers have traditionally been seen as both water sources and pollution sinks. (Water Development Report, 2021). For ages, they have been developed and controlled, and they have been used for navigation, energy, and water supply. They do, however, deliver a much larger variety of benefits to people and economies. These advantages include, but are not limited to, the worth of the water running down them.

- River floodplains, for example, can lessen the risk of flooding within cities, which is a growing problem in the face of climate change.
- Rivers provide habitat for the bulk of freshwater fisheries. This low-cost protein derived from freshwater fish benefits disadvantaged rural people, improves food security, and stimulates regional economy.
- Rivers transport silt that sustains deltas, which are some of the world's most important agricultural regions and home to a vast number of people.

Untreated domestic, industrial, and agricultural discharges flowing directly into streams, development within the natural catchment basin, change in the natural river profile as a result of anthropogenic activities, extraction of river water to meet city demands, which further alters the natural flow, and pollution from other anthropogenic sources are typical

problems faced by urban rivers. In order to meet the increasing water challenges, the urban planning framework needs to be relooked with an intent to manage the urban water systems. (Making River Sensitive Master Plans, 2021). The core areas of concern for river health in an urban setup include the following key challenges.

Figure 1-1: Issues related to Urban Rivers
Source – Strategic Guidelines for Making River-Sensitive Master Plans, NIUA

The challenges of urban rivers are diverse in nature, as explained above, involving environmental, economic, technical, political as well as social impacts. These call for a shift in the way urban water systems are managed by the city administrator. Since it is the cities that have been a major contributor to the deterioration of the river health, it must be a part of the solution as well. So, any improvement in the river's condition cannot be achieved without first addressing the issues in urban areas, which is the very significance of this research.

1.2 AIM & OBJECTIVES:

The aim of this project is to integrate Urban River Management with the City's Master Plan through designing a Policy based initiative to Plan and Manage Urban Rivers within the ambit of the City's Master planning process.

The objectives are as follows:

- To enliven the waterfront with a range of attractive uses integrated with a range of upland communities
- To improve governmental regulation, coordination and oversight of the waterfront and waterways
- To expand public access to waterfronts and revive the people-river connect

1.3 RESEARCH APPROACH:

1.3.1 A SPOTLIGHT ON RIVER CONCERNS

Rivers have been at the heart of human settlements throughout history, owing to the simple availability of water for subsistence, agriculture, navigation, and other essential demands. (Fang Y. 2019). A number of the earliest and most important ancient towns

were built along the banks of rivers, including the Euphrates-Tigris in Mesopotamia, the Nile in Egypt, the Ganga in India, and the Huang-Ho in China. Even today, there are numerous examples of cities where rivers have played an important role in shaping the outlines of their growth. The Thames in London, the Seine in Paris, the Hudson in New York, the Yarra in Melbourne, the Ganga in Varanasi, the Yamuna in Delhi, and many others are examples.

Rivers and cities have an inextricably linked relationship that is beneficial in so many ways. On the one hand, rivers supply a wide range of services to cities, resulting in both real and intangible advantages, and they support the livelihoods of a vast number of people. (Gebre T. 2019). Among these advantages include reliable water supply for residents, companies, agriculture, and public places; fish and other riverine resources; flood management; recreational areas; and carbon sequestration. Rivers also provide several social and religious benefits. Rivers, on the other hand, rely on good urban practises to help preserve their natural character and profile, as well as their ability to continue to provide various ecosystem services. Rivers, for their part, have always delivered. (Tickner D., 2017).

Many of our rivers are under assault on numerous fronts now. Concerns have been raised about river pollution, the drying up of river segments, encroachment into floodplains, the loss of river-related biodiversity, and a variety of other issues. (Making River Sensitive Master Plans, 2021). Invariably, urban development activities are the root cause of these concerns and obstacles. Cities have somehow bitten the hand that feeds them in their pursuit for economic prosperity. For example, only 22 kilometres of the Yamuna River in Delhi is responsible for 70% of the pollution in the entire river. (Down to Earth, 2015). Similarly, the last 120 kilometres of the Sabarmati River before it hits the Arabian Sea are made up entirely of industrial effluents and sewage from Ahmedabad and other nearby towns.

As highlighted before, healthy rivers are an absolute necessity for healthy and liveable cities. Cities will, therefore, need to plan their development activities with due consideration for the river, respecting the threshold of disturbance that it can handle naturally without any alteration in its properties, or ability to function. The importance of integrating the river within the 'planning' mechanism of the city is, therefore, of paramount importance. This will not only help in long-term conservation and preservation of the river; it will also help leverage the economic, social, and environmental value of the river in a sustainable manner.

1.3.2 URBAN RIVER MANAGEMENT – NEW OPPORTUNITIES

To address the aforementioned river-related difficulties, various degrees of river restoration mechanisms are necessary at each scale of planning and development interventions (for example, at the basin, city, and local area levels). The concept of Urban

River Management, on the other hand, is limited to the urban scale. Various terms related to Urban River Management have been already defined by organizations having expertise in this sector. As mentioned in **Rivers by Design, Rethinking Development and River Restoration**, "River restoration aims to improve the quality and function of rivers and to restore them to support healthy and thriving ecosystems". "**River restoration** is the re-establishment of natural physical processes (e.g., variation of flow and sediment movement), features (e.g., sediment sizes and river shape) and physical habitats of a river system (including submerged, bank and floodplain areas)." - International Union for Conservation of Nature 'River Restoration and Biodiversity'.

WWF describes **Integrated River Basin Management** as "the process of coordinating conservation, management and development of water, land and related resources across sectors within a given river basin, in order to maximize the economic and social benefits derived from water resources in an equitable manner while preserving and, where necessary, restoring freshwater ecosystems". (Urban River Management Framework, 2020).

As per the Urban Rivers: **Re-making Rivers, Cities and Space** in Europe and North America, by Stéphane Castonguay and Matthew Evendenix, urban rivers are defined in a descriptive sense as "rivers that flow through cities", and in an analytical sense as "those rivers that have been folded into the process of urbanization, whether flowing through urban centres or not". "Urban Rivers examine both the role of rivers in the process of urbanization and the impact of urbanization on rivers".

URBAN RIVER MANAGEMENT can be defined as the process of conserving, developing, and restoring river resources inside the administrative boundaries of a city. It seeks to strike a delicate balance between a river's ecological, infrastructural, social, recreational, and economic purposes inside the city. (Mainstreaming Urban Rivers, 2021). Two basic categories of efforts must be taken to address river management within cities. Following a top-down approach, it must be integrated into the cities' current planning and development framework in the form of urban planning-related actions. In addition, city officials can identify certain priority interventions and projects. Improve the state of the rivers that run through these cities through project-based interventions implemented from the ground up. Both approaches must work in tandem, capitalising possibilities on each other. These two groups are as follows:

A. **Urban planning-related** using various planning instruments. It is expected that these actions/recommendations would be adopted in the town's Development/Master Plan or any other long-term plan for the city.

B. **Project-based interventions** for river management. It is expected that towns will initit the relevant projects that are required to enhance the river outlook in the town.

Figure 1-2: Two types of approaches to Urban River Management
Source – Strategic Guidelines for Making River-Sensitive Master Plans, NIUA

The first category, as described above, is concerned with incorporating sustainable river health management into a city's overall long-term strategy. To remedy this, river management must be incorporated into present city planning as well as national policies. The current planning framework includes a number of plans at various scales and with specific needs, such as the 'Regional Plan,' 'Master Plan,' 'City Sanitation Plan,' 'City Development Plan,' 'River Basin Management Plan,' 'Sanitation Safety Plan' (by World Health Organization), 'City Disaster Management Plan' for Municipal Corporations, and 'District Disaster Management Plan' for smaller towns, among many others.

The second is linked with creating a city-specific river management plan. The Urban River Management Plan (URMP) framework, defines numerous project-based interventions that cities can identify to improve the three fundamental pillars of river management: river health, social cohesion, and economic value. (Mainstreaming Urban Rivers, 2021). The Urban River Management Plan (URMP) developed by the National Institute of Urban Affairs (NIUA) and the National Mission on Clean Ganga (NMCG) is a planning framework designed to assist cities along the Ganga River in planning interventions systematically and holistically in order to revitalise and sustainably maintain the rivers in their areas. Its overarching goal is to assist Ganga towns in improving the state of the river in their stretch. It is embedded in the central idea that maintaining healthy rivers in the Ganga towns is crucial to enhance liveability in the towns. Using the

very essence of URMP, i.e., assisting the development of cities that have grown along rivers, in this project is the backbone of this research.

1.3 STUDY LOCATION

Cuttack is a city in the Indian state of Odisha. It is located at the mouth of the Mahanadi River. Cuttack was founded by King Anangabhima Deva III in the 13th century, but it was conquered by Muslims in 1266. It was later captured by the Marathas (1751) and the British (1803). The city served as the capital of Orissa province until 1948, when it was replaced by Bhubaneswar. Cuttack is an important river port and trade centre with extensive rail and road connections to the rest of Odisha as well as Kolkata (West Bengal) and other Indian cities. (Panigrahi S., 2020). Manufacturing, handicrafts, and agricultural product milling are among the industries in Cuttack. It is also known as the Millennium City. The city's historic and most significant section is situated on a strip of land between the Kathajodi and Mahanadi rivers, surrounded on the southeast by Old Jagannath Road. The city is traversed by four rivers, including the Mahanadi and its tributaries Kathajodi, Kuakhai, and Birupa. The city is located at the junction of two major rivers, the Mahanadi in the north and the Kathajodi in the south, making it particularly vulnerable to flooding. The city's geography is formed like a saucer, with the middle portion being lower in height than the outside. It is protected from flooding by embankments that encircle it. Previously, the city had several ponds that were utilized to absorb and regulate stormwater flow into the sewer. These ponds were later largely filled, resulting in low-lying regions with little room for natural drainage.

The territory around Cuttack is made up of a thin marshy strip near the coast and an irrigated rice-growing alluvial plain and a mountainous part inland. It is drained by the Mahanadi and Brahmani rivers and produces jute and pulses, as well as fishing. Among the manufacturers are glass, steel tubes, paper, and textiles. To the northeast, Jajpur is a popular pilgrimage destination, while Ratnagiri, located between Jajpur and Cuttack, contains the ruins of a huge Buddhist monastery.

1.4 FINDINGS

Cuttack has developed on the banks of River Mahanadi and River Kathajodi due to their strategic importance for transportation, trade, agriculture and fishing. For decades, the dependence was on the traditional and cultural fronts such as idol immersion, boita bandana on Kartik Purnima and performing funeral rites. There has been a shift in the perception of river, from being a primary factor in the livelihood front be it for fishing or agriculture to an economic front where rivers were seen as a mode of trade, transport and navigation and then to a more social front where river is seen as a place for social gathering, recreation with certain potential to boost the tourism of the city.

It was observed that there has been a decline in the people-river connect. One of the reasons could be attributed to limited access to the riverfront or lack of such vibrant and

active recreational spaces that would attract the public to use the same. Such issues can be addressed by proposing for new publicly accessible riverfronts with activities that would act as pull factors for the residents as well as outsiders, ensuring that the developed public realm is of high quality and at the same time support diverse uses. This would also involve spurring re-investment in developing the riverfronts taking examples from the current best practices making it self-sustainable and also incentivizing or forming SHG groups for maintaining the cleanliness of the riverfront brownfield sites. In order to implement the aforementioned recommendations, it is an absolute necessity that there is an improved coordination and oversight of the waterfront and waterways by the city governments and an enhanced efficiency of the permitting process for in-water construction.

1.5 SCOPE OF THE STUDY

The scope of the study includes:

- Identifying anthropogenic activities and land use characteristics of the riverfront
- Re-establishing connections between the city and the river in the most sustainable manner
- Devising suitable planning interventions and policy proposals based on the findings from the study

1.6 LIMITATIONS

The study has certain limitations as described below:

- The research does not look into the environmental aspects in particular like pollution issues, etc.
- Due to time constraint the financial aspect of the project has also not been taken into account.
- The design related aspects have not been detailed out, but have just been represented spatially.

1.7 MODULE STRUCTURE

This document has been structured in a very systematic manner starting from **Chapter 1**; which briefly describes the background of the research, the problem areas, the aim and objectives of this dissertation work, the opportunities as well as the scope of the project and limitations. **Chapter 2** is basically divided in to two sections, Section A; gives an overview of the literature review and key learnings from it while Section B, talks about the case studies in details. **Chapter 3** talks about the details of the case study area, Cuttack and the governance scenario as well as issues identified. **Chapter 4** covers the details of data collection the methodological design and the findings, the land-use and land-cover along with activity mapping and some key findings about the river-city interface. **Chapter 5** details out the strategies and planning proposals and how these can be implemented on ground and some practice of the practical considerations. **Chapter 6** talks about the key takeaways in the entire project the lessons learnt in the way forward.

Chapter 2 : BACKGROUND RESEARCH

SECTION A – LITERATURE REVIEW

2.A.1 SUMMARY

Cities have been regarded mainly responsible for the deterioration of rivers and, as a result, will need to play an important role in the rejuvenation efforts as well. Previous efforts to revitalize urban rivers and restore their ecology in isolation have always resulted in chaotic management practices that completely ignore the city or region's natural pattern of growth, human interdependence on the urban river, and uncoordinated initiatives that do not go hand in hand. Many of the interventions required to revive urban waterways are not feasible through infrastructure projects and engineering solutions alone (Strategic Guidelines for Mainstreaming Urban Rivers, 2021).

According to the India Rivers Week Assessment, "70% of our rivers face existential concerns." Over 60% of sewage generated in India is thrown untreated in rivers and bodies of water. The country's contaminated river sections have climbed to 352 from 302 two years ago."

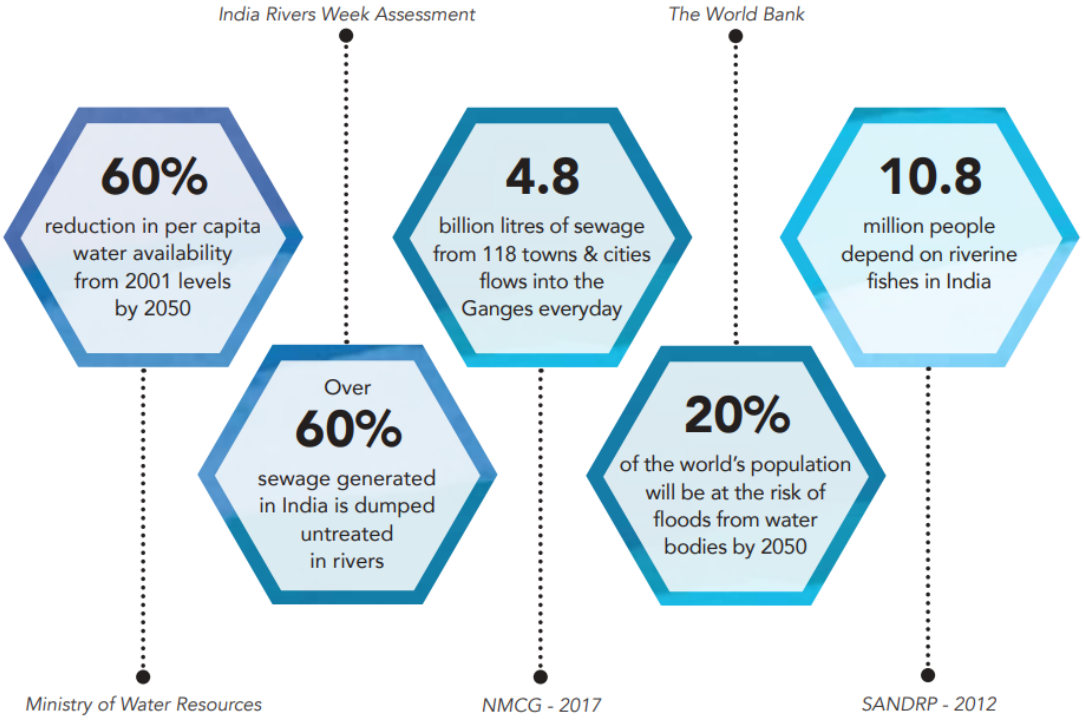


Figure 2-1: Water Statistics by Various Agencies
Source – Charting our Water Future, 2030 by McKinsey

In the context of urban river management, planning has two broad goals. The first is to revitalize and repair damaged riverine lengths that have become inefficient in serving their essential functions, primarily as a result of disruptive human activities. The second step is to devise a long-term strategy to ensure that the revitalized river portions are efficiently maintained. Holistic river management will necessitate interventions and coordination at several geographical scales, such as the national, basin, city, and river

zone levels. In India, however, river management is typically regarded at the river basin size, which includes the entire watershed, or in the form of particular projects along the river channel and its immediate vicinity. River management at the city level is uncommon.

2.A.2 ANNOTATED BIBLIOGRAPHY

The table below shows the name of the literature (news article, journals, research papers and government documents, etc.), the case study area followed by the theme that it talks about to give a better understanding of the existing study that has been done in this area and identify the research gap.

Table 2-1: Literature Review Thematic Divisions

NO.	NAME OF THE LITERATURE	THEMES
01	Strategic Guidelines for Mainstreaming Urban Rivers - NIUA, 2021 **River Ganga**	River-centric Urban Planning
02	Room for the River - Ministry of Delta and Water Management, 2021 **Netherlands**	River Restoration
03	A green nod for Pune Riverfront Project - Shoumojit B., 2021 **Pune**	Cosmetic Modifications
04	The demise of Urban Rivers - Venkatesh Dutta, 2020 **Gomti River**	River Restoration
05	Reclaiming the City, Waterfront Development in Singapore - TC Chang, 2010 **Singapore**	River-centric Urban Planning
06	What will it take to create a real connect between Yamuna and City Dwellers? **Delhi**	Restoring the people–river connect
07	Blue-Green Masterplan of Delhi - NIUA, 2021	Restoring the people–river connect
08	Urban Renewal Waterfront Development – The case of Sava Riverfront **Serbia**	Cosmetic Modifications
09	Tourism & Riverfront Development for Pekanbaru Damanik & Pratiwi, 2017 **Indonesia**	Cosmetic Modifications
10	Framework for Revitalizing the Riverfront in Urban Areas - Karteek Guturu, 2020 **Hyderabad**	Cosmetic Modifications
11	Cultural Landscape of Bhagirathi-Hooghly Riverfront Bardhan & Souporni, 2021 **Kolkata**	Cosmetic Modifications
12	Principles for Sustainable Riverfront for Malaysia - Yassin & McDonagh 2012 **Malaysia**	River-centric Urban Planning
13	The health impact of urban parks along waterways - Monika Trojanowska **Poland**	Restoring the people –river connect
14	Conservation and Transition: the case of Industrial Towns of China - Chen Xie **China**	River Restoration
15	Challenges & Strategies Towards a Livable - Water Sensitive Delta City **Guangzhou**	River-centric Urban Planning
16	Role of Water in Stabilizing Cities – Case of Delhi City - Purushottam Uttarwar **Delhi**	River Restoration

2.A.3 KEY FINDINGS

The literature studied so far mostly deals with the broad aspects of riverfront development as follows:

A. Enhancing tourism/cultural significance through cosmetic modifications
B. Enhancing River ecology through scientific approach and pollution mitigation strategies
C. Restoring the lost connection between the river and the people

Riverfront development should not merely be concerned with aesthetics and cosmetic modifications, it must also address issues of environment and ecology as well. It should take into account the community's views and perceptions and their expectations from such developmental activities that is likely to influence their relationship and interaction with urban rivers. A participatory visioning exercise would ensure the successful implementation as well as acceptance of such projects.

