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

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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. 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, the two most important rivers of Odisha are a victim of manmade hazards, climate change and mismanagement.

Cuttack has expanded into the river, burying every possibility to improve it. 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.

KEY WORDS
Anthropogenic activities, Urban River Management, People-River Connect, River-centric, Governance.

1. INTRODUCTION

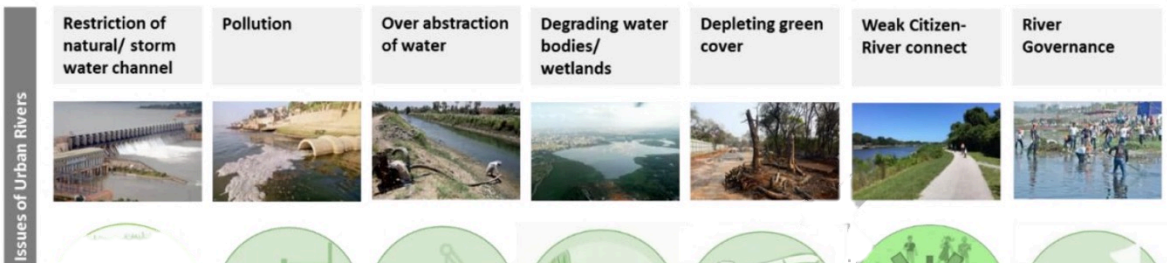
1.1 BACKGROUND:

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.

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

*Figure STYLEREF 1 \s 1. SEQ Figure * ARABIC \s 1 1: Issues related to Urban Rivers*
Source – Strategic Guidelines for Making River-Sensitive Master Plans, NIUA

first addressing the issues in urban areas, which is the very significance of this research.

1.2 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 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:

*Figure STYLEREF 1 \s 1. SEQ Figure * ARABIC \s 1 2: Two types of approaches to Urban River Management* Source – **Strategic Guidelines for Making River-Sensitive Master Plans, NIUA**

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 initiate the relevant projects that are required to enhance the river outlook in the town.

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 s/pecific 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.

2. HISTORICAL BACKGROUND AND CONTEXT

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.

2.1 DEVELOPMENT OF THE RIVERINE CITYSCAPE

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.

