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A SUSTAINABLE RIVER FRONT PLANNING

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Abstract - Rivers have always been essential to the survival of any human settlement. The ruins of the first townscapes can be discovered along the rivers. Human beings ploughed the first lines along the rivers, laying the groundwork for the growth of urbanization. With the growth of human populations and their requirements, the river has always been the most significant with the advent of urbanisation, the river eventually became an urban river serving as an urban corridor with all of its essential offerings for urban communities. Urban River witnessed environmental decline, indifference, and pollution. It gradually became an eyesore for the community as it lost touch with its life-giving boundaries. Then came the era of environmental conservation and river rejuvenation, which focused on all of the physical, social, cultural, and heritage dimensions of the river that restore the urban settlements once more.

Cities have recently acknowledged the value of water as a representational and spatial contextualising element: Water creates spaces that are ideal for slowing down and strolling. It animates and organises urban environments while avoiding the creation of spatial boundaries. It increases the value of urban environments and can help individuals visualise a specific image in their heads. The revitalization of urban waterfronts or former ports, as well as the qualitative upgrading of their spatial condition values, are a particular focus: especially if significant urban conversions occur and new (housing) districts modify the urban heritage. The development of waterfront areas is critical in this regard, as it allows for the right integration of human activities and agglomerations in an increasingly vulnerable and deteriorating environment. At the same time, sustainable waterfront development can help cities and regions compete more effectively on a global scale. First and foremost, the relationship between the waterfront, the city, and sustainability is the focus of this research. The conditions for a sustainable urban development along the waterfront are then established. These ideas are made clearer by examples of planning practice.

***Key Words*:** riverfronts, Sustainable development, sustainable riverfront development

1. INTRODUCTION

Water is one of the most important natural resources for maintaining human health and civilisation. India is fortunate to be able to call itself a water-rich country with numerous rivers with significant recreational possibilities. Many Indian River systems have been changed from water to non-water businesses as a result of population development, economic growth, urbanisation, and increasing technology. A sustainable strategy for integrating the river into the development of the urban fabric has been devised. The natural potential of the land for development into a biodiversity zone for the conservation of the river basin's natural heritage, as well as the local requirements for facilities at the urban level, such as large-scale city open spaces of various forms with recreational facilities, have been taken into account. The waterfront may be a one-of-a-kind and irreplaceable resource; nevertheless, defining its borders is challenging due to the presence of mixed-use development that is comparatively uniform.

In India, waterfront redevelopment has occurred over the previous two decades. Waterfront attraction initiatives have been successful in some waterfront development projects, but they have not been successful in many others. Improving riverbank attractiveness through landscaping is one component, but in the case study regions, cumulative environmental problems such as water pollution and floods have been recognised as a major effect of waterfront development. This paper takes three different approaches: theoretical, applied, and analytical research. The theoretical research focuses on the concept of waterfront development, as well as identifying sustainable waterfront development through learning about sustainable development principles, quality-of-life indicators, and place making criteria.

1.1 Need of the study

Various factors which explaining the need of the study

- Deteriorating conditions of urban rivers
- Background of riverfront landscape design
- Narrow public space
- Degrading local economy
- Eco-efficiency

Fig -1: Ignorance of the historical context

1.2 Issues related to urban rivers

Channelization - Channelization is an engineering process that involves expanding or deepening rivers to increase the capacity for flow volume in specific sections. As a result, watercourses may move more swiftly and accommodate more water, resulting in less bank damage and a lower risk of banks being carried away during floods.

Water quality degradation - Freshwater degradation occurs when the physical, chemical, or biological properties of water become hazardous to the environment or species, including humans, reducing the utility of the water supply.

Removal of riparian vegetation-The narrow strips of land adjacent to streams, rivers, lakes, ponds, and wetlands are known as riparian regions. Healthy riparian vegetation helps in stream bank erosion reduction and stream channel geomorphology stability. Shade is also provided by vegetation, which helps to cool the water.

Low-flows and increased flood frequency - When there is substantial rainfall, over-abstraction and increased surface run-off in urban areas reduces low flows within a river but increases flood frequency and reaction time.

Invasive species - Because cities serve as hubs for global transportation networks, invasive non-native species are particularly vulnerable in urban rivers.
The natural ecosystem and many of our native creatures are being affected.
The cumulative effect of these difficulties makes urban rivers less resilient to climate change's expected consequences, making river management challenging.