Riverfront development should not merely be concerned with aesthetics and cosmetic modifications, it must also address issues of environment and ecology as well. The riverfront initiatives often fail because of lack of basic framework and duplication of beautification ideas and the change of political parties once in every five years. (Framework for Revitalizing the Riverfront in Urban areas). The 1989 Red River Action Plan involved a unique aspect of community based participatory visioning exercise where the communities were made to think about how they wanted the riverfront to look like, what they wanted to achieve through the project, and how it would impact their livelihoods was effectively taken into consideration which led to creation of multiple riverfront projects. So, from this we get an understanding of the fact that river planning or river from development projects are dealt with in isolation and city master plans have solely been concerned with land-use planning, creating linkages between built up and open spaces, social settings and their surrounding environment. So, an approach which integrates both River and city planning i.e., river sensitive urban planning is missing, which requires specialised interventions to address river related issues within the city is in a holistic and comprehensive manner. Therefore, it needs to be understood that an urban river cannot be handled in isolation and that the approach to creating city development plans and master plan should rather be a more complimentary one rather than being a conflicting one while also clarifying the City's vision for a river, and illustrating on how it perceives the river in its development landscape (Blue - Green Cities Research Project, UK).

SECTION B – CASE STUDIES

2.B.1 SABARMATI RIVER FRONT DEVELOPMENT PROJECT

It has long been recognized that the development of Ahmedabad's riverside and the construction of suitable infrastructure may transform the Sabarmati River into a major asset for the city, greatly improving the quality of life. The Sabarmati Riverfront provides

the city a distinct character, to bring people closer to water, to refocus attention on the city centre, and to build city-level social infrastructure and recreation amenities.

2.B.1.1 BRIEF OVERVIEW

The city of Ahmedabad implemented the Sabarmati Riverfront Development Project as an urban design, urban regeneration, ecological, and environmental improvement project. This project aims to transform Ahmadabad's historic but neglected river into a vibrant and vital focal point for the city, along with extensively landscaped parks and gardens, clean ghats, a serene environment, clean water, sewerage diversion, and improved conditions for urban poor residents living on the riverbed. Sabarmati's proposed development is of mixed land use that includes commercial recreational and residential developments within both the sides of the river banks from the Gandhi Bridge to the Sardar Bridge. The project consists of a 10.5 km stretch creating approximately 202 ha of reclaiming land. There is a water management system for minimising floods and cleaning up the river with the new sewage treatment infrastructure as well. Several areas have particular focus in the project, namely:

I. Cleaning of the river to improve the river ecology and greening of the environment
II. Rehabilitation and resettlement of the Urban Poor on the Riverbank including sustaining
III. Revitalizing the traditional informal activities happening on the river bank
IV. Creation of the new area through best practices in urban design and urban renewal

2.B.1.2 PROJECT BENEFITS

The construction of permanent infrastructure for 1200 informal market sellers and 162 Dhobi Ghat washermen is complete. Almost 95% of the road network has been completed. All 162 Washermen who have been granted permanent facilities for washing clothing have well-equipped separate units.

I. Now it is possible to retain surface water in the river all year around
II. The ground strata are recharged with storage of 12.5 million cubic meter river water.
III. More than 250 MLD sewage is diverted from the river and pollution is eliminated.
IV. The river is protected from the scour and stopped the erosion of the river banks with Diaphragm walls.
V. 202 ha. land is available by retaining wall on both sides for further development for the city and flood protection.
VI. The embankments provided with wide walkways, green space with tree plantation and many other facilities.
VII. Rehabilitation of resettlement of 10046 slum dwellers in great pukka houses

VIII. Traditional users of a river like washer men and unorganized vendors are now provided with organized facilities.

IX. Easy access to the river water through Ghats, Stairs or Ramps

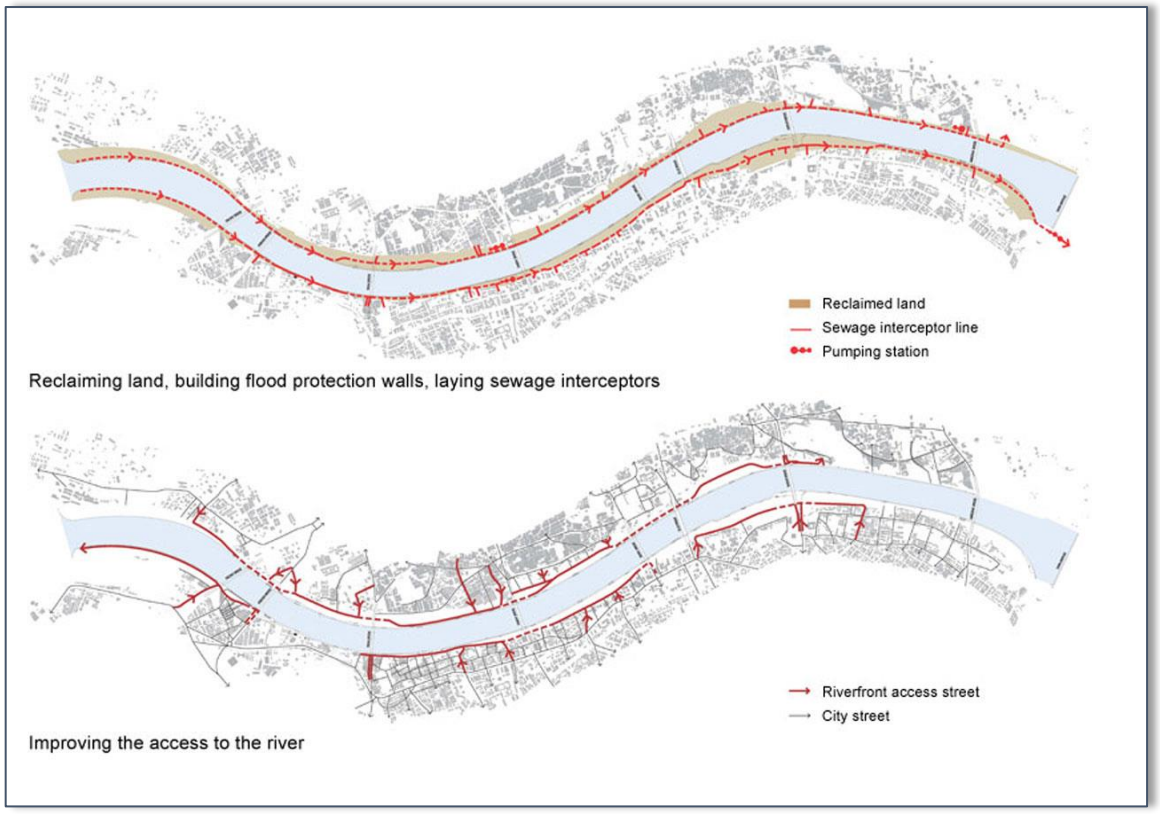


Figure 2-2: Spatial Representation of Land Reclamation and Improving Access to the River
Source – Riverfront Development by HCP

2.B.1.3 ADVERSE IMPACTS

According to an investigation conducted by regional officers and social activists, it was reported that when Sabarmati approaches Ahmedabad it no longer contains any freshwater. In fact, the river side is simply a pool of dirty stagnant water and it has been reduced to a canal transporting effluents from factories in Naroda, Odhav Vatva, and Narol regions, as well as sewage from the city. One of the activists emphasised that the Sabarmati River's drought like condition is exacerbated by the Riverside construction, resulting in an adequate groundwater recharge and increasing reliance on the already ailing Narmada River. The riverfront development has seen relocation of around 5,000 families. Apart from those who are presently bearing the brunt of high levels of pollution in the river, these relocated masses look at Sabarmati as a socio-political issue governing their lives and livelihood.

2.B.2 PLANNING OF RIVER YAMUNA

MPD 2021's ecological ambitions recognize the Yamuna River as a "green-blue" asset whose care and maintenance will be critical to supplementing Delhi's water supply, promoting green businesses, and integrating the city into the broader circuits of eco-

tourism. The proposal exposes its commercial perspective of the Yamuna by referring to it as a "asset."

2.B.2.1 BRIEF OVERVIEW

While earlier Delhi master plans have included everything from entertainment parks to biodiversity reserves along the Yamuna, the newest proposal focuses on restoring the city's lost "river people link" with the river. Continuing MPD 2021's ecological ambitions, the new plan recognises the Yamuna as a "green-blue" asset whose care and maintenance will be critical to supplementing Delhi's water supply, promoting green businesses, and integrating the city into the broader circuits of eco-tourism. The key interventions include:

I. Integrating River planning with the environmental aspect of formulating a Masterplan
II. Ensuring Waterbodies and Green spaces are synchronously planned
III. Cleaning of the waterbodies, canals and drains and regulating their health
IV. Creating green trails around them that can be used as buffer zones and promote NMT and Pedestrian movements

Figure 2-3: Mapping of Ghats by their usage
Source – Blue Green Assets, Masterplan of Delhi, 2041

2.B.2.2 EXPECTED OUTCOMES

The major focus here is on integrating sustainable ecological techniques with the creation of public "interactive zones." Desilting existing wetlands and developing new ones, planting indigenous species of flora, and using treated wastewater to ensure enough flow in the river all attempt to revitalise the river's ecosystem. The projected benefits from the proposals include:

I. Creation of quality Public Realms through public promenades, parks, green trails, etc.
II. Attaining ecological sustainability through cleaning of the river Yamuna
III. Rejuvenating River ecosystem on one hand and monetizing them into urban commons for aesthetic purposes
IV. Installation of a large-scale storm water capture project in the Yamuna Floodplains through Green Funds

2.B.2.3 ISSUES

Farmers along the Yamuna have continued to face eviction due to implementation of the Yamuna Riverfront Development Plan to build parks in place of the farms. (Scroll.in, 2021). Several issues related to removal of encroachments and reclaiming of land at several places, adding that poor upkeep and dumping of industrial and untreated waste into the river made large parts of the Yamuna Riverfront inaccessible (Financial Express, 2021). At present, Yamuna barely has any freshwater running through it by the time it exits Delhi and flows into neighbouring Uttar Pradesh.

2.B.3 VARANASI HERITAGE DEVELOPMENT

The issue of increasingly threatened heritages holy sites, is consequence of the unplanned development where religion-politics interface plays a crucial role. The social agenda is to respond to a river in need, a river that feeds one of the highest densities of population in the world, and in its resurrection, not only bring back the glory of the past that also create potential for the future that sustains Ganga's intrinsic importance in the lives of the future generation.

2.B.3.1 BRIEF OVERVIEW

This project aims to rehabilitate and develop the ghats and crematoriums along a 210-kilometer stretch of the Ganges, India's longest river. The project, titled "**A River in Need**," is part of the larger National Mission of Clean Ganga (NMCG), with twin objectives: to ensure effective abatement of the river's pollution and to conserve and rejuvenate it. Morphogenesis worked on a total of 33 ghats and 20 crematoria along the stretch of the river between the holy cities of Allahabad and Varanasi. While looking at the rejuvenation of the river, prime design concerns included the erosion of the river bank and flooding.

2.B.3.2 KEY INTERVENTIONS

The plan includes both smart as well as cosmetic modifications like proposing hume pipes to stabilize the bank, redesigning the crematoria and the pyres to reduce the amount of wood needed to just 30% of the traditional requirement. Ghats were redeveloped in a manner so as to stabilize the river-edge while providing an interface for human engagement with the river. The urban design interventions combined the use of several

typologies of platform to account for diverse functions: extended ones to access water-transport at all levels, smaller ones for daily rituals, and large performance stages for events. Platforms were designed to be supported by colonnades to make sure that the river flow remains uninterrupted. In an attempt to add to the ghats' traditional religious function, the new developments were enabled with Wi-Fi; as it was envisioned that the ghats were important urban spaces for discourse and dissemination of knowledge. The ghats were designed to almost entirely on solar power: Solar panels are installed atop "Smart Columns," which act as shading devices while simultaneously fulfilling the essential functions of providing drinking water and internet connectivity. Furthermore, locally-available and low-maintenance materials were used to reduce ecological impact: the flooring was made out of porous stone to enable water to percolate through, while the structures were predominantly built-in brick.

Figure 2-4: Varanasi Ghat Redevelopment
Source – INI Design Studio portal

2.B.3.3 OUTCOMES

Urban interventions for sustainable restoration of a historic interface between the space of human habitation and space of matter. Reforestation with plants that are resilient and work with varying flood levels on the ghats. Rejuvenation of the usage of urban rivers with an aim to turn the city upside down by sustainable development of the riverside urban frontage. Whilst looking at the rejuvenation of the usage of urban rivers, the design concern has been dealing with the erosion of the river bank due to varying flood levels. The design interventions merely cater to the problems of pollution of the riverfront because of major anthropogenic activities and the developments being mostly directed towards increasing usage of the ghats leading to enhanced pollution of the holy waters through rituals and other practices.

According to an expert in Political Science from Banaras Hindu University, the corridor will give a political mileage to BJP in the coming elections as a temple complex attracts several million tourists and devotees from across the country and is a key developmental project that will make up revenues. Now, since the acquisitions were done amicably, the testimony of the success story of this project is the fact that there is no litigation pending in any court of the country regarding land acquisition or rehabilitation. On the contrary, the locals have expressed their misery that their ancestral family homes were demolished

and properties acquired and despite of constant negotiations with the government authorities they miserably failed to persuade them otherwise. A lot of the people who had the business and shops over the land got consumed by this project and shifted elsewhere.

2.B.4 MARINA BAY, SINGAPORE

Singapore as an island city has been blessed with a long coastline and waterbodies right in the heart of the city center. Within and near the City Centre, we have the Singapore River, Kallang Basin and Marina Bay. Marina Bay is a unique waterfront district extending seamlessly from the CBD. It is a dynamic, Garden-City-by-the-Bay with multiple opportunities for business and financial services.

2.B.4.1 BRIEF OVERVIEW

The precinct of the Marina Bay was envisioned to be a vibrant 24/7 "live-work-play" and environmentally friendly district, with a good mix of commercial, entertainment, hotel and residential developments. The aim was to provide a series of layered gardens creating ample green space throughout the Bay, extending the tropical garden landscape from Marina City Park towards the Bayfront. The landscape network reinforces urban connections with the resort's surroundings, and every level of the district has green space that is accessible to the public.

2.B.4.2 KEY INTERVENTIONS

The project led to the creation of an attractive total lifestyle environment. The existing grid pattern of the city and has in-built flexibility to meet changing business needs and market demands. A variety of development intensities and building heights, with lower-rise buildings located along the waterfront and higher buildings stepping up behind, helps to create an attractive signature skyline. Three key strategies were adopted:

- Creating an activity corridor for recreation and leisure through mixed land uses;
- Mixing old and new developments,
- Forging a public/private sector partnership.

2.B.4.3 OUTCOMES

The precinct became a vibrant 24/7 "live-work-play" and environmentally friendly district, with a good mix of commercial, entertainment, hotel and residential developments. Not only did it provide prime office space for global business and financial institutions, it will also have condominiums, hotels, shops, restaurants and nightspots. This increased the potential for mixed-use developments and encourages live-work-play communities.

2.B.4.4 KEY LEARNINGS

The success of Marina Bay Sands is owed, in large part, to its completely seamless integration of elements. None of the components work well as independent silos, but

together they create a complex microcosm of a city that serves as a vital public meeting place. Each element adds something to the experience of the resort as a whole. The renovation of Singapore's urban waterfront, as shown by the Golden Shoe district, the Singapore River, and Marina Bay, encapsulates Singapore's unique approach to urban development in balancing economic, social, and environmental goals in a land-constrained context.

While the process has developed since its inception, core principles have remained similar over time. Urban regeneration necessitated forethought and planning, and it began concurrently with the establishment of a comprehensive master plan framework for Singapore. A systematic method to long-term planning was finally established, with the Concept Plan being reviewed every 10 years to map out development directions for the next 40-50 years. The strategy also includes the creation of a Master Plan to translate the Concept Plan's broad and long-term ideas into concrete plans for implementation over the next 10-15 years.

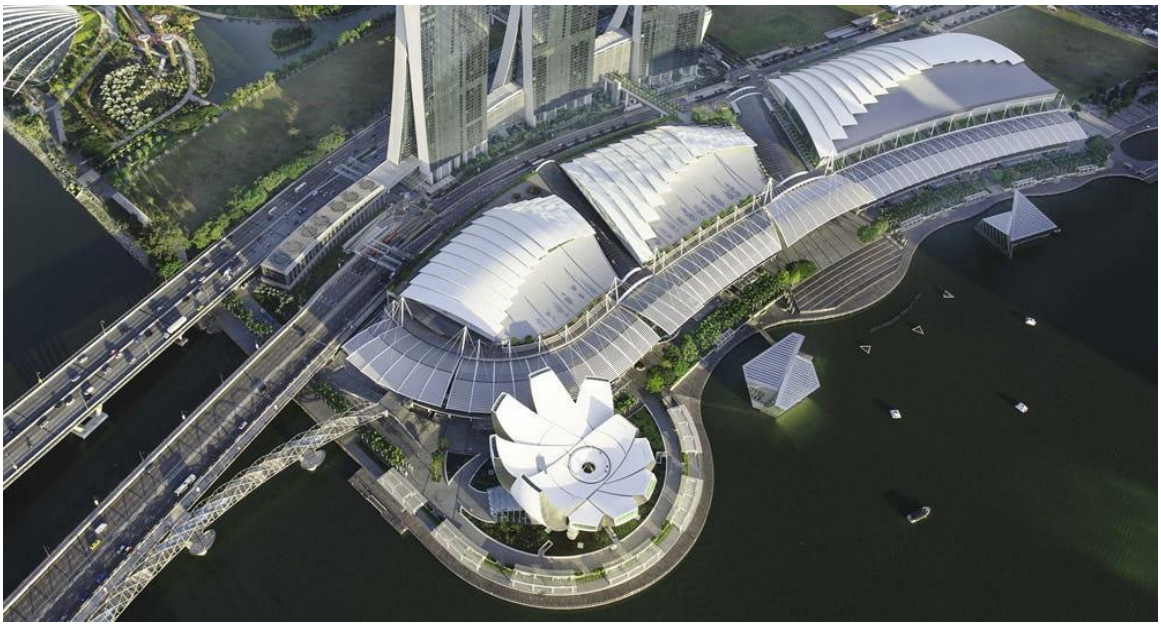


Figure 2-5: Marina Bay Waterfront Development
Source – AECOM Projects portal

Singapore's integrated planning regime differs from those of other cities in that its plans do not exist solely on paper. They are efficiently coordinated, implemented, and executed by designated government entities with the necessary knowledge and resources. The Urban Redevelopment Authority, the Housing and Development Board, and the old Public Works Department are among the action-oriented agencies. The makeover of Singapore's urban waterfront is largely the result of the government's effective collaboration with the markets. In many ways, this collaboration is exemplified by the Government Land Sales programme, in which the government provides upfront public infrastructure as well as a clear, transparent framework for development in the form of

land sale terms and a bidding procedure. The commercial sector, for its part, offered creative expertise as well as financial resources.