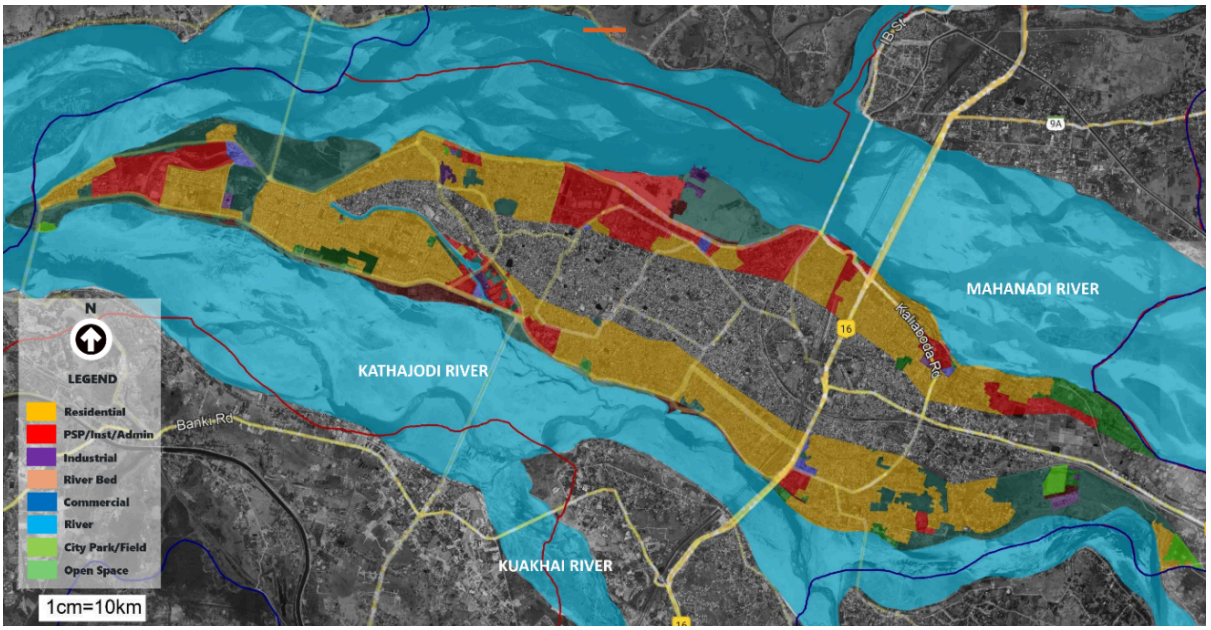
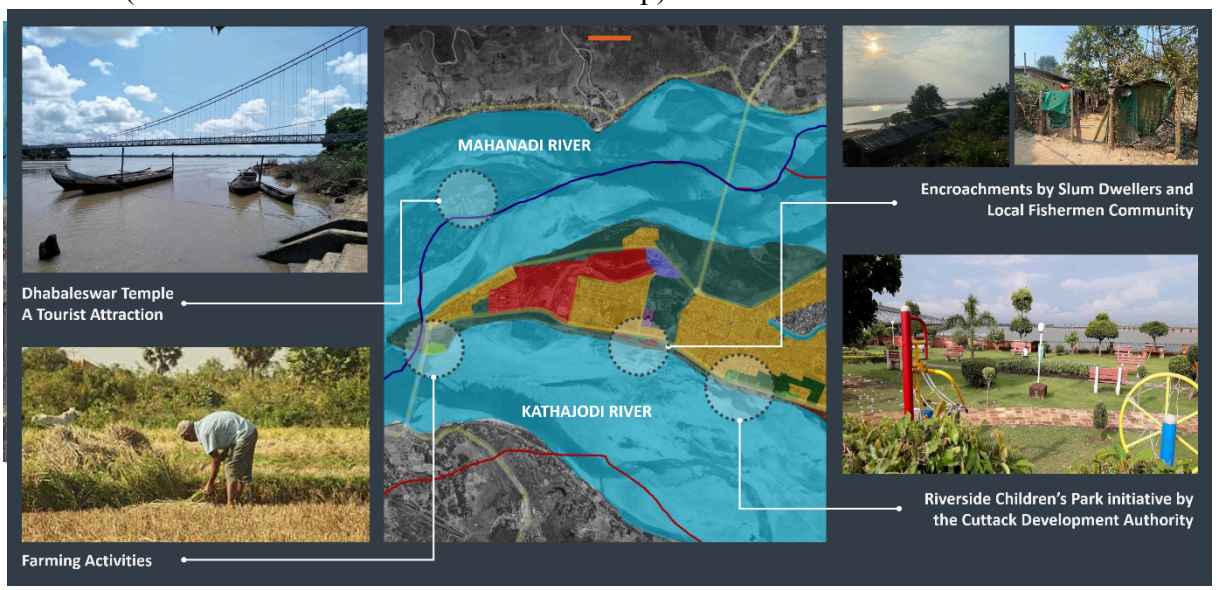
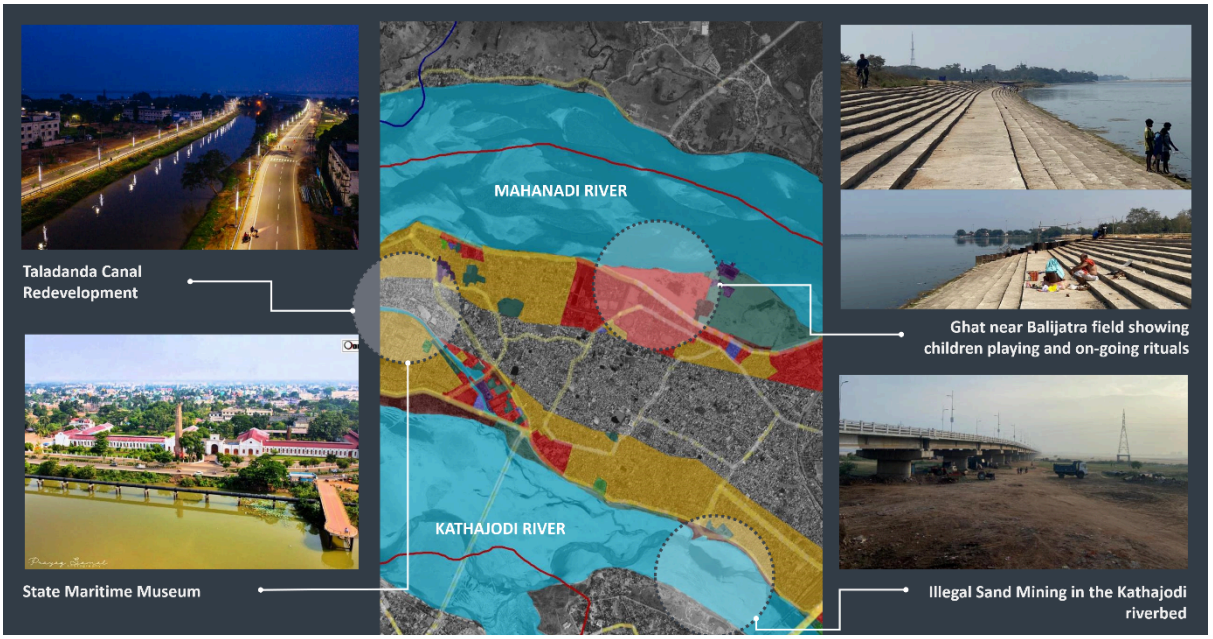