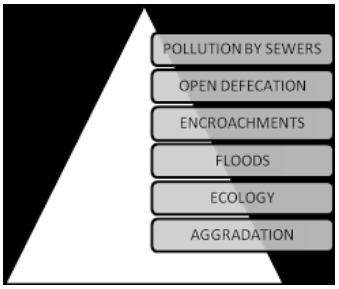

Fig -2: Factors affecting sustainable waterfront development

1.3 Characteristics of urban riverfronts

Dynamic area - It's a dynamic environment with constantly shifting biological, chemical, and geological characteristics.

Habitat - This phrase refers to ecosystems that are highly productive and biologically diverse and serve as significant nursery sites for a wide range of species.

Natural Defense - A mangrove forest, for example, is an important natural barrier against natural disasters (flooding, erosion and storms).

Pollution moderator - River ecosystems may help to mitigate the effects of pollution from the land, such as wetlands that absorb excess nutrient sediments and human waste.

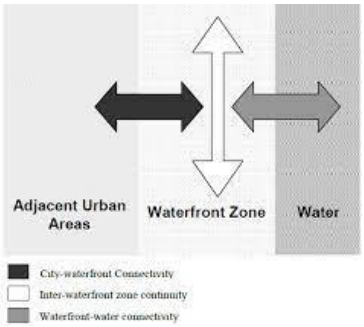

Fig -3: Connectivity of water & adjacent area by riverfront

1.4 Types of urban riverfronts

Cultural river fronts - A river front with a sense of belonging, celebration, creative expression, relaxation, and commercial activity.

Environmental riverfronts - coastline stability, wetland protection, prairie restoration, and so on.

Historic riverfronts - A riverfront that gives an area "a sense of individuality and character." By conserving the cultural heritage of a location, you may provide a unique educational experience.

Mixed use riverfronts - A riverfront with a dynamic space offering a variety of activities that are well-balanced.

Recreational riverfronts - "The site of community gathering" is a recreational riverfront. Parks, gardens, picnic spots, strolling, cycling, and water sports such as boating and fishing are all available.

Residential riverfronts - A riverfont with housing provides space for various activities such as retail, recreation, and restaurants.

Working riverfronts - A riverfront where activities such as fishing, boat maintenance, and other river-related activities take place.

Redeveloping riverfronts - A riverside with recently changed land uses or abandoned and under utilised assets suggests the possibility of positive change.

2. Water front Development

An environmentally conscious approach for integration of the river/sea into the urban fabric development. There has been an appropriate consideration of the natural potential of the land for developing into a biodiversity zone for conserving the natural heritage of the river basin as well as the local and transient requirements of facilities at the city level, like large scale ecology trails of varying nature along with some recreational facilities.

2.1 Advantages of riverfront development

- Source of revenue for government –shops, restaurants, sport activities, Transportation, boating etc.
- Tourism development through providing a variety of attractions such as water sports, entertainment arenas, parks, and shopping places, among others.
- Economic spin-offs include an increase in property values, which acts as a drive for renovation and rejuvenation in the surrounding area.
- Human-environment interactions, as well as land protection and development
- Flora and fauna conservation
- Protection and restoration of habitat - river water conservation
- Maintenance of river bank.
- Flood control measures
- Rejuvenating the community
- Provide an open place for the general public's recreation and amusement.
- Creation of a healthy and active urban environment

2.2 Elements of riverfront development

Geology, morphology, hydrology, and land cover are all significant aspects of ecosystem function that should be considered. Along the river, there are so many opportunities for integrated regenerative design, like storm water management, habitat restoration, public access, stewardship, and redevelopment.

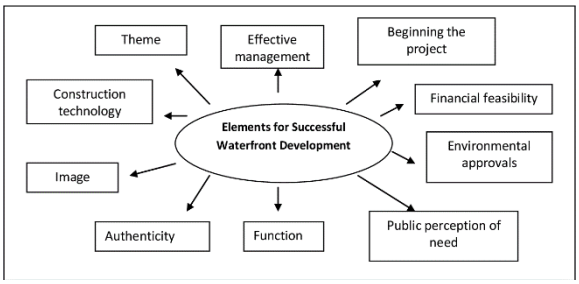

Fig -4

2.3 Principles of riverfront development

Basic principles which need to be considered while planning

- Feature the riverfront as the front door
- Showcase the history of the river
- Make the riverfront more active.
- It extends from the riverfront into residential areas.
- It links to the river and limits barriers.
- Use high-quality architectural materials and technical processes that are environmentally friendly.
- It helps to restore and improve the environment.