Chapter 3 : SITE STUDY

3.1 CASE STUDY AREA

Cuttack gets its name from the Sanskrit word Katak, which means "army cantonment." Cuttack was the eastern twin of Banaras, well defended and a thriving mega-mart of silver trade. Cuttack's nautical greatness had even reached the ears of the greatest Mauryan emperor Asoka, who had waged the Kalinga War in 261BC, much to then turn it over to a local king under his reverence. Cuttack even maintained its maritime superiority during the Afghan assault and following Imperial Mughal administration.

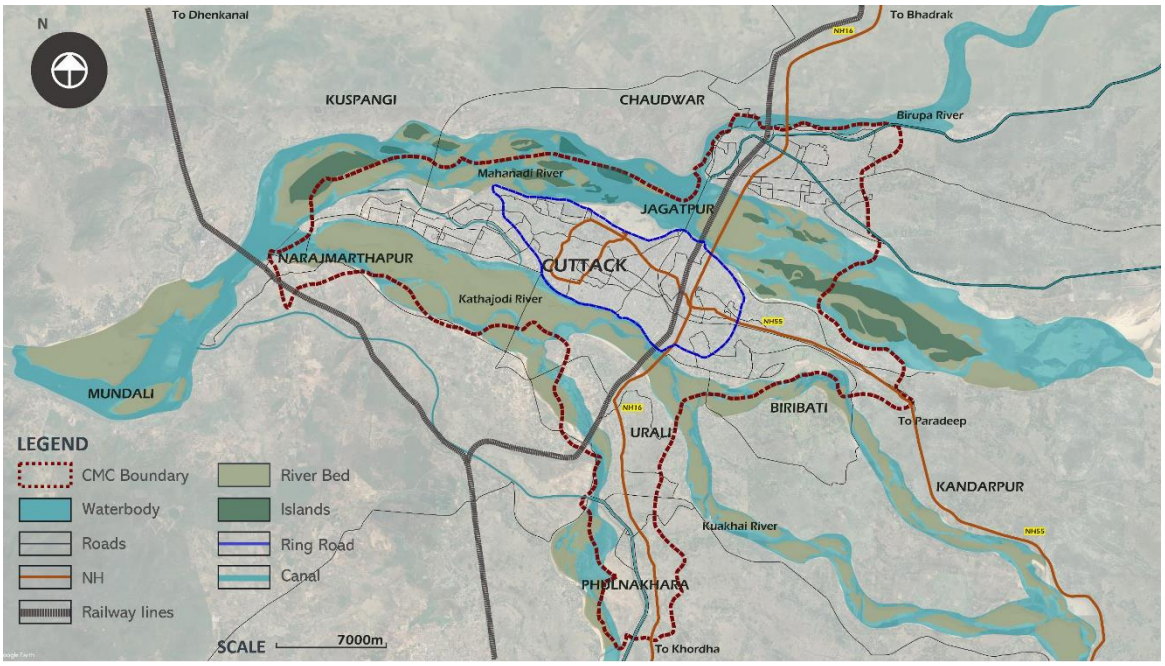


Figure 3-1: Base map for the city of Cuttack

The city's old and most important part is centred on a strip of land between the Kathajodi and Mahanadi rivers, limited on the south-east by Old Jagannath Road. The city is part of the Cuttack Municipal Corporation, which has 59 wards. Cuttack spans from Phulnakhara in the south over the Kathajodi River to Choudwar in the north across the Birupa River, while in the east it starts at Kandarpur and runs west to Naraj. The city is traversed by four rivers, including the Mahanadi and its tributaries Kathajodi, Kuakhai, and Birupa. Further, Kathajodi is divided into Devi and Biluakhai, giving the geographical area the appearance of fibrous roots. Cuttack and Bhubaneswar are often referred to as Odisha's Twin Cities. Concurrently, during the Marathas' reign, Cuttack flourished as a commercial hub, diversifying into handlooms and handicrafts. Even before Europe could enjoy the Renaissance, which brought out brave explorers from many kingdoms daring the unknown and discovering sea routes to distant lands, the sadhavs (sailors) of Cuttack had already established commercial relations with foreign lands such as Java, Bali,

Borneo, Sumatra, Cambodia, Indonesia, Malaysia, Sri Lanka, Maldives, Myanmar, and even some east African countries. It's hard to believe they didn't have advanced nautical equipment like a navigator's compass, maps, or hauls to help them navigate the huge ocean. Their biotas (boats) were also fashioned of basic wood from local forests. Cuttack's trade experienced an unexpected setback with the arrival of the British. The East India Company dismantled the Jobra ship-building workshop, which had been established with local financing to build more vessels to boost trade. Cuttack's wealthy merchants, bankers, and tradesmen were destitute as a result of their punitive rules. Some traders went to Cambodia and Indonesia, where they re-established their businesses. However, the majority remained to pay for their own subjugation. With trade options dwindling, the locals turned to farming, cattle-rearing, and other professions they were never proficient at. Families became impoverished by the day until the most catastrophic wave of the 1866 famine, when the death tolls drew international attention to British control. (Mohanty K.S., 2020).

The Cuttack Municipality was established in 1876 to develop the town for residential British residents, long before Pondicherry and other cities were revamped by the British. Cuttack's peculiarity as a commerce centre, on the other hand, remained completely unnoticed. Even international supporters had to withdraw their assistance since they, too, were suffering under the weight of colonisation. If one visits the Cuttack Maritime Museum now, he/she will witness the old, indigenous machines of the workshop sulking inside the glass panes, still flashing clicks of ancient marine technology. The descendants of Cuttack's trading families are still telling guests and visitors about their forefathers' experiences in far-away locations like Bali and Java. Cuttack has developed on the banks of River Mahanadi and River Kathajodi due to their strategic importance for transportation, trade, agriculture and fishing. For decades, the dependence was on the traditional and cultural fronts such as idol immersion, boita bandana on Kartik Purnima and performing funeral rites.

Figure 3-3: Mahanadi River View Point

Figure 3-2: Kathajodi River Side

There has been a shift in the perception of river, from being a primary factor in the livelihood front be it for fishing or agriculture to an economic front where rivers were seen as a mode of trade, transport and navigation and then to a more social front where river is seen as a place for social gathering, recreation with certain potential to boost the tourism of the city.

3.2 GOVERNANCE AT GLANCE

3.2.1 THE URBAN LOCAL BODIES

On June 4, 1876, the Cuttack Municipality was created. It was later granted the status of Municipal Corporation with effect from 15.08.1994, and is currently known as Cuttack Municipal Corporation. This municipality has a land area of 1925 square kilometres and a population of around 5,35,139 people. It has 783 kilometres of road coverage and 1729 kilometres of drainage. It has built 1682 tube wells, 9902 street lights, 12 medical dispensaries, and 10 schools, among other things.

The various services rendered by the Cuttack Municipal Corporation are as follows:

- Construction & Maintenance of Civic Infrastructure
- Poverty Alleviation
- Sanitation & Public health
- Mutation of Holdings
- Removal of Encroachment
- Creation of Vending Zones
- Issue of Birth Certificate and Death Certificate.
- Issue of Trade & Carriage licence.
- Issue of Marriage Certificate.
- Post Disaster Management Relief & Rehabilitation.

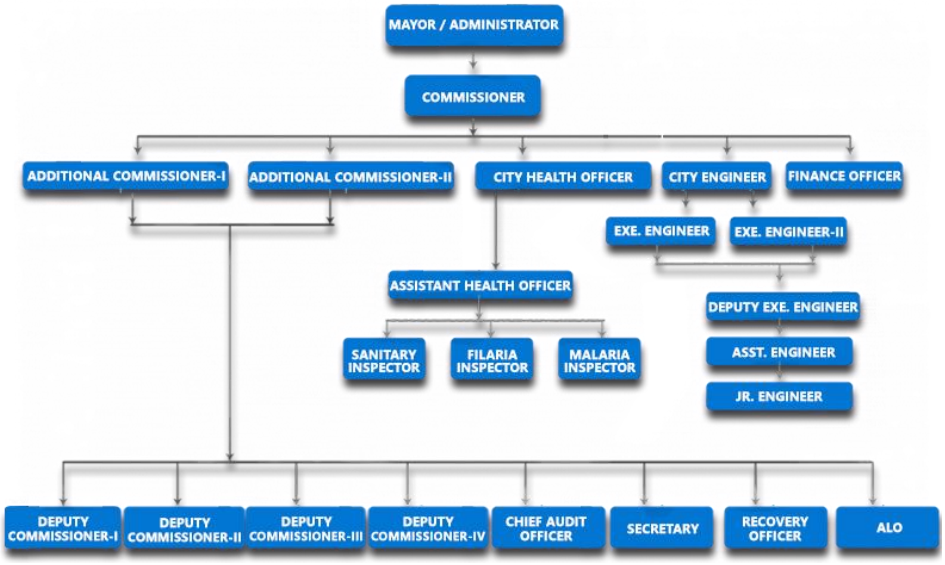


Figure 3-4: Organisational Structure/Organogram for Cuttack Municipal Corporation
Source: Cuttack Municipal Corporation portal

The Cuttack Development Authority has been constituted vide Housing and Urban Development Department Notification No: 37634/HUD, under the provisions of the Orissa Development Authorities Act, 1982. The Authority has the following objectives:

- To undertake works pertaining to construction of housing colonies, shopping centres, markets, industrial estates and provide public amenities.
- To prepare development plans including zonal development plans.
- To regulate development and use of land including private land.
- To undertake schemes for improvement and clearance of slums and re-development programmes.
- To enhance the green cover of the city by taking up mass plantation programmes.

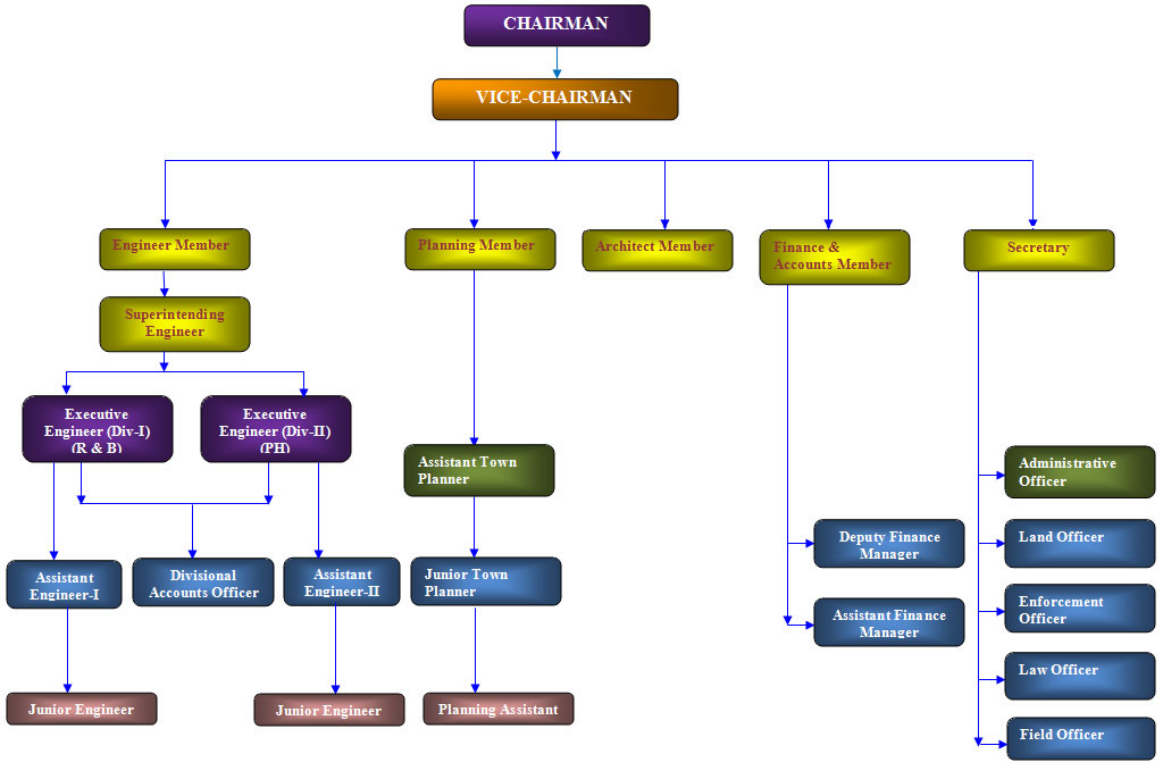


Figure 3-5: Organisational Structure/Organogram for Cuttack Development Authority
Source – Cuttack Development Authority portal

3.2.2 GOVERNANCE RELATED ISSUES

Holistic river management necessitates deliberate and coordinated efforts from a variety of government agencies involved in irrigation and flood control, groundwater, pollution control, tourism, public works, horticulture, forestry, and other activities. Non-state entities such as NGOs, citizen groups, and religious bodies also play an important role. Unfortunately, in most cities, there is little communication and cooperation among these stakeholders, resulting in a "silos" management strategy.

The poor financial condition and lack of institutional capacity, is one of the biggest reasons behind the reiterated state of rivers in the city. There is excessive state control exercised by the state government over the Municipal Corporation and Development Authority. That proves to be more of a bane than boon, because instead of providing guidance and support through the control mechanism, the control turns out to be negative, restricting the functions of these bodies. Another critical fact is the lack of management capacity to either plan an economic activity or execute the same. During municipal meetings, social and economic elements such as caste, religion, and economic standing play an important part in driving decision-making. It is said that members/authorities from higher castes and those with more resources dominate and are often effective in getting their decisions/resolutions accepted. As a result, other members' problems are often ignored. In this case, it may not be wrong to suppose that when judgments are implemented, only a subset of the population benefits.

The system of recruitment fails to bring in the best men. Several vacancies are not filled for years and transfers are affected at the free will of the senior bureaucrats and the government officials. The planning functions have been entrusted with the development authority and the corporation has little or no role to play in it, so there is lack of coordination. Inability to coordinate leads to administrative in efficiency and poor governance. There are policies in place that require implementation and monitoring, but because of poor planning and poor coordination among Centre, State and various departments at the local level, leads to poor implementation of these policies and schemes.

Lack of interdepartmental coordination is one of the most significantly prevalent issues in almost all local government bodies of Odisha. Inter-departmental coordination is a huge issue because there are no clear regulations defining what each department will do, when it will do it, and how. This demonstrates the absence of a defined division of labour among departments involved in policy implementation. Another issue linked with coordination is officer position ambiguity, which is caused by a lack of proper regulations, suggesting that the form of rules impacts the level of coordination. As a result, the existence of proper rules can make a significant difference in attaining coordination.

Chapter 4 : SITE ANALYSIS

4.1 DATA COLLECTION

Reconnaissance Survey is a very important parameter to visually understand the site as a preliminary survey tool. In this survey we visit the site and click photographs, identify problem areas. A quick reconnaissance also exposes the capacity of the facilities, such as the total number of primary schools, the length of open space, accessibility to play grounds, distance to local shops, and so on, and aids in assessing planning issues, particularly at the local level.

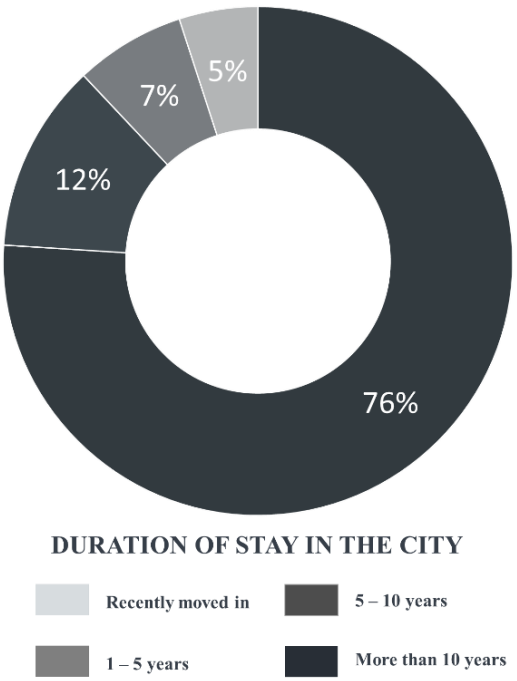
Figure 4-1: Rituals performed at Gadgadia Ghat
Source – Captured by Author

Figure 4-2: Taladanda Canal Redevelopment
Source – Kalinga TV

The study being a typically qualitative one, required data to be collected from various survey participants like Local Communities, Residents, various Government Departments like Cuttack Development Authorities, Municipal Corporation, Odisha Water Supply and Sewage Board, State Pollution Control Board, etc., various news channels and local dailies along with NGOs and Temple Trusts.

Data obtained from the Residents and Locals comprised of details like Socio-economic profile, income-generating activities being practiced and the amount of revenue generated, etc. that would give us a comprehensive understanding of the Level of Dependence, their behaviour & attitude towards river & its usage as a resource and level of control that is already being exercised. Data from the government departments consisted of Previous Master Plans or CDPs, Maps or Shapefiles related to Land Use Plan – both Existing and Proposed, any ongoing efforts by NGOs/CBOs related to the concerns of River pollution, any efforts or initiatives taken by the Authority for riverfront development, River - Tourism related initiatives or projects in the pipeline, Development Control Guidelines, Status of Swachh Cuttack Abhiyan – Interim Reports, AMRUT, Budget Allocation for initiatives related to riverfront or river cleaning or mitigating flashfloods, Initiatives related to Mitigation Strategies of flashfloods in the city, Grievances registered by residents to register concerns of flashfloods, upcoming STP Project, and so on.

4.1.1 RESIDENT PERCEPTION SURVEY



76% of the people surveyed feel that the course of the river has changed and the quality has deteriorated.

12% of the people feel that the current state of the rivers is due to dumping of untreated sewage and waste disposal by the slums abutting the shoreline.

Figure 4-3: Pie Chart showing the Interviewees' duration of stay at Cuttack
Source – Resident Perception Survey

The respondents shared their perception of river, how they've seen it change over the years, how there has been a shift in the level of dependence and connection of people and river. Understanding every age-group's perception about urban rivers, their idea of having a recreational space near the banks of the river, their relationship with the rivers, how pandemic has affected any kind of tourism or recreational activity that used to take place and so on.