Figure 2.1:Land Use-Land Cover Map for the 1km area from each side of the rivers

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.

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).





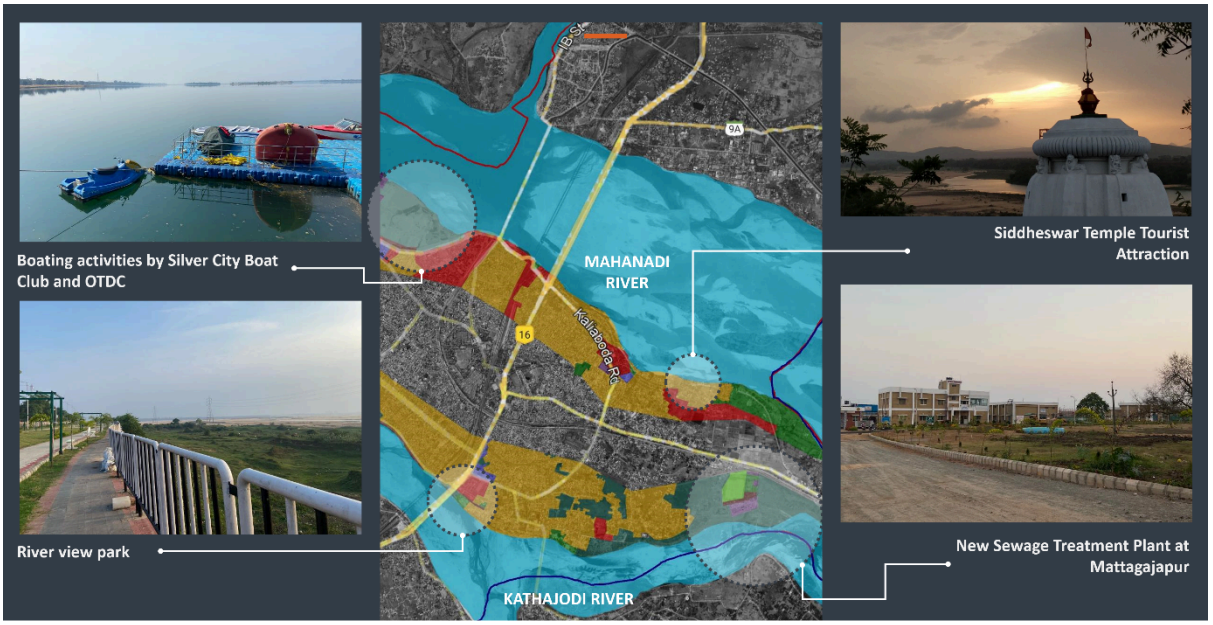


Figure 2.2, 2.3 and 2.4:Segment A, B and C respectively

3. 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 3.1: Bolbom rituals at Gadgadia Ghat
Source – Times of India

Figure 3.2: Balijatra during Day Time
Source – Times of India

3.1 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.

Figure 3.3: Dimensions of the River

3.2 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.

4. RECOMMENDATIONS

4.1 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 Figure 4.1. 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:

a) Enhancing connectivity and improves the public access to the river by designing a well-connected Riverfront
b) Promotes cycling and walkability, thereby acting as a pull factor for enhancing community health and well-being.
c) 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.
d) Has got facilities like bio-toilets, water ATMs, open-air theatres, open-air gymming equipment, etc.
e) Easy to maintain by charging a minimal amount (through ticketing), pay and use toilets, tickets for cultural evenings at the open-air theatre, etc.

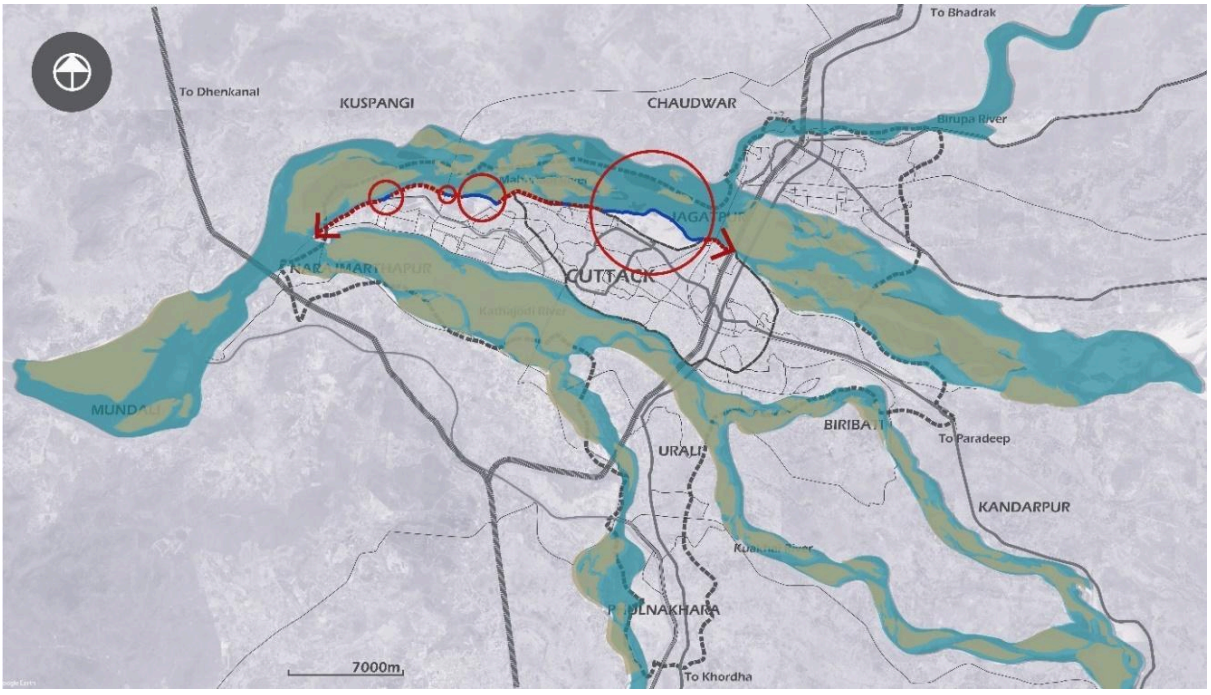


*Figure 4. SEQ Figure * ARABIC \s 1 1: The red dotted line represents the proposed Trail*