It was observed that people prefer going to river view parks and playgrounds near the river banks for their recreation. Specially people from the age group of 15-30 years go to the playground and park near the river banks for recreation purpose. People from the age group 31-50 years go for walking/jogging purpose or sometimes go in the evening for leisure. The older age group above 51 years is ignorant of any recreational activities in Cuttack or any riverfront parks that have recently been developed by the urban local bodies (23% of the interviewees).

Figure 4-4: Infographics showing the interest of activities by the Interviewees
Source – Resident Perception Survey

The interviewees expressed certain amount of concern about the growing congestion in the city and the fact that the newly developed open spaces for purposes of recreation are coming up in the outskirts of the city and is difficult for them to access. Apart from the issues of accessibility and proximity, there are safety concerns as well as the growing amount of pollution of the rivers and disposal of untreated sewage into the rivers.

Table 4-1: Concerns expressed by residents of Cuttack

1.	2.	3.	4.
"It gets highly unsafe for the elderly people to get out after dusk, even we are afraid to visit the Balijatra field because it is deserted and dark" - Resident from Mission Rd.	"I don't let my little kids go and play in the field near the river because a lot of drowning cases are taking place in the same area and there are no safety/control measures to monitor the kids" - Resident from CDA Sector 6	"The play areas and theme parks along the rivers is very far from our place of residence. So even if there is any recreational facility available, we are ignorant of the same." - Resident from Bidanasi Area	"The STPs are not yet functional but this does not mean that the untreated waste has to be dumped into the river. Additionally, the slums encroaching the riverbed make it more polluted" - Resident from Buxi Bazar Area

4.1.2 LIVELIHOOD DEPENDENCE SURVEY

A livelihood dependence survey was carried out among the slum communities of Cuttack to understand their level of dependence on rivers for their livelihood. Data was collected from 50 respondents who belong to various slum communities of Bidanasi Dhoba Sahi, Bidanasi Kumbhar Sahi, Krusaka Bazar, Munda Sahi and Khannagar Guru Sahi Keuta. The following map shows the locations from where the samples were collected:

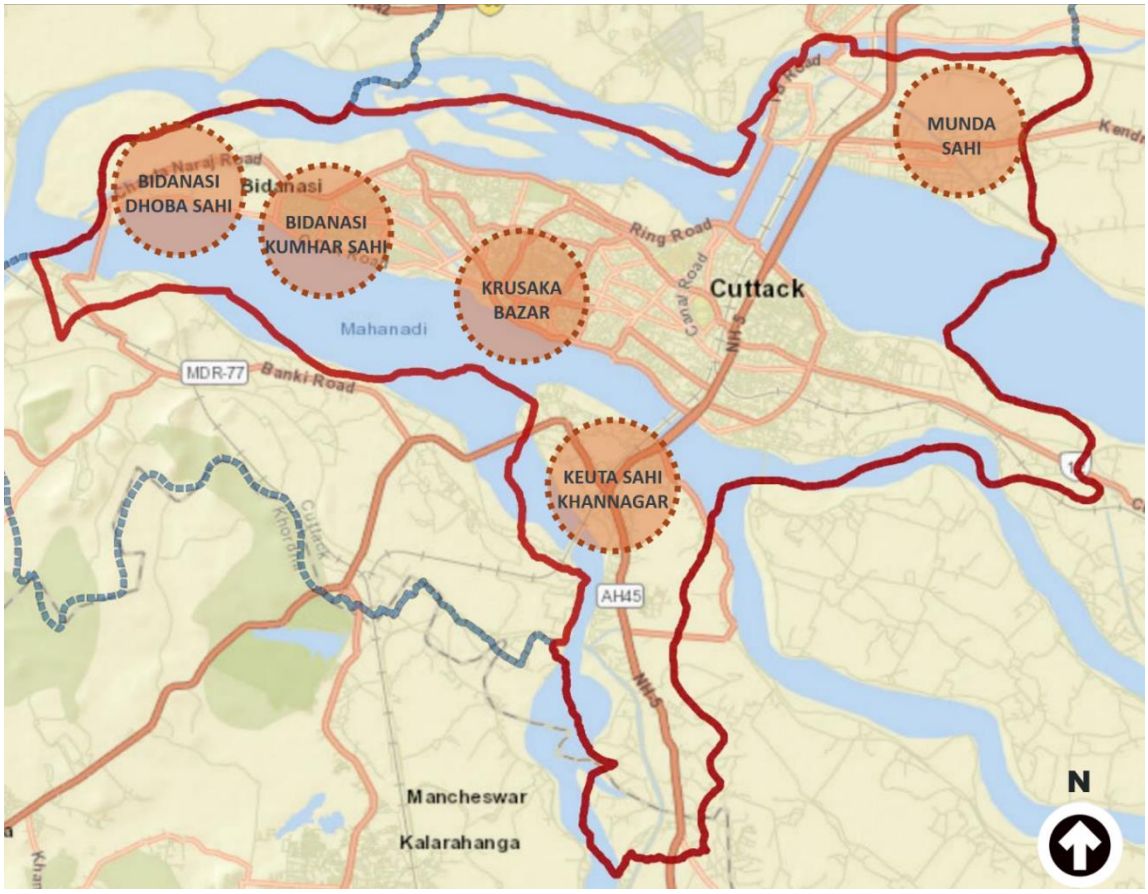


Figure 4-5: Map showing spatial location of Informal settlements
Source – Livelihood Dependence Survey

BIDANASI DHOBA SAHI

This slum community has around 24 households and has got piped water supply and community toilets. This slum community has existed in the same location for the last 30 years and mainly earns its living by washing clothes (as the name suggests). They are dependent on the river for their livelihood and in fact use the riverbed area to dry the wet clothes.

Figure 4-6: Washermen washing clothes at the Dhobighat in Dhoba Sahi
Source – Captured by Author

BIDANASI KUMHARA SAHI

This has been existing for the past 25 years and the slum dwellers mainly earn their living by creating idols and other earthen wear pots and selling them to a local vendor. During an off season, when there is no puja or idol creation required, they get into construction works or serve as maids and security guards for their living. This community also perform theatre or 'Jatra' as Odias call it and prepare costumes for the same.

Figure 4-7:Storage of Idol Making equipment at Kumhara Sahi
Source – Captured by Author

KRUSAKA BAZAAR SAHI

This slum was previously located at Jobra Canal and now has been relocated to Mattagajapur because of the rehabilitation measures for Canal Redevelopment. There are 343 households in this slum community and their only source of income is agriculture. The land they use for cultivation is a double crop land and is in close proximity to Kathajodi side.

Figure 4-8: Daily market of Krushak Bazar Sahi
Source – Captured by Author

MUNDA SAHI

This slum has come up very recently and has existed for about 10 years. There are around 76 - 80 households and the people here are mostly engaged in household and construction work. Some of them work as auto-drivers and some have small grocery shops nearby.

Figure 4-9: Interviewing a resident of Munda Sahi **Source - Captured by Author**

KHANNAGAR GURU SAHI KEUTA

This is mainly a fishermen basti and has existed for 4 - 5 generations now. Earlier the prime source of income was fishing and aquaculture. But the waters are not fit for freshwater fish breeding so the produce declined and then most of them switched their prime occupation to auto drivers, household construction workers and so on.

Figure 4-10: The Fishermen Community at Keuta Sahi
Source – Captured by Author

4.1.3 FOCUS GROUP DISCUSSIONS (FGDs)

For the purpose of this project two FGDs were conducted one, which comprised of 8 women with their kids who work as household maids and two, comprised of 12 senior citizens (>55 years) who are basically retired military officers. With the help of these FGDs, several issues could be identified as follows:

Figure 4-11: FGD with a bunch of Women
Source - Captured by Author

Congestion The city is extremely congested and lacks open spaces. The city grown into the course of the rivers.

Deterioration of rivers Dumping garbage and untreated sewage in the river are critical issues that slowly kills the biodiversity catered by the river.

Decline in the people river connect There has been a paradigm shift in the perception of river from being a primary contributor in livelihoods to just recreational aspects.

Illegal sand mining Excessive sand mining has altered the riverbed and has contributed to change the course of the river.

Deteriorated old city heritage Cuttack, being a Millennium City has rich cultural heritage which stands in a deteriorated stage because of lack of maintenance by the authorities.

Lack of enforcement of RRZ Guidelines as Cuttack relies on NDMA regulations and the old building byelaws, leading to encroachment of riverbanks

4.2 LAND USE LAND COVER

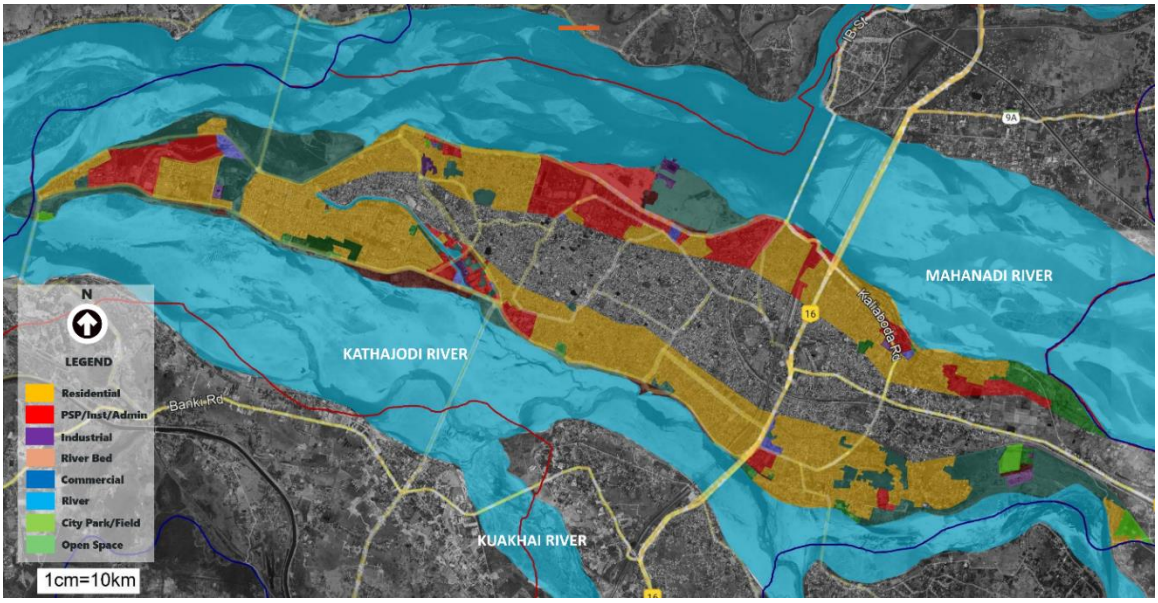
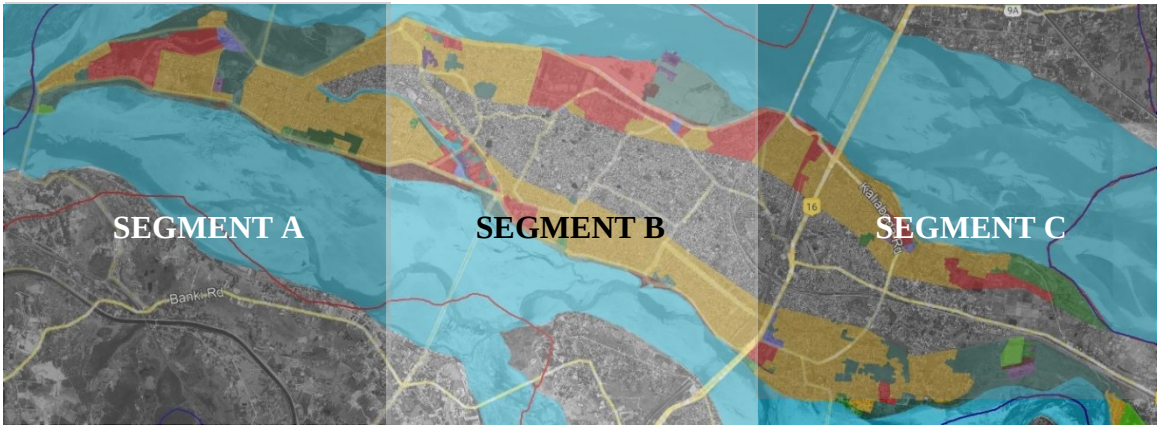


Figure 4-12:Land Use-Land Cover Map for the 1km area from each side of the rivers

This land use map has been done only for the purpose of mapping out the activities taking place on both sides of the river within a buffer of 1 kilometre only which is why the land use of the entire city has not been mapped. The land use has been mapped through land sat imagery from the Google Earth archive data as recent land use land cover data was not available. From the map above, it can be easily figured out that maximum area adjacent to the rivers are of the Residential land use category (50.34%), followed by Open Spaces (17.82%) and then comes the Public-Semi-Public use category (12.28%) which mostly comprises of Temples, Religious precincts, Ghats, etc.

4.3 ACTIVITY MAPPING

River banks are often used for recreational purposes, such as strolling, running, and bicycling. Along the banks of rivers, sports events and festivals are commonly held. River cruises for tourism are also popular. Rivers are popular recreational locations for communities. River enthusiasts' fish, and other recreational activities such as boating, wildlife watching, sports, and other leisure activities take place beside rivers. For mapping the activities near the rivers, the above map has been divided into three different segments A, B and C. (Please refer **Annex II** for the whole map).



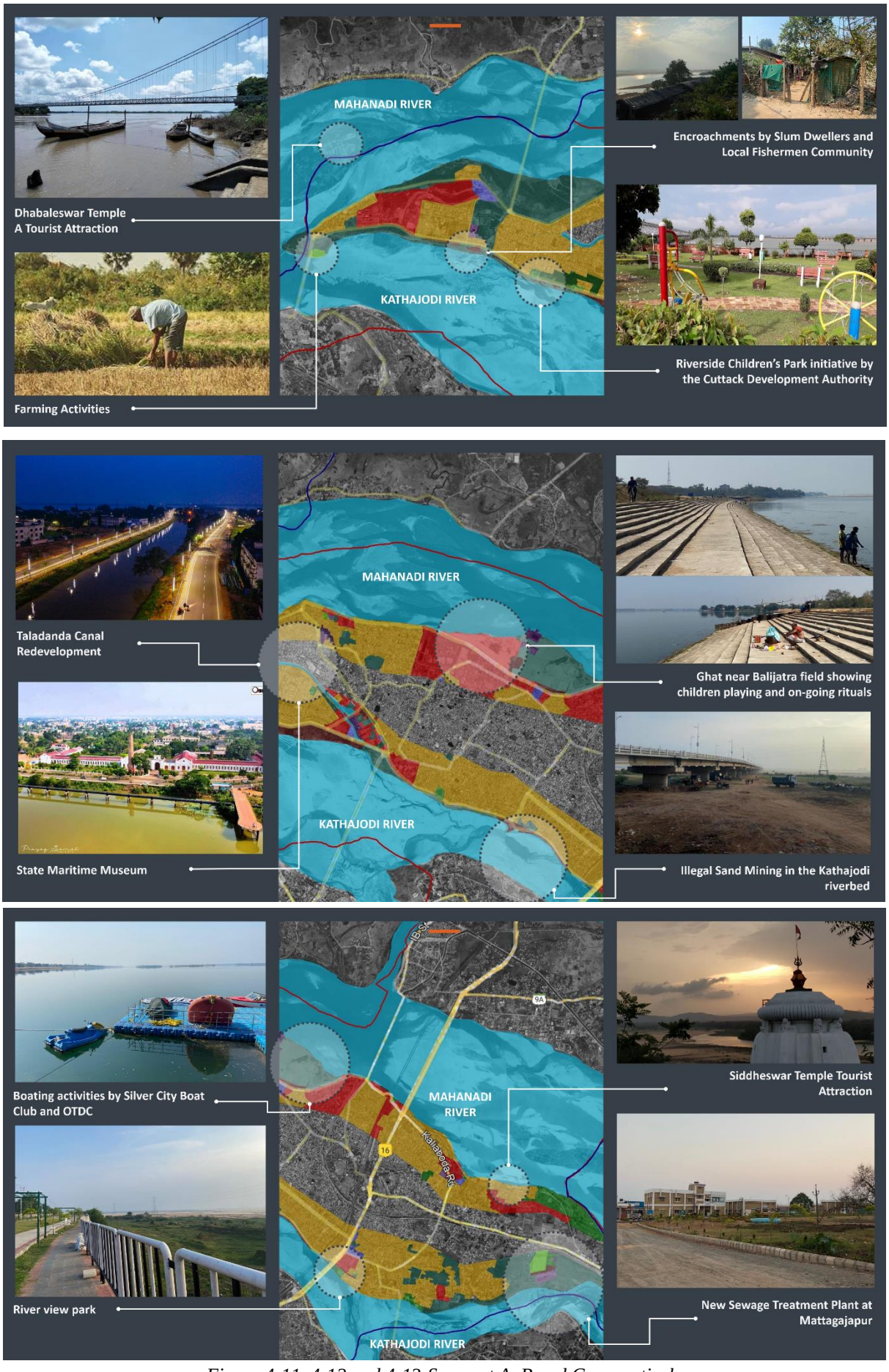


Figure 4-11, 4-12 and 4-13:Segment A, B and C respectively

4.4 KEY FINDINGS: RIVER-CITY INTERFACE

It was observed that there has been a decline in the people-river connect. One of the reasons could be attributed to limited access to the riverfront or lack of such vibrant and active recreational spaces that would attract the public to use the same. Such issues can be addressed by proposing for new publicly accessible riverfronts with activities that would act as pull factors for the residents as well as outsiders, ensuring that the developed public realm is of high quality and at the same time support diverse uses. This would also involve spurring re-investment in developing the riverfronts taking examples from the current best practices making it self-sustainable and also incentivizing or forming SHG groups for maintaining the cleanliness of the riverfront brownfield sites. In order to implement the aforementioned recommendations, it is an absolute necessity that there is an improved coordination and oversight of the waterfront and waterways by the city governments and an enhanced efficiency of the permitting process for in-water construction.

Figure 4-15: Bolbom rituals at Gadgadia Ghat
Source – Times of India

Figure 4-14: Balijatra during Day Time
Source – Times of India

4.5 STAKEHOLDER DISCUSSIONS: 'WHO OWNS THE RIVERS?'

While interviewing several Government officials, a very interesting question regarding the ownership of the rivers was asked and most of them replied that "Rivers are a National Asset and a Natural Resource and hence it cannot be owned by any particular Government Body or Territory despite of agreeing to the fact that a lot of interstate river conflicts happen every now and then in the country. Few of their comments are mentioned below for reference:

1 "River is a natural resource, so no one owns the river. There are various layers to this when it comes to ownership as river cannot be seen as a property that can be owned by any particular authority."
~ Municipal Commissioner, Cuttack Municipal Corporation

2 "Rivers in India is a State Subject, but is also a root cause of many inert-state disputes. However, determining whether the rivers 'belong' to the state necessitates a more thorough legal analysis focusing on the intricacies of the terms 'ownership' and 'control.'"
~ Engineer-in-Chief, Department of Water Resources

3 "According to the Supreme Court, river water is a national asset in which no single state can claim exclusive possession. The water of a river is a "national asset" and a valuable gift from nature, and no state can claim it or deprive others of it."
~ Assistant Town Planner, Cuttack Municipal Corporation

4.6 DIMENSIONS OF THE RIVER

Figure 4-16: Dimensions of the River

River can have different dimensions based on people's perception and the way people use it or the purpose. River flows connect people, places and other forms of life, inspiring and sustaining diverse cultural believes, values and ways of life. The diversity and interdependencies of human flow relationships such as the linkage between river flow and human well-being, spiritual needs, cultural identities and sense of place-that are typically overlooked when environmental flows are assessed and negotiated. For many human populations around the world, river flows are linked to livelihood, identity, sense of place, religious believes and language systems or educational practises. Historically River has been looked from the point of view of cultural aspects and religious beliefs associated with the river. For example, people dispose the ashes of a human body after the funeral rites according to the Hindu mythology. Similarly, during the holy occasion of Kartik Poornima, the people of Odisha float their tiny little boats loaded with candles, flowers and fruits singing praises of their ancestors and worshipping them. River has also been a major factor in the economic aspect and a significant contributor to livelihood generation be it fishing or agriculture or trade or commerce. Over the decades there has been a gradual shift from being used as a social cultural aspect at trade and commerce and now we see people locate rivers as a luxury, as a place they can go for leisure or recreation.

All these aspects can be interlinked to the much bigger aspect, i.e., the **environmental aspect.** All these aspects have something or the other to do, with the environment as each dimension affects the environment, it could be either positive or negative. For example, the social aspect of river, where river connects people and places and is used as a focal point for gathering and socializing, might also turn out to be a reason for river pollution. Another example, taking the cultural aspect into account, people take a holy dip into river Ganga, dispose the ashes of human body which in turn pollutes the river. So, the river-people connect is definitely something to look up to but there is a need of drawing a boundary to limit the exploitation of the river's potential.

Chapter 5 : PLANNING STRATEGIES

5.1 PROPOSALS

5.1.1 GREEN TRAIL ALONG MAHANADI RIVER SIDE

All of Cuttack's important strategic locations are situated in close proximity to the Mahanadi River side as shown in map (XX). The ancient ghats and the Balijatra field which is of historic importance is also located on the Mahanadi River side. So, to connect all the strategic locations, a Green Trail is proposed on the Mahanadi River side, to connect all these locations and can be accessed only by pedestrians and cyclists. The trail shall be built by taking into account all the essential NMT guidelines (Non-Motorised Transport Guidance Document, NIUA) like provision of Natural Shade, Lighting, Rest Areas, Barrier-free Design and Universal Signage.

The essential features of the Green Trail would be as follows:

I. Enhancing connectivity and improves the public access to the river by designing a well-connected Riverfront
II. Promotes cycling and walkability, thereby acting as a pull factor for enhancing community health and well-being.
III. Acts as an income generator for small-scale vendors selling some local goods and products, like a small Dahi-wada store, a small shop that would exhibit silver filigree works or dokra works, or a fast-food store, etc.
IV. Has got facilities like bio-toilets, water ATMs, open-air theatres, open-air gymming equipment, etc.
V. Easy to maintain by charging a minimal amount (through ticketing), pay and use toilets, tickets for cultural evenings at the open-air theatre, etc.

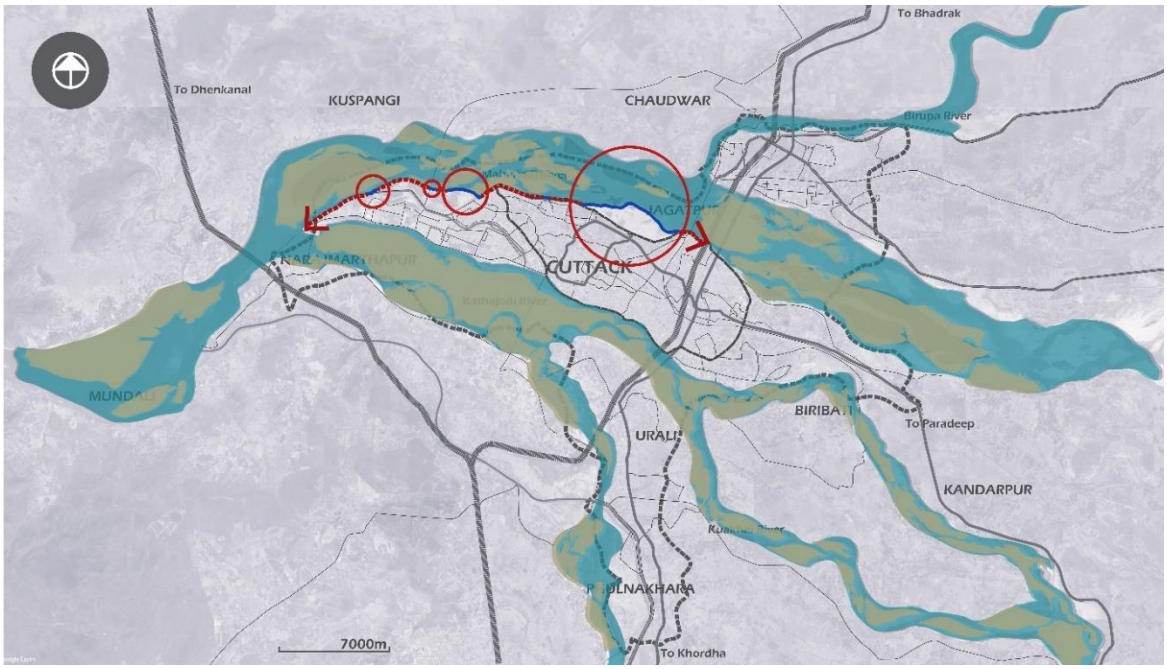


Figure 5-1: The red dotted line represents the proposed Trail

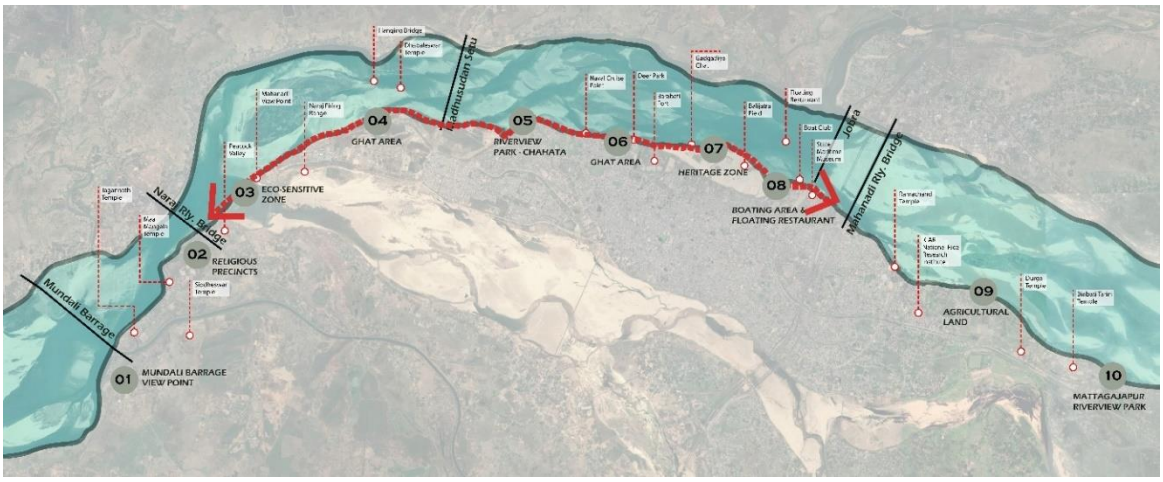


Figure 5-2: Proposed trail connecting all strategic locations of Cuttack

5.1.2 RIPARIAN BUFFER ALONG THE KATHAJODI RIVER SIDE

The southern side of the city which is traversed by the Kathajodi River is constantly exposed to externalities like over abstraction of water, encroachments by upland communities and illegal sand mining by the sand mafias, which has tried to constantly change the course of the river, draining it off its resource potential. Now, Riparian Buffers can act as a great solution to this. Riparian buffers can help our ecosystem in a variety of ways. These planted riparian buffers are critical to preserving and increasing water quality and overall system health by preventing erosion, mitigating flood and storm damage, and providing valuable wildlife habitat.

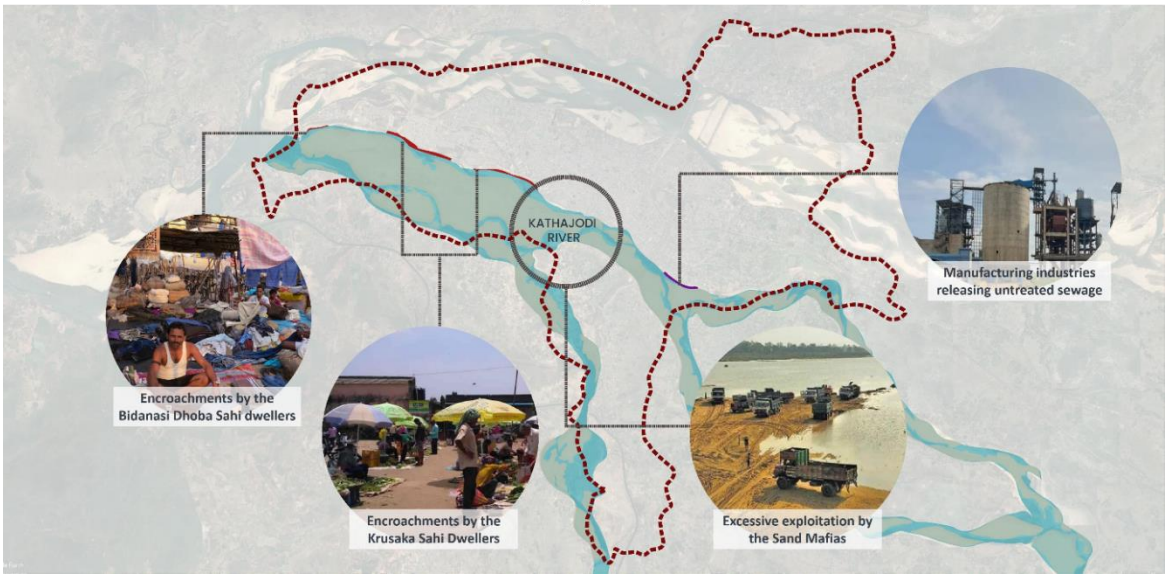


Figure 5-3: Vulnerability Map of River Kathajodi

The sole intervention under this objective is to develop and implement a riparian buffer development strategy for the river banks, and implement this strategy. These simple strips of vegetated land can offer an enormous number of environmental benefits, including:

1. Restoring and maintaining the physical and biological integrity of the water resources

2. Removing pollutants from urban stormwater
3. Stabilizing stream banks resulting in reduced erosion and sedimentation
4. Providing infiltration of stormwater run-off
5. Maintaining base flow of streams
6. Contributing organic matter that serves as a source of food and energy for the aquatic ecosystem
7. Providing tree canopy to shade streams and regulate temperature

So, what is the significance of riparian buffers? In a nutshell, they provide essential protection against external effects that damage and harm stream and other aquatic systems. They also give tangible environmental benefits, such as:

Water Quality: Riparian buffers improve water quality by absorbing and filtering nutrients and suspended sediments that degrade quality and function, such as animal faeces, sediments, and pesticides. These buffers' effective filtering ability has been found to lower the number of pollutants entering the water, therefore enhancing long-term quality.

Erosion and Flooding Control: Riparian buffers help to avoid erosion and sedimentation. These buffers help to maintain streambanks and provide a place for storm and flood energy to be properly absorbed, reducing downstream damage. They help reduce the impact of flooding by slowing the release of water from heavy rainfall.

Animal Habitat: Riparian buffers provide shade, shelter, structure, and food supplies for a diverse range of aquatic and terrestrial wildlife species. The buffer not only generates food supplies from organic materials, but it also helps regulate the temperature of the water for the species living in the stream while providing natural debris that forms

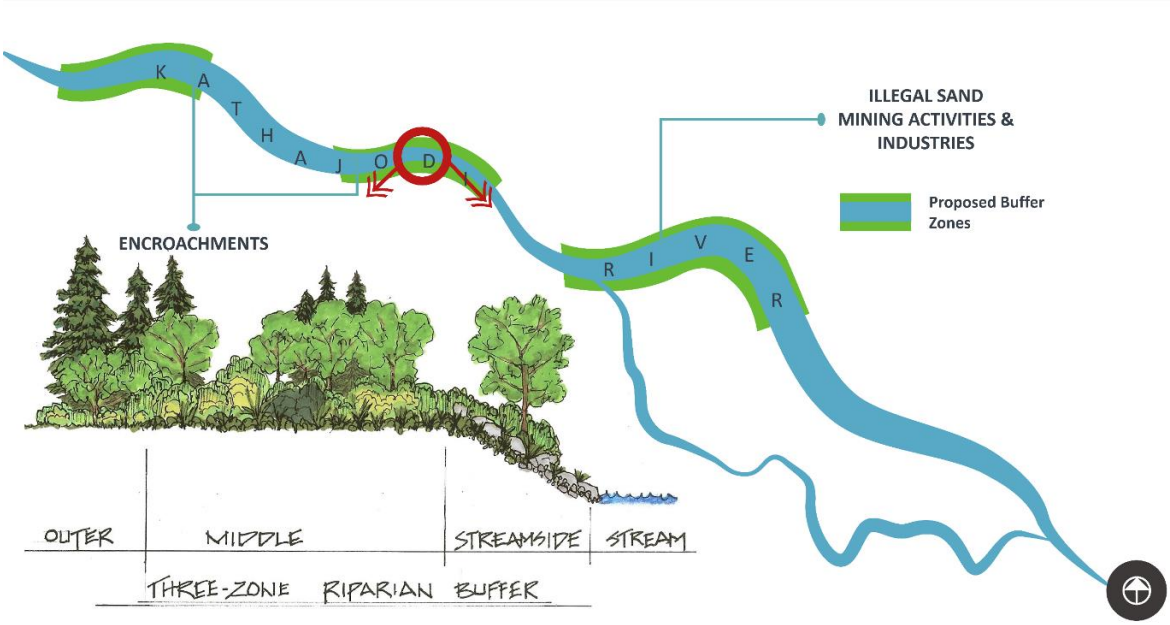


Figure 5-4:Proposed stretches of Riparian Buffer along Kathajodi River

structure and extra food and energy sources

Riverside zone

Because of its critical importance in protecting water quality, this zone has the most stringent restrictions.

Permitted Activities (recommended but not mandatory)

- Footpaths
- Road crossings
- Utility rights-of-way
- Flood control structures

Restricted Activities

- Removal of existing vegetation (except where necessary to accommodate permitted uses)
- Soil disturbance (grading or filling)
- Use of pesticide or fertilizer
- Presence of livestock
- Use of motorized vehicles
- Construction of permanent structures

Outer zone

The primary purpose of this zone is to protect the streamside zone, and to provide distance between the riverside zone and any upland development. While the retention of the natural vegetation is encouraged, some form of management is allowed.

Permitted Activities:

- Removal of mature tree cover (retention of shrub layer and herbaceous groundcover is required to allow for infiltration of run-off)
- Bike paths
- Stormwater management facilities
- Approved recreational uses

Restricted Activities:

- Soil disturbance (grading or filling)
- Use of pesticide or fertilizer
- Presence of livestock
- Construction of permanent structures

5.1.3 ENHANCING PEOPLE-RIVER CONNECT

People travelled along waterways, from canals to large rivers, to establish companies, villages, and new lives. Rivers were both feared and revered. The river was a playmate for a child to splash around in or a source of joy for a woman after a long day's labour. A river could also represent the erratic elder who inspired awe. Flooding has often changed a sign of life and wealth into a raging torrent, destroying human lives and destroying crops, resulting in food shortages and starvation. Rivers and urban development are both

essential. Both are required, but we must ensure that civilizations that have evolved on river banks do not find themselves in a scenario where the river becomes lost in the city and people abandon rivers.

One of the most crucial challenges that needs to be addressed is the weak people-river connect. Historically, the river has been at the centre of a variety of societal acts, including cultural, religious, livelihood, and leisure activities. This citizen-river connection is critical for establishing the river's identity and providing it societal worth. This value encourages inhabitants to feel a sense of ownership over the river, which is good in the long run. While this is still popular in some areas, many cities (particularly larger ones) have lost touch with the river. In this research proposal, several small-scale urban design interventions can be used to enhance the people-river connect as shown spatially below:

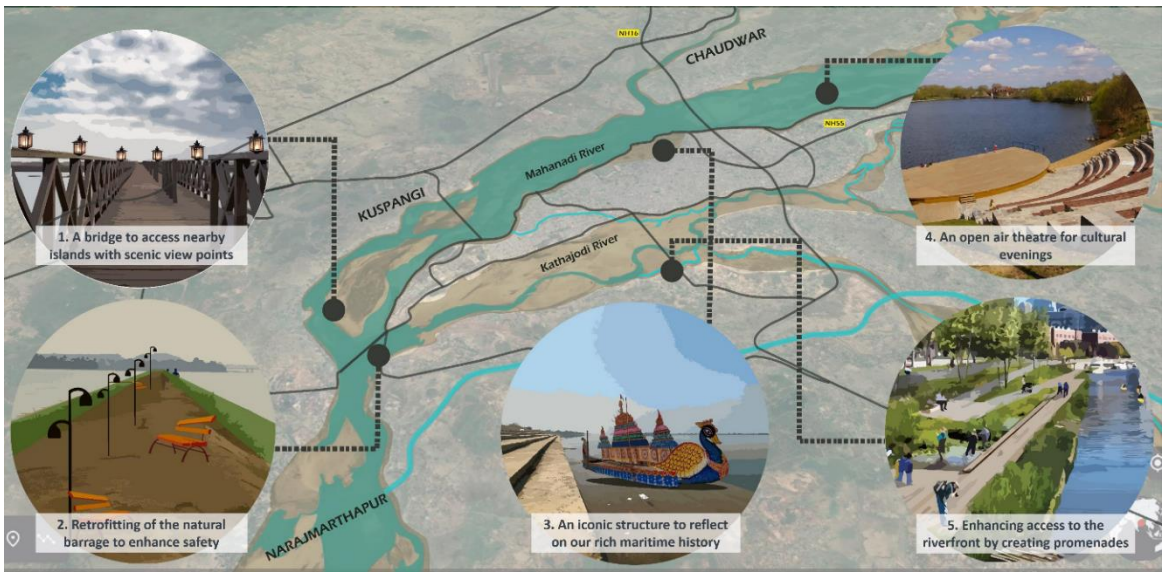


Figure 5-5: Urban design interventions for enhancing People-River connect

Objectives:

- To design and develop a riverfront catering to the needs of the citizens in a sustainable manner
- To make the riverfront accessible to the public
- To create a stronger economic value for the river

Using Master Plan as a planning tool to implement this strategy:

I. Localising National Policies and Initiatives

National Water Policy, Ministry of Water Resources, 2012

The directions of the Policy relevant in this context are:

Rivers and other water bodies should be considered for development for navigation as far as possible and all multipurpose projects over water bodies should keep navigation in mind right from the planning stage

National Tourism Policy, 2002, Ministry of Tourism and Culture, GoI

The directions of the Policy relevant in this context are:

- The potential for river cruises in India needs to be developed for the North-Eastern States, (Brahmaputra and Ganges) and Kerala.
- To capitalize on the potential of the several navigable rivers that have high tourism significance, strategic actions are required to harness the potential as a means of transport as well as unique tourism products.
- White water and more sedate great river rafting offer a unique tourism product, while regulations and certification for adventure tourism operators should be introduced so that they meet minimum safety standards.
- Eco-tourism should be made a priority tourism product with focal points located in the Himalayas, North-Eastern States, Western Ghat, Jharkhand, Andaman and Nicobar Islands, and the Lakshadweep Islands.
- Business travel is also a form of tourism and typically occurs in urban environment. Urban quality along the lines specified for regional and site master plans, including tourism interests and requirements in the urban planning processes should be improved.
- A series of themed cultural attractions should be developed based on outstanding site planning and design.