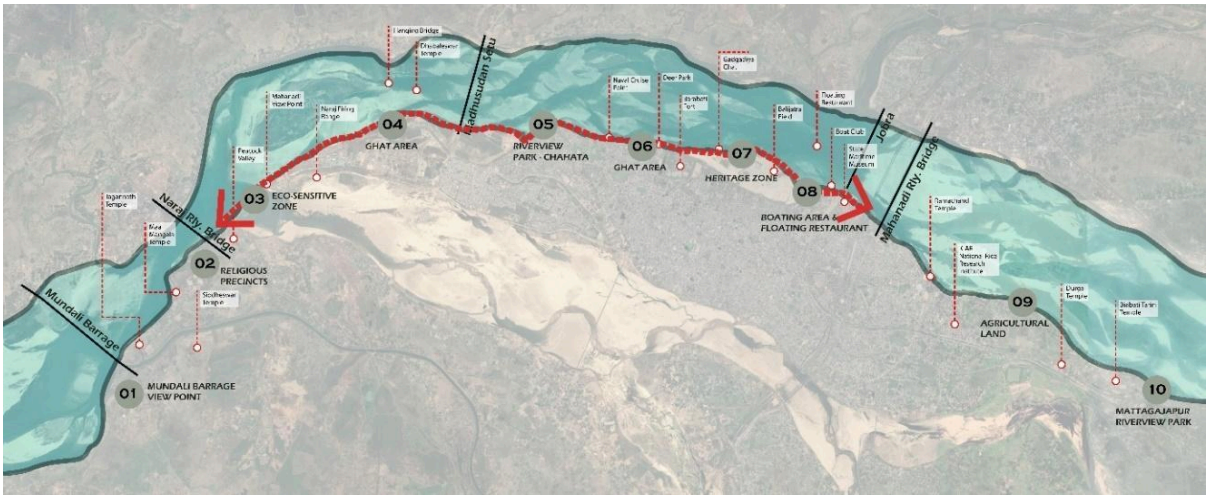


*Figure 4. SEQ Figure * ARABIC \s 1 2: Proposed trail connecting all strategic locations of Cuttack*

4.2 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.

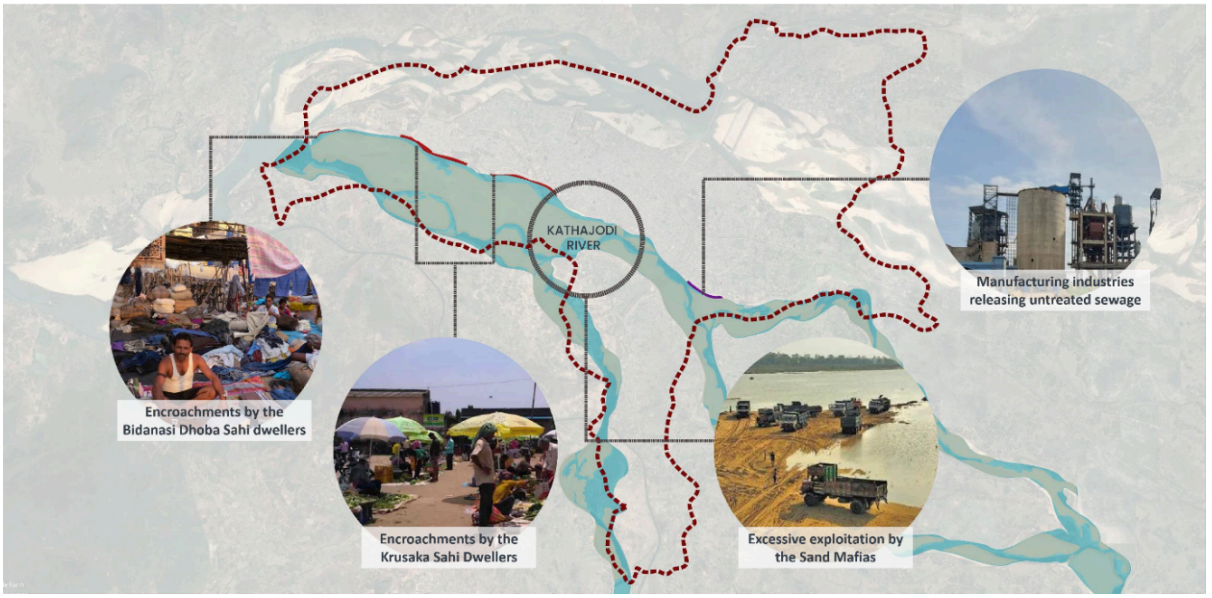


*Figure 4. SEQ Figure * ARABIC \s 1 3: Vulnerability Map of River Kathajodi*

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 structure and extra food and energy sources