II. Town Specific Sectoral Strategies

Enhancing the potential of sustainable river-related tourism (sensitive to the carrying capacity of the river). Such a strategy would typically touch upon the following:

- Thrust sectors for tourism based on a ground study (e.g., water sports; river cruise; floating markets; navigation; spiritual riverfronts; etc.)
- Creating an enabling environment for the tourism to flourish (e.g., policies, infrastructure,
- Marketing, advertising, infrastructure and governance mechanism
- Enhancing livelihood opportunities
- Minimising environmental impacts
- Timelines and budgetary considerations

III. Assigning Land Use Categories

Land Allocation

Earmarking a dedicated 'Interactive sub-Zone' within the 'River Zone' for:

- Eco-sensitive religious activities (designated ghat areas)

- Tourism activities (water sports)
- Navigation activities (dock stations, jetties)
- Public recreation activities

Land Use and Use Zone

Assigning specific land use categories and use zones for religious, tourism, navigation, recreational and other areas in the river Zone.

Use Activities

Permitting only eco-sensitive activities by enlisting:

- Permissible activities
- Regulated activities
- Prohibited activities

IV. Development Control Regulations (DCRs)

Adopting revised building bye-laws for the Interactive Zone, including specific provisions based on footfall

- Ground coverage and percentage of built-up
- FAR and height restrictions
- Material usage
- Accessibility
- Parking provision
- Public facilities (toilets, lighting, signages, security)

V. Norms and Standards

Recommending and regulating the permissible footfall for the river Zone.

An assessment of the carrying capacity of different ecologically sensitive sites within the river Zone may be used to establish the footfall limit for each area (especially the areas earmarked under Interactive Zone).

VI. Special Projects

Such projects may include -

- Eco-parks along river banks
- Tourism and religious infrastructure
- Urban Riverfront Development

Urban Riverfront Development can be proposed with nature-based elements such as,

- Riparian landscaping
- Bio-remediation practices

- Landscape features along the riverbank, in a manner sensitive to and respectful of the existing natural habitat

Riverfront Development may also have facilities like public plazas, seating spaces, lighting, toilet, parking etc.

5.1.4 LAND USE AND ZONING

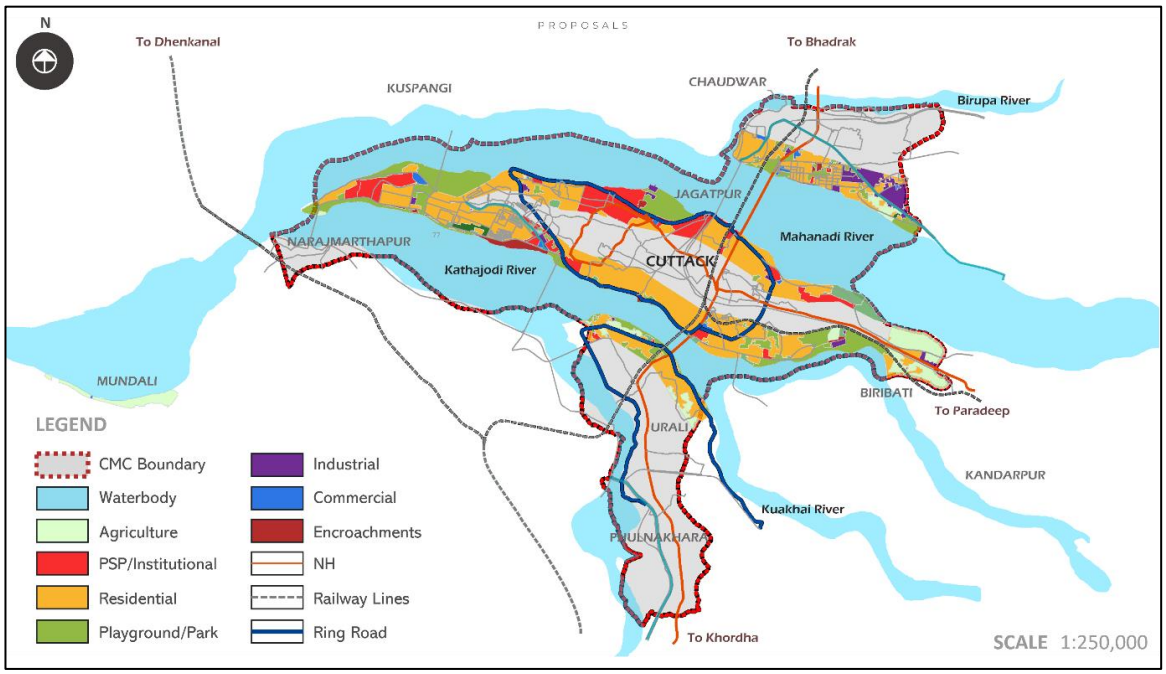


Figure 5-6: Land Use and Zoning

River Mahanadi and Kathajodi are rivers that flow at less than 300m elevation, within municipal limits (high population densities) where the floodplain has already been heavily reduced and infrastructure facilities are well developed (e.g., temples, ghats, road, various residential, commercial or recreational buildings, boat jetties, fish landing facility, etc.); water quality much degraded and restoration most difficult and fall into the category of Flood Plain Rivers and the RRZ III. According to the Notification on River Regulation Zone (RRZ) of 2016, the following guidelines shall be applicable to these rivers as follows:

Prohibited Activities Zone (RCZ-PA)

Extend from river bank up to 500m from HFL without embankments. Extend from river bank up to 100m from HFL with embankments. Entire area available on both sides of the river banks for ecologically sensitive area, National parks, Wild life Sanctuary etc.

Restricted Activities Zone (RCZ-RAI)

Extend up to 1 km from outer limits of RCZ-PA. (1.5 km from HFL) without embankments. Extend up to 1.1 kms from existing embankment. (1.1 km from HFL) with embankments.

Regulated Activities Zone (RCZ-RAII)

Extend up to 3 kms from outer limits of RCZ-RAI.

RRZ III – Use Permissibility (excerpt taken from RRZ Guidelines, 2002)

- No further extension of any infrastructure that may necessitate reduction in the remaining floodplain or affect the course of the river channel
- Total prohibition of disposal of all kinds of solid wastes
- Total prohibition of groundwater extraction within 500m of the river channel and limited (regulated) extraction beyond that area

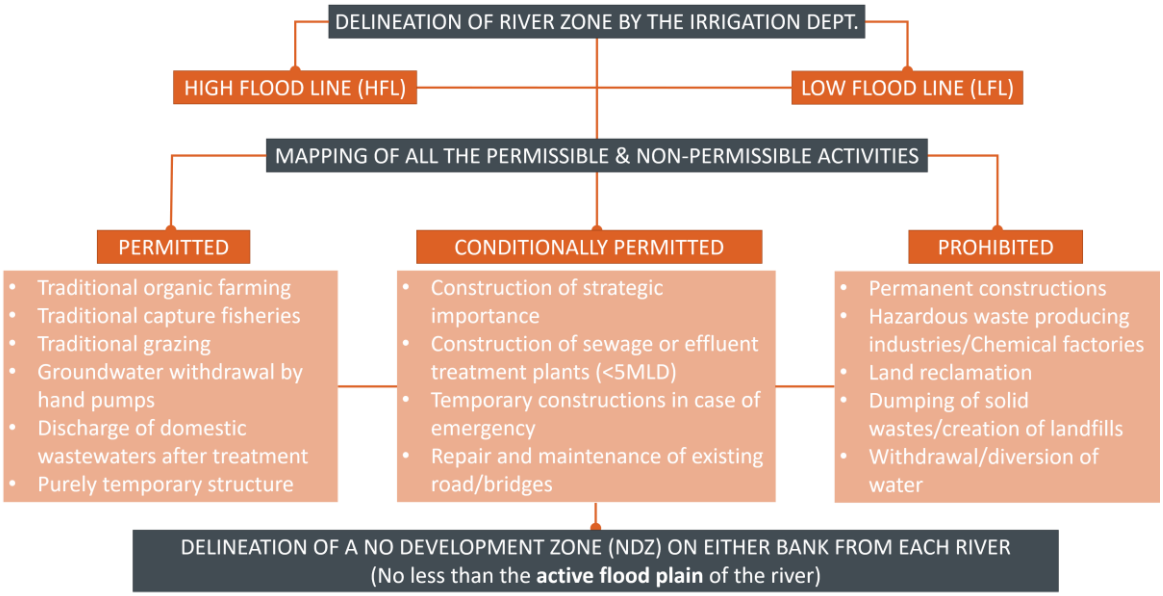


Figure 5-7: Action Plan for Devising Zoning Regulations

5.1.5 IMPROVING RIVER MANAGEMENT AND GOVERNANCE

Objectives:

- To establish a wholesome multi-disciplinary and inter-sectoral framework for river management in a city
- To scale up citizen involvement in river management activities
- To identify resources for project implementation, management and funding

Using Master Plan as a planning tool to implement this strategy:

I. **Localising National Policies and Initiatives**

National Water Policy, Ministry of Water Resources, 2012

The directions of the Policy relevant in this context are:

- Integrated Water Resources Management (IWRM) taking river basin or sub-basin as a unit should be the main principle for planning, development and management of water resources.

- Being inter-disciplinary in nature, water projects should be planned considering social and environmental aspects also in addition to techno-economic considerations in consultation with project affected and beneficiary families.
- Project financing should be structured to incentivize efficient & economic use of water and facilitate early completion of ongoing projects.
- All components of water resources projects should be planned and executed in a pari-passu manner so that intended benefits start accruing immediately and there is no gap between potential created and potential utilized.
- Pricing of water should ensure its efficient use and reward conservation.
- To meet the need of the skilled manpower in the water sector, regular training and academic courses in water management should be promoted.

II. Town Specific Sectoral Strategies

Promoting holistic management of activities in the flood plains, using a systematic approach. The governance strategy should touch upon the following:

- Formation of a composite body, for single-point management and earmarking the responsibilities of various agencies.
- Monitoring and management at regular intervals, i.e., every five years.
- Engaging citizens in river management activities.
- Developing an online portal or a dashboard, for single point availability of data (related to water/ river management) from multiple sources.

III. Norms and Standards

Establishing a city's contribution to the environmental flow of the river based on a scientific study.

IV. Recommendations and Directions

Engaging citizens in river management activities (e.g., citizen science; river health monitoring; river clean-up activities; celebrating river day)

V. Special Project

Such projects may include -

- Creating an integrated database for river/water management
- Creating a public dashboard for disseminating relevant data/information to general citizens

5.2 PRACTICAL CONSIDERATIONS

This research work talks about providing ideas, innovations and various nuances related to the set of planning proposals. It has also demonstrated how different river-related challenges can be addressed with these planning tools and instruments. However, we as planners should also be aware of the practical aspects that need to considered in making robust river-sensitive Master Plans. Some of these aspects are enlisted below:

5.2.1 HANDLING INFORMAL ENCROACHMENT SENSITIVELY

Informal encroachment on floodplains, particularly on river banks, is often in the form of slum settlements with no other options for dwelling. The people of these slum settlements frequently rely on the river for a living. Given the lack of sufficient sanitation and solid waste disposal facilities in these settlements, their presence in the floodplain is sure to have a negative impact on the river. However, evicting them will merely move the problem to another area, which may have an indirect influence on the river. As a result, such approaching entities require a systematic rehabilitation plan that prioritises alternative livelihood possibilities in addition to a relocation strategy.

5.2.2 ASCERTAINING LAND OWNERSHIP

Naturalization of the near vicinity is an important part of conserving and protecting river and riverine resources. This could include planting green buffers, soft scaping, de-concretizing, utilising green infrastructure, and so on. Implementing such solutions will necessitate FAR, ground coverage, and building height limits. Ascertaining land title in these locations is consequently critical in order to avoid legal difficulties throughout the Plan's implementation.

5.2.3 DEVELOPING A FRAMEWORK FOR IMPLEMENTATION

A framework for implementation will aid in the successful implementation of the Master Plan on the ground. A framework of this type should clearly identify the numerous actions to be taken, the entities responsible for action, important performance indicators, and a method for taking stock. The implementation framework should ideally be part of the Master Plan so that it has official status after the Plan is notified.

5.2.4 ALLOWING FOR COURSE CORRECTION

The implementation of the Master Plan does not always follow the directions of the Plan. Many times, improvisations are required in order to recognise and adapt to ground realities. The Master Plan must take these into consideration by allowing for course corrections at regular intervals. Most Master Plans are reviewed every five years, which provides a great opportunity for these course adjustments to be implemented.

5.2.5 LEVERAGING ON TECHNOLOGICAL ADVANCES

While the Master Plan should be technologically agnostic in order to avoid favouring any one technology provider, it can establish an atmosphere that encourages the employment of cutting-edge technologies (without naming the suppliers) for river management. Satellite-based water quality monitoring, artificial intelligence for riverine biodiversity mapping, big data and citizen research for river health monitoring, unmanned aerial vehicles for floodplain mapping, and other technologies are already being deployed successfully around the world. The nature and type of technologies are projected to grow increasingly sophisticated and effective in the future. As a result, the city must be prepared to welcome these changes in a smooth manner.

5.2.6 CLIMATE CHANGE IMPLICATIONS FOR RIVER MANAGEMENT

Climate change is one of the world's most pressing issues today. The fundamental channel through which the impacts of climate change reveal themselves is water. Rivers are thus extremely vulnerable to the effects of climate change in terms of flow variability, sediment load, and biotic quality. Planners will need to account for these predicted changes and respond appropriately.

5.3 CHALLENGES

When it comes to Urban rivers, cities become the biggest challenge and the most significant contributor in their mismanagement, as described below:

Restriction of natural/ storm water channels

The river need room in order to execute its natural tasks, one of which is to act as a sponge to avoid flooding. Unplanned construction and encroachment along riverbanks, on the other hand, have severely curtailed the natural channels in many municipalities. Furthermore, channelization and excessive concretization constrain the river, causing the river's entire geomorphology and ecosystem to be disrupted. The impermeable character of the environment causes excess runoff and river flooding, resulting in property and life damage.

Pollution

Pollution is undeniably one of the most serious issues in Indian rivers, particularly in the Ganga River Basin. Pollution from numerous sources, including home sewage, industrial effluents, agricultural runoff, and solid waste dumping, is wreaking havoc on the rivers. The situation is exacerbated by floral offerings and garbage generated by religious events. Large portions of rivers have literally turned into running sewers in numerous cases. Because cities rely heavily on these rivers, river pollution causes major health risks. More critically, not only the river, but the entire riparian ecosystem1 is severely impacted.

Over-abstraction of water

As the rate of urbanisation in cities increases, so does the strain on water resources to fulfil the increased demand. Agricultural water demand exacerbates the problem in peri-urban regions. Rivers and aquifers are rapidly decreasing as a result, creating changes in hydro-morphology and the natural hydrological regimes of water channels.

Degrading lakes, ponds and wetlands

Lakes, ponds, and wetlands are key features that help maintain groundwater levels while also delivering a variety of socioeconomic and environmental advantages. They are a significant source of groundwater recharge, increasing groundwater levels and lowering demand on river water resources. However, in several towns, these bodies of water are significantly deteriorated as a result of encroachment and pollution. The loss of catchment basins, changes in water quality, and the extinction of natural flora and fauna raise worries about the effects of growing urbanisation on these sensitive ecosystems.

Depleting green cover

From the standpoint of river management, green cover is critical. It acts as an erosion control mechanism on riverbanks. In some locations, it serves to supplement groundwater levels while also providing a habitat for species to thrive. Unfortunately, cities today are mired in a divisive green-grey dispute. The general pattern is that as cities expand their built-up areas, green cover tends to dwindle.

Weak citizen-river connect

Historically, the river has been at the centre of a variety of societal acts, including cultural, religious, livelihood, and leisure activities. This citizen-river connection is critical for establishing the river's identity and providing it societal worth. This value encourages inhabitants to feel a sense of ownership over the river, which is good in the long run. While this is still popular in some areas, many cities (particularly larger ones) have lost touch with the river.

Piecemeal governance

Holistic river management necessitates deliberate and coordinated efforts from a variety of government agencies involved in irrigation and flood control, groundwater, pollution control, tourism, public works, horticulture, forestry, and other activities. Non-state entities such as NGOs, citizen groups, and religious bodies also play an important role. Unfortunately, in most cities, there is little communication and cooperation among these stakeholders, resulting in a "silos" management strategy.

Vulnerability to climate change

Rising temperatures and variable precipitation amounts put aquatic bodies and water canals at risk. The frequency and intensity of these changes in climatic conditions and extreme weather occurrences have grown as a result of anthropogenic influences. This increases the risk of catastrophic floods, increased droughts, stream drying, cyclones, and the spread of waterborne diseases. Understanding these risks and their effects on river ecology, as well as climate resilience, is an important factor in urban river planning.