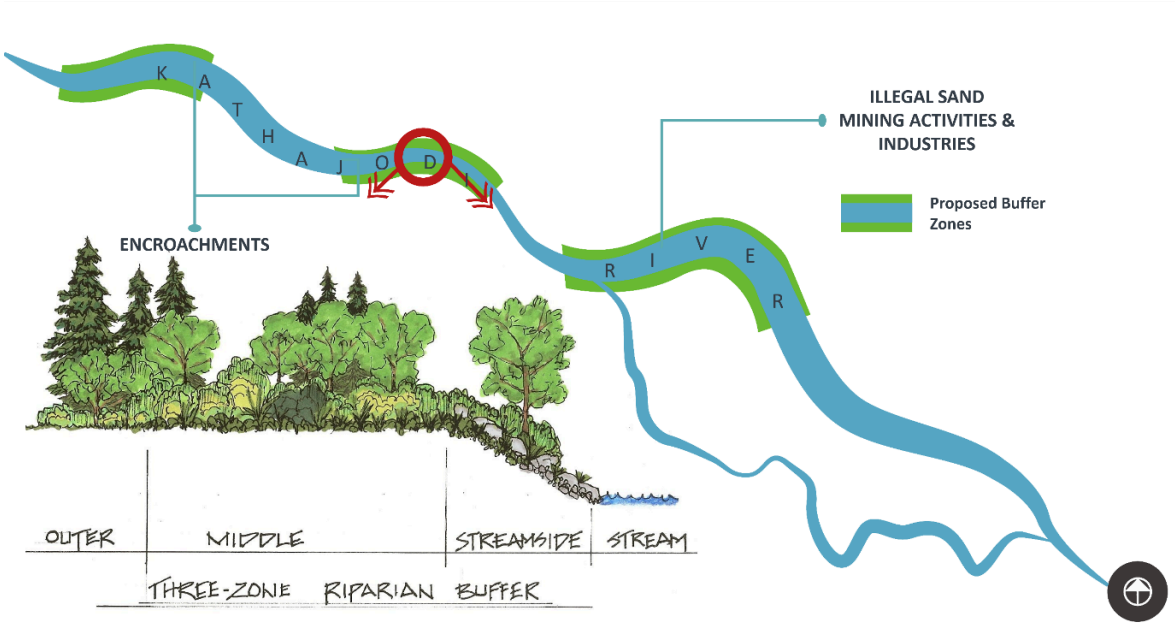


*Figure 4. SEQ Figure * ARABIC \s 1 4:Proposed stretches of Riparian Buffer along Kathajodi River*

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

4.3 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:

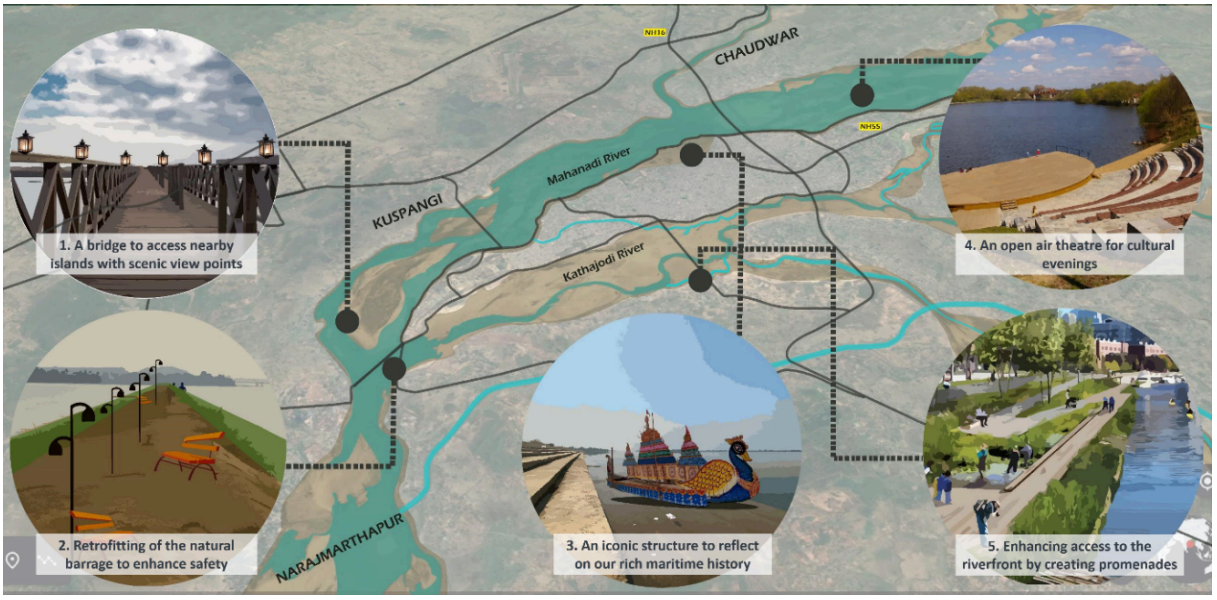


*Figure 4. SEQ Figure * ARABIC \s 1 5: Urban design interventions for enhancing People-River connect*

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. Specific Sectoral Strategies for Cuttack

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.

4.4 LAND USE AND ZONING

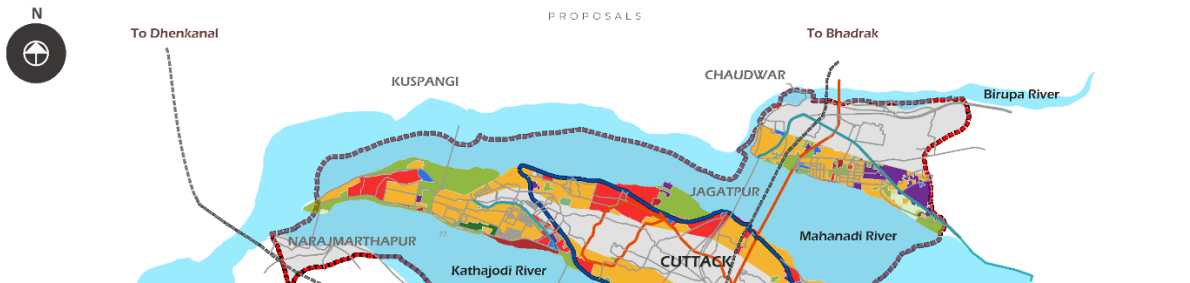


*Figure 4. SEQ Figure * ARABIC \s 1 6: Land Use and Zoning*

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

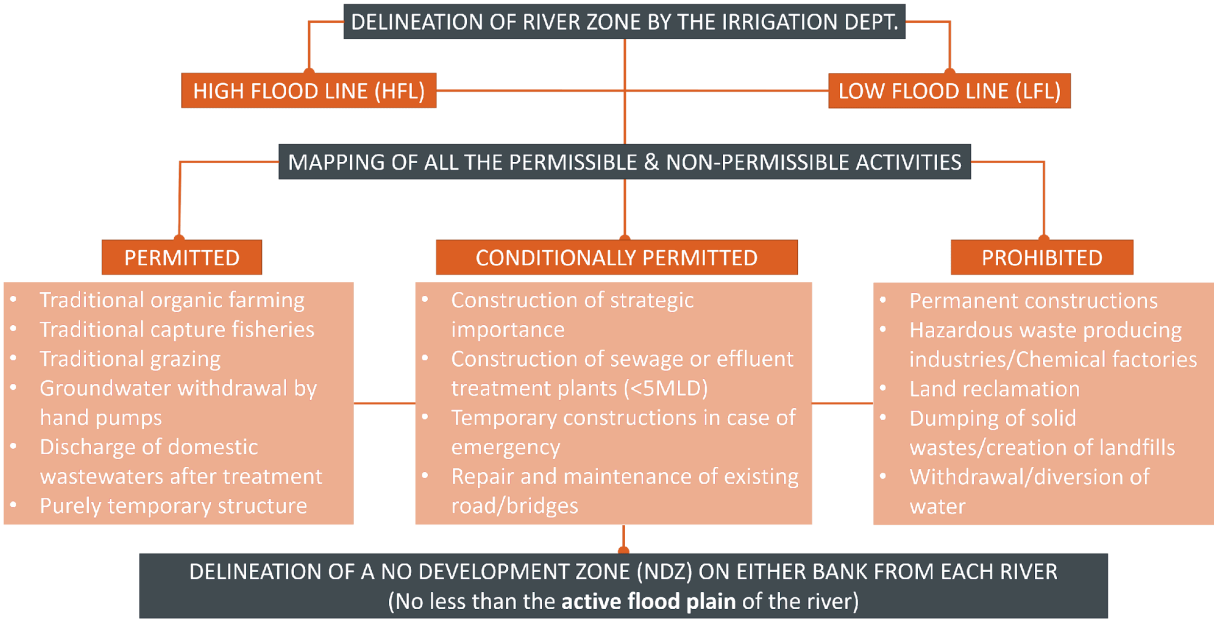


Figure 4.7: Action Plan for Devising Zoning Regulations

4.5 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

4.6 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.

4.7 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

5. CONCLUSION AND 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.

5.1 ACKNOWLEDGEMENTS

The authors sincerely acknowledge the valuable inputs received from the team of National Institute of Urban Affairs and National Mission for Clean Ganga for their critical comments during the study at multiple levels of the research work.

5.2 CONFLICT OF INTEREST

Authors has no conflict of interest to declare.

5.3. FUNDING

This research is funded and is a part of the sponsorship received under the National Thesis Sponsorship Competition in 2021 by National Institute of Urban Affairs (NIUA) and National Mission for Clean Ganga (NMCG).

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