5.4 ROLE OF VARIOUS STAKEHOLDERS

There are various stakeholders who are involved when it comes to developing and managing the waterbodies of a city or a State, especially rivers. In this case, the stakeholders are the Water Resources Department, the State Pollution Control Board, Housing and Urban Development Department, the Irrigation Department, Odisha State Water Supply and Sewerage Board and then the Urban Local Bodies. The roles of these stakeholders have been listed below:

Water Resources Department

- Provide support for development of general infrastructure
- Provide Central assistance for certain State schemes
- Ensure effective abatement of pollution and rejuvenation of the river bodies

Odisha State Pollution Control Board

- Plan comprehensive program for preventing, controlling and reducing pollution of rivers
- Conduct, encourage and participate in investigation and research relating to prevention of river pollution, its control and abatement
- Collaborate with the Central Pollution Control Board and organise training programs related to the prevention, control and abatement of river pollution
- Sensitize behavioural changes among youth and city residents through Information, Education and Communication activities, street plays and distribution of awareness posters or pamphlets.
- Inspect the Sewage Treatment Plants and other Manufacturing industries to keep a check and regulate their activities

Housing and Urban Development Department

- Design and implement innovative pilot projects in selected areas with community participation in a citizen-centric manner
- Facilitate reforms and policy interventions
- Improve the financial base of the Urban Local Bodies and their interface with citizens

Irrigation Department

- Delineate the River Zones and map the High Flood Lines (HFL) and Low Flood Line (LFL) for all the rivers flowing through Cuttack (Mahanadi, Kathajodi, Birupa and Kuakhai)
- Demarcating suitable use zones within the active flood zones and listing down the Pohibited Activities, Regulated Activities and Permissible Activities
- Delineate a No Development Zone (NDZ) on either side of the river banks from each river which is no less than the active flood plain of the river

Odisha Water Supply and Sewerage Board

- Implement the sanitation related projects and devise pollution abatement schemes for River Kathajodi and Mahanadi
- Organise and group together Self-Help Groups to participate in the maintenance of cleanliness of the river banks specially in and around the places of public attraction like vending zones near the Open-Air Theatre or View Points, etc.

Urban Local Bodies

*ULBs play a critical role in **urban river management.** Illustrated below are the roles and responsibilities of both **Cuttack Municipal Corporation** and **Cuttack Development Authority.***

Cuttack Municipal Corporation

- Construct and maintain the proposed infrastructure development along the course of Mahanadi and Kathajodi
- Remove and rehabilitate of the informal settlements encroaching the banks of the river bodies
- Provide basic infrastructure like bio-toilets, water ATMs, etc. in the proposed trail
- Create an integrated database for river management
- Collect taxes under appropriate heads like for parking, user charges, etc.

Cuttack Development Authority

- Prepare a detailed plan on the proposed interventions with diagrams and views and prepare a detailed budget and financial framework on which Centrally funded or State funded schemes can be used to fund the proposed interventions
- Form a composite body that would only look after the river related aspect and is responsible for the operation and maintenance of the same
- Develop an online dashboard that would be a single stop platform for dissemination of information and availability of data that can be accessed by not only the government officials but also by the general citizen

Chapter 6 : CONCLUSION

6.1 LINKING OF OBJECTIVES TO STRATEGIES

OBJECTIVE 1 - To enliven the waterfront with a range of attractive uses integrated with a range of upland communities

STRATEGIES:

I. Spur Re-investment in Riverfronts
II. Incentivize/form SHGs for the Cleaning of Riverfront Brownfield sites
III. Increase knowledge of historic resources on the Riverfront

OBJECTIVE 2 - To improve governmental regulation, coordination & oversight of the waterfront & waterways

STRATEGIES:

I. Improve efficiency of the permitting process for in-water construction
II. With inputs from various Stakeholders, establish design guidelines for in-water infrastructure such as bridges, etc.

OBJECTIVE 3 - To expand public access to waterfronts and revive the people-river connect

STRATEGIES:

I. Create new Publicly accessible Riverfronts
II. Create a more connected Riverfront
III. Ensure public open spaces are of high quality & support diverse uses

6.2 GENERAL RECOMMENDATIONS

6.2.1 INFORMATION, EDUCATION AND COMMUNICATION (IEC) STRATEGY FOR RIVER MANAGEMENT

The effectiveness of any river management programme will be determined by how well citizens are engaged. It is widely known that some projects have failed because the intended beneficiaries were not included in the design and implementation stages of the project. IEC is a method of changing or reinforcing positive behaviour in a specified target audience over a set length of time. The goal of creating IEC in the current environment is to instil more river-sensitive behaviour in inhabitants and re-establish the river's connection, which has weakened over time. To enable important stakeholders to have an active part in protecting and sustaining river health, the IEC plan should mix different techniques and explore various media.

6.2.2 SETTING UP A COMMUNITY-BASED RIVER HEALTH MONITORING MECHANISM

In a number of nations, communities and the general public are being involved in river health monitoring programmes. The goal is to encourage the formation of a personal connection between communities and the river, which will lead to more citizen-driven proactive river management initiatives.

6.2.3 TO LEVERAGE ON THE ECONOMIC POTENTIAL OF THE RIVER

River markets (or floating markets) have long been an important element of river cities, acting as a means of trade and commerce and contributing to the city's economy. This also aided in strengthening the bond between the city and the river. However, as time passed, these markets were supplanted by larger markets located further away from the river. River markets may find it challenging to be the primary source of trade and commerce in today's world, particularly in larger cities. From a governmental standpoint, there is also a considerable emphasis in India on providing pathways for eco-friendly river tourist options. Various state and UT administrations contribute to the development of tourism infrastructure, including water sports.

6.2.4 ENSURE ADEQUATE GOOD QUALITY RETURN FLOW FROM THE CITY INTO THE RIVER

The primary intervention under this activity will be determining an adequate return flow that the city can return to the river. There is no universally accepted reference point for determining how much a city should return. This will necessitate a scientific investigation and will be determined by a number of elements, including:

- The river's current flow
- The river's overall environmental flow requirement in the city length
- The extent to which projected wastewater reuse is envisaged
- Stormwater runoff
- Drains and channels draining into the river

Other low-hanging fruit measures that a city could pursue include:

- Regular desilting of drains to ensure that more runoff reaches the river
- Ensuring that stormwater and wastewater do not combine

6.2.5 TO KEEP THE RIVER FREE FROM POLLUTION

Municipalities have traditionally relied on centralised citywide sewerage systems with vast sewer networks and STPs. However, for smaller communities, this may not always be possible due to a lack of technological know-how, financial limits, and an insufficient labour force. As a result, there is a need for decentralised (and non-sewered) techniques to supplement centralised systems in order to improve the city's sanitation coverage. Decentralized techniques are short-term projects with low capital and operating and maintenance costs, and they allow for local recycling and reuse of treated wastewater for low-quality water demands (gardening, horticulture, construction and flushing).

6.3 WAY FORWARD

As a next step, the city ULB can use this policy framework in the development of its master plan to meet specific river needs such as studies and others, if any. This will aid in the incorporation of necessary adjustments when the present Plan is reviewed. If possible, the state town and country planning organisations should identify the special needs of each river that flows through the city and implement the appropriate measures. The Development Authority should create a blueprint that incorporates the river-sensitive component. During the Plan's preparation, all relevant agencies must be contacted, which will aid in creating the Plan's implementation paths.

The majority of the negative status of rivers is caused by disruptive anthropogenic activities, which are particularly prevalent in cities. As a result, city-based interventions are crucial for river regeneration and conservation. Cities have Master Plans, and cities are the operational units from which action can be conducted on the ground. As a result, incorporating river thinking into Master Plans sets the framework for actionable items to be executed directly. It takes time and constant work to restore deteriorated streams. A Master Plan is typically created for a period of 20-30 years, giving it an excellent vehicle for including long-term actionable river management issues.

The Master Plan is a legally binding document for the city and is therefore in an excellent position to provide recommendations on current and upcoming issues that must be addressed. Climate change, for example, is likely to alter river flows, disrupting the ecology that relies on them. Similarly, with rivers and groundwater decreasing, it is becoming increasingly clear that water demand management is the only way ahead for large urban areas to meet their water demand. The Master Plan has the authority to issue concrete suggestions and directives to the various authorities on how to proceed in this regard. Finally, river being a public entity has a social connect with the communities, making it important to consider the local river needs. The planning exercise shall thus also involve citizen consultation, for incorporating strategies that improve the citizen connect with the rivers.

Holistic river management demands active and coordinated efforts from a wide range of stakeholders, the majority of whom work in silos. A Master Plan for the entire city is prepared, which includes numerous planning sectors. It has the authority to create structures and techniques for multiple agencies to work together toward a common goal.

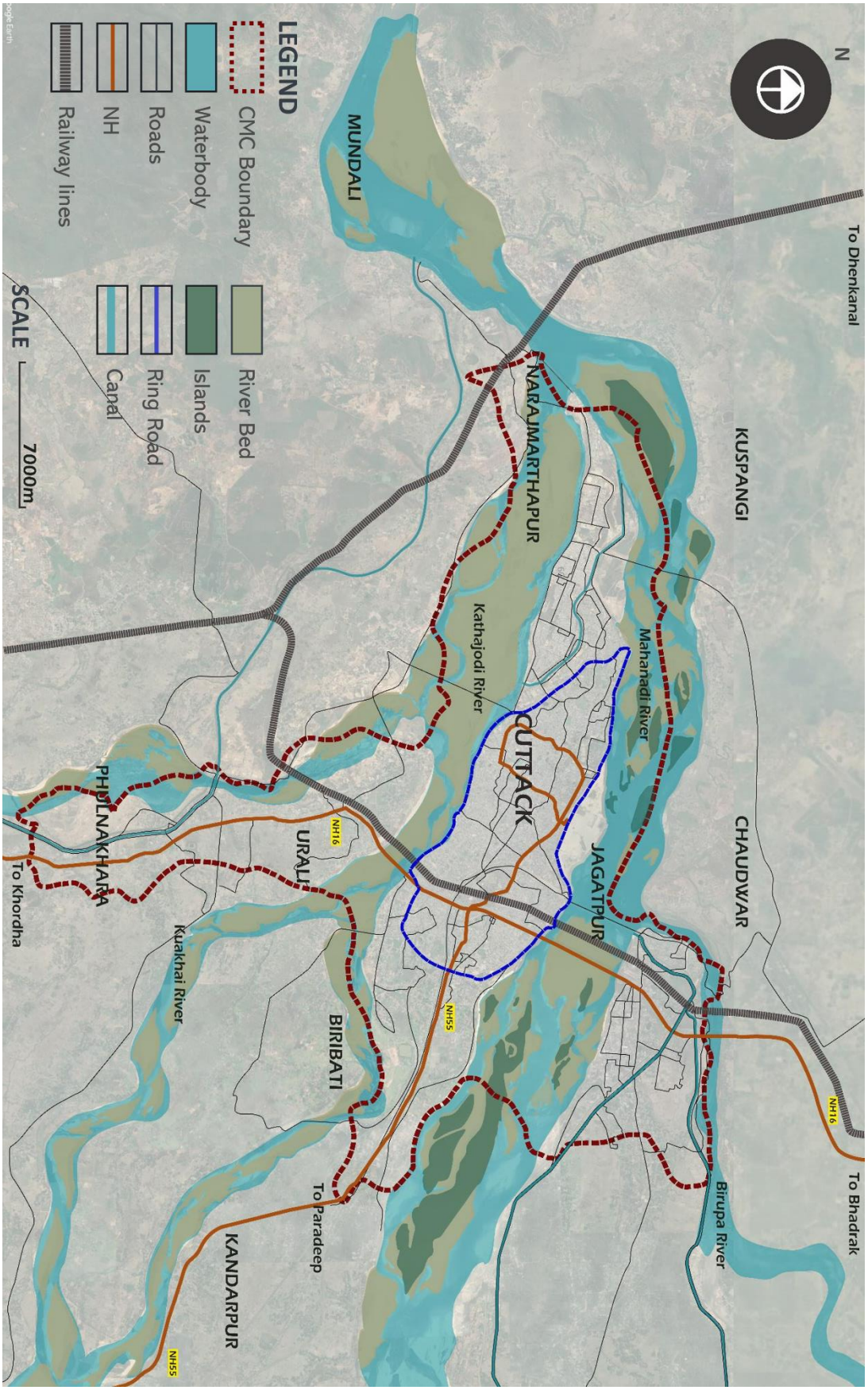
Master Plans are expected to be produced with the participation and cooperation of citizens. As a result, citizens can influence the Plan's evolution. This is a once-in-a-lifetime chance to make river protection and rejuvenation a people's mission.

REFERENCES

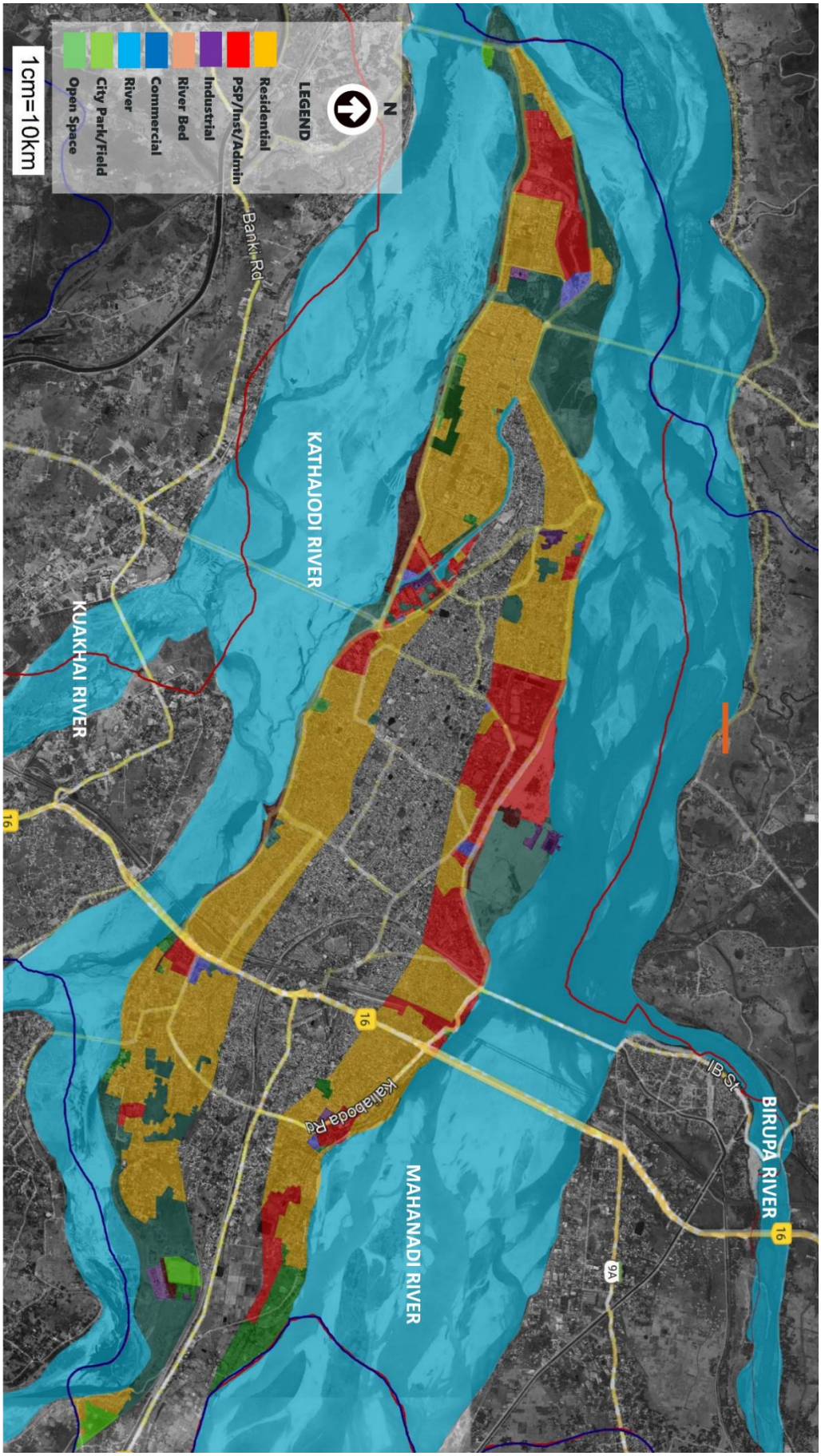
1. NIUA, "*Making River Sensitive Master Plan*". 2021
2. Mankikar S. and Driver B., "*Blue-Green Infrastructure: An Opportunity for Indian Cities*". 2021
3. Indian Express, "*DDA Master Plan-2041: Emphasis on increasing interaction with Yamuna green zones*". 2019
4. NIUA and National Mission for Clean Ganga, "*Draft Urban River Management Plan (URMP), Elements and Guidance Note*". 2019
5. The direction of development of waterfronts in Wroclaw outlined at a Seminar "*Urbanization of Urban Waterfronts - The Face of The River, Which Connects*", 2008.
6. Damanik F. K. and Pratiwi W. D., "*Consideration of Tourism Riverfront Development Elements for Pekanbaru City Transformation*". 2017
7. Guturu, K., "*Framework for Revitalizing the Riverfront in Urban Areas*". 2020.
8. Bardhan S. and Souporni, "*The cultural landscape of the Bhagirathi-Hooghly riverfront in Kolkata, India: Studies on its built and natural heritage*", 2021.
9. Yassin A. B., Bond S. & McDonagh J., "*Principles for Sustainable Riverfront Development for Malaysia*", 2012.
10. Rasal S., "*Revitalization of an Urban Riverfront to Revitalize the Socio-Economic Conditions of Springfield, MA*", 2012.
11. CPHEEO (2013) - Advisory on Conservation and Restoration of Water Bodies in Urban Areas
    http://mohua.gov.in/upload/uploadfiles/files/Advisory%20on%20Urban%20Water%20Bodies.pdf
12. MoWR, RD and GR (2017). Guidelines for the Scheme on Repair, Renovation and Restoration (RRR) of Water Bodies under PMKSY(HKKP)
    http://pmksy-mowr.nic.in/documents/RRR_PMKSY_Guidelines_2017.pdf
13. A Water Quality Guide to Managed Aquifer Recharge in India (2014). CSIRO Land and Water Flagship, Australia and UNESCO International Hydrological Programme
    https://recharge.iah.org/files/2016/11/A-Water-Quality-Guide-to-MAR-in-India-2014.pdf

ANNEXURES

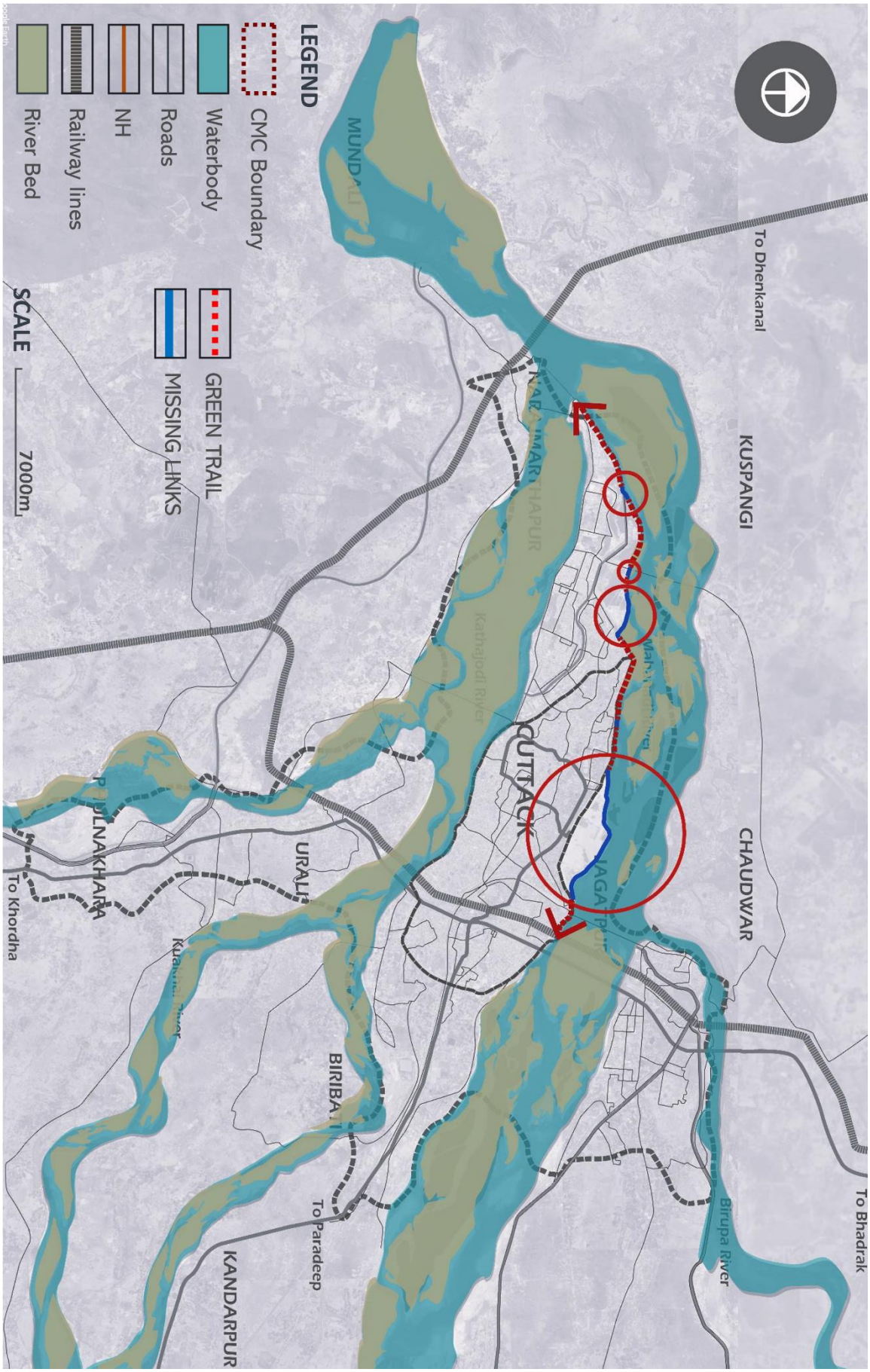
ANNEXURE I – BASE MAP



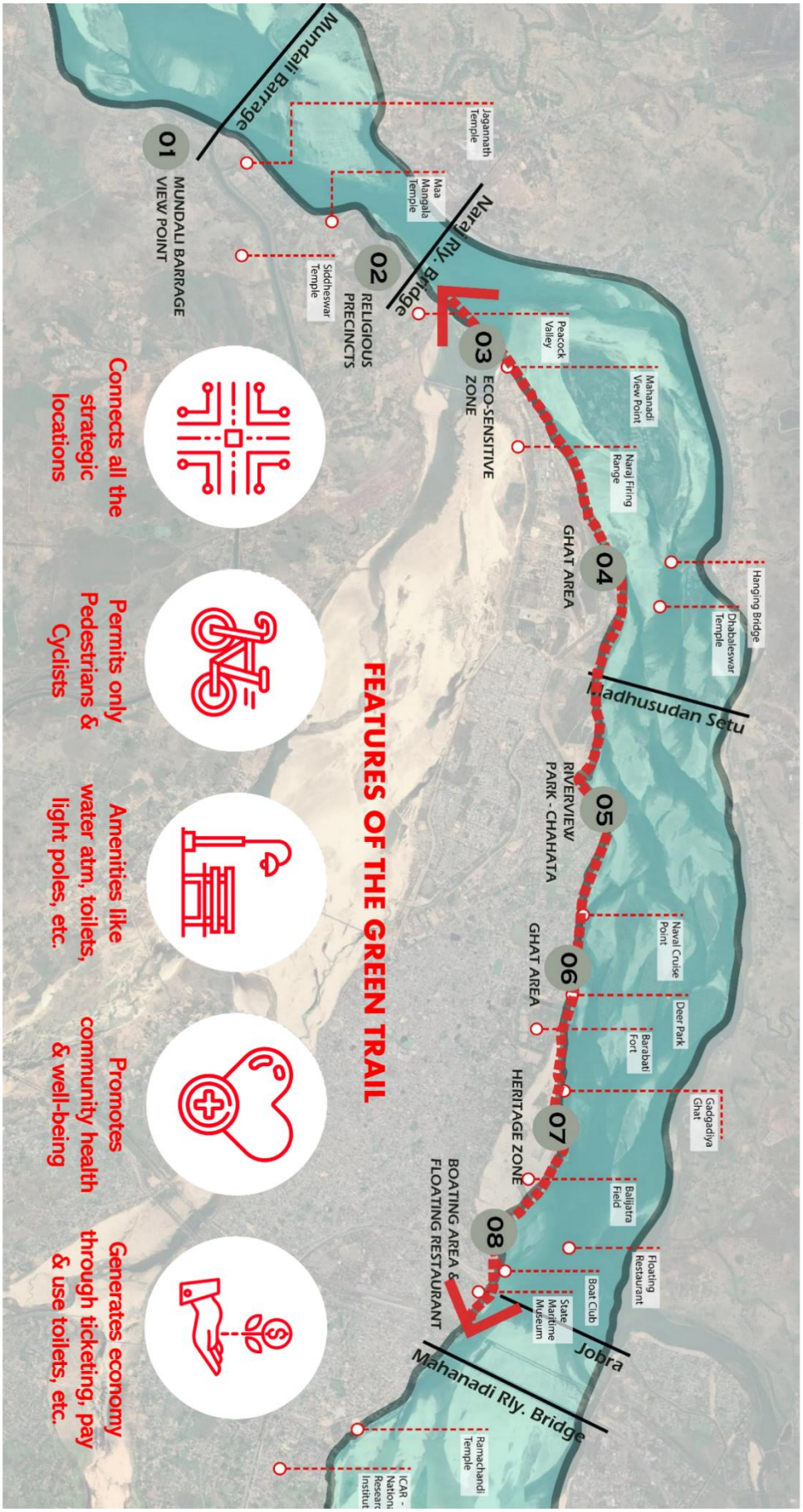
ANNEXURE II – LAND USE LAND COVER MAP



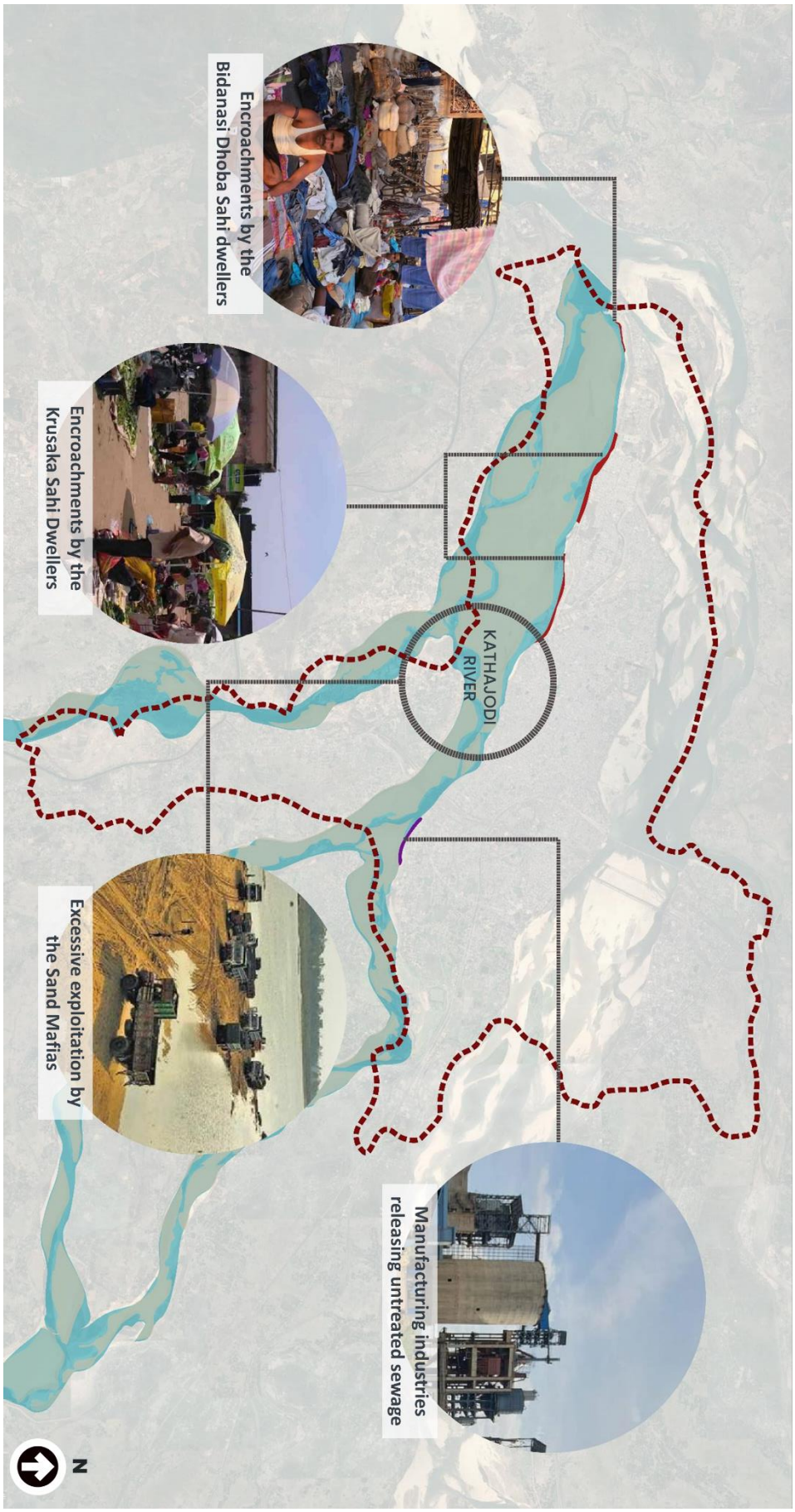
ANNEXURE III – GREEN TRAIL PROPOSAL



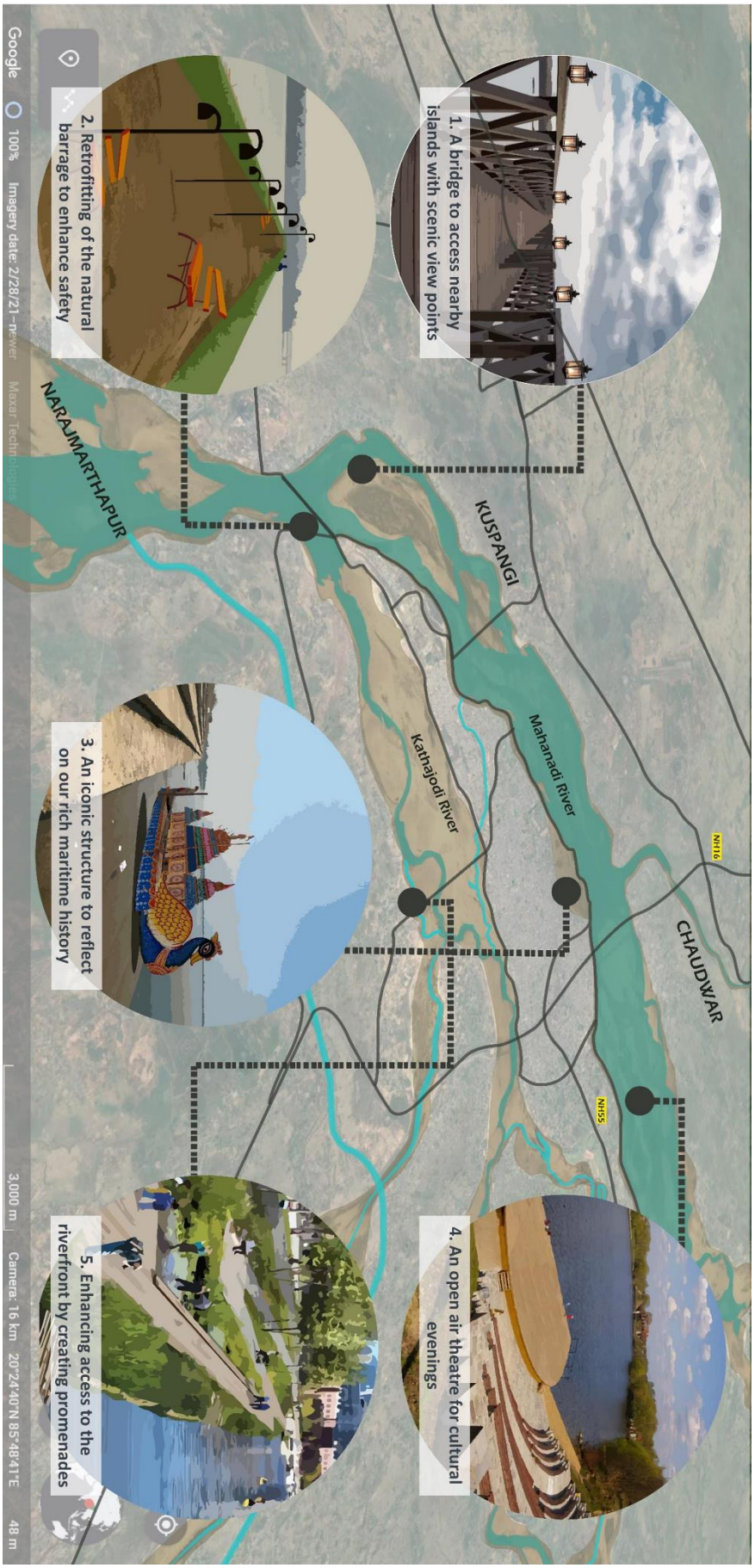
ANNEXURE IV – GREEN TRAIL PROPOSAL DETAILING



ANNEXURE V – RIPARIAN BUFFER ALONG KATHAJODI RIVER



ANNEXURE VI – ENHANCING PEOPLE RIVER CONNECT



ANNEXURE VII – RESIDENT PERCEPTION SURVEY

SURVEY FORM FOR RESIDENTS OF CUTTACK

Master in Urban and Regional Planning
School of Human Settlements
XIM University, Bhubaneswar

Brief Overview

As part of my Dissertation Project titled, ***"Integrating Rivers in the City Planning Process - A Framework to Integrate Urban River Management with the City's Master Planning Process for the City of Cuttack"***, I would like to conduct a Resident Perception Survey to understand the different age-group's perception about urban rivers, their idea of having a recreational space near the banks of the river, their relationship with the rivers, how pandemic has affected any kind of tourism or recreational activity that used to take place for the river Mahanadi and Kathajodi.

Name of the Respondent
Age Group
Area of Residence

1. For how long have you stayed in Cuttack?
   a. recently moved in
   b. 1-5 years
   c. 5-10 years
   d. more than 10 years

2. How far is the river bank (Mahanadi/Kathajodi) from your place of residence?

3. How often do you or any of your family members pay a visit to the river banks?

4. What kind of activities do you usually do for recreation?

5. What kind of recreation facilities/options available nearby?

6. If you have stayed in this city for more than 10 years what are the changes that you have observed in:
   a. course of the river
   b. anthropogenic activities along the river banks
   c. do you think that the water quality has been deteriorated?
   d. if yes, what according to you are the probable reasons for this state of the rivers?

7. What do you perceive from the phrase "Riverfront Development"?

8. How do you imagine your riverfront to look like (after explaining to them what riverfront development is and what are the possible options keeping Cuttack's spatial form in mind?

9. Are there any tourism related activities taking place in the rivers of Mahanadi and Kathajodi?
   a. Yes
   b. No

10. If yes, what are they?

11. If yes, have you experienced these tourism related activities?
    a. Yes
    b. No

12. a. If yes, what did you like or dislike about it?
    b. How do you think they can be improvised?

Contact details for future engagements (optional)

Ph –

Email id –

ANNEXURE VIII – LIVELIHOOD DEPENDANCE SURVEY

SURVEY FORM FOR LOCAL COMMUNITIES OF CUTTACK
Master in Urban and Regional Planning
School of Human Settlements
XIM University, Bhubaneswar

Brief Overview
As part of my Dissertation Project titled, ***"Integrating Rivers in the City Planning Process - A Framework to Integrate Urban River Management with the City's Master Planning Process for the City of Cuttack",*** I would like to conduct a Resident Perception Survey with the local communities of Cuttack to understand their relationship and dependance on the rivers Mahanadi and Kathajodi.

Name of the Respondent –

Area of Residence –

Age –

01. For how long have you been staying in this Basti?

02. What is the main source of livelihood for you?

03. Household size?

04. Are you the only person in the family to earn a livelihood?

05. If No, what is the primary source of income?

06. You have been encroaching government land, do you feel you can be forced to eviction at some point in time? Have you faced any such situation of a similar kind before?

07. Tell us about your dependence on the river or relationship with the river based on your day-to-day activities.

08. How has this dependence/relationship changed over the years and why?

CERTIFICATE OF COMPLETION

This is to certify that this thesis project titled "**Integrating Rivers in The City Planning Process -** A Policy Framework to Integrate Urban River Management with the City's Master Planning Process for the City of Cuttack" was carried out by Ms. **Preetikrishna Panda**, a student of **Master in Urban and Regional Planning**, at the **School of Human Settlements, XIM University, Bhubaneswar**. The research for this project was undertaken under the guidance of the afore-mentioned institute and completed during the period of **21.08.2021** to **14.04.2022**.

This project was shortlisted under the *Sponsored Thesis Project Competition on "RE-IMAGINING URBAN RIVERS" (Season - 2)* hosted by the National Institute of Urban Affairs (NIUA) and the National Mission for Clean Ganga (NMCG).

This report has been submitted by the student as a final deliverable under the competition. All parts of this research can used by any of the undersigning parties.

1. **Student**
   Name - PREETIKRISHNA PANDA
   Signature - Preetikrishna Panda

2. **Institute**
   Name - XIM UNIVERSITY, BHUBANESWAR
   Department - SCHOOL OF HUMAN SETTLEMENTS
   Authorized Representative - DR. TATHAGATA CHATTERJI
   Signature -

3. **Sponsors**
   Name - National Institute of Urban Affairs
   Authorized Representative - Hitesh Vaidya, Director
   Signature -

   Name - National Mission for Clean Ganga
   Authorized Representative - G. Asok Kumar, Director General
   Signature -