2.4 Concepts of development

THE RIVER AS A PRIMARY DEVELOPMENT ATTRACTION

- The river itself must be developed before any additional development
- It is not authorised to remove or change the river line or row.

BEAUTIFICATION OF RIVER

- Keeping a river reserve as a buffer zone to combat environmental issues like soil erosion.
- Create a river recreation and beautifying strategy.

DEVELOPMENT OF PERMANENT INFRASTRUCTURE

LEVEL OF RIVER FLOW

- The level of river flow would not be increased by building near river areas.

2.5 Riverfront development parameters

- ✓ Physical
- ✓ Social
- ✓ Economical
- ✓ Environmental
- ✓ Management

3. Sustainable development

Sustainable development can be defined as development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

Sustainable waterfront development must result in better living circumstances for the city's residents. In this approach, ecological, economic, and social goals must all be combined. A sustainable waterfront is defined as "a place where people of all ages and backgrounds can live, work, play, visit, and learn in a way that strengthens and celebrates the city's beauty, diversity, economic vitality, opportunities, creativity, heritage, and natural environment."

4. Criteria for a sustainable development at the river front

Three levels of criteria

1. Primary
2. Secondary
3. Tertiary

- **Primary level -** This includes the three basic dimensions of sustainability that are critical to any project's success: environmental, social, and economic.
- **Secondary Level -** Each of the above factors contributes to the achievement of each of the criteria. Addressing the issue of water management, for example, is classified as environmental since it plays a part in making a project environmentally sound.
- **Tertiary level -** These contain indicators that are required to complete the secondary level. For example, safety is a critical component of pedestrian planning, which is crucial in ensuring that the project addresses the issue of social sustainability.

4.1 Principles of sustainable riverfront development

Planning for waterfront development is frequently governed by priorities:

- balanced land use
- respect for limited resources
- improved public access
- safeguards for environmental quality
- Protect water quality and the climate.
- Public participation is an element of sustainability.
- Historical identification
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4.2 Urban Waterfront Development Standards

Land uses - Local business areas such as industry, fishing, trade, recreation, transportation, offices, and residential areas, integrating with residential communities such as "school, playground, park, stores," or leisure areas such as "recreational facilities, public parks, culture facilities, public spaces, entertainment."
Replacing the waterfront's functions (to tourist and consumer sectors, as well as socio-economic expansion with cultural appeal) is the catalyst for reconstruction of the waterfront, as well as the city and region as a whole.

Urban Identity - It is determined by the human activities in and around the city areas including the waterfront areas.

Socio & Economic Benefits - The waterfront area is considered an urban advantage, which attracts many investments to the surrounding territory and to the whole city. These new investments must be compatible with the urban uses such as the cultural, tourism, leisure projects. (Long-term value, Competitive advantage, Business and market places).

Accessibility - Access to the waterfront regions is provided via a network of public transit and services, including public transportation, pedestrian and bicycle traffic, as well as private automobiles. All of this is provided as part of a movement plan aimed at preventing disputes between all users in Belfast's city Centre.

Place Making Quality - Being a living city is crucial. Mixed-use zones, such as residential communities with a variety of dwelling types, facilities and services, and recreation and entertainment activities, can help achieve this. Furthermore, movement on the water produces a unique level of life that can be achieved by providing coastal ferries and ports.

Environmental quality –

- Ensure the quality of water and the environmental conservation
- Reduce your energy and material use.
- Use green infrastructure along the green road, such as trees and shrubs.
- Use sustainable storm water management
- Creating pedestrian-friendly routes and inviting open spaces with plenty of shade
- Providing Sustainable transportation system
- Providing sustainable buildings
- Using renewable energy resources
- Using a garbage collecting system that is environmentally friendly

These applications should minimise energy consumption, enhance air quality, lessen the heat island effect, and aid in the reduction of sound transmission and noise pollution.

5. Guidelines

The fundamental goal is to create an environment that is appealing to pedestrians and gives visual interest while preserving the waterfront setting's uniqueness. Some of the most essential concerns for properties along the riverside are the design character of a building's site and how it works.

5.1 Building Placement and Orientation

Building placement on a site should be examined in the context of its surroundings, as well as how the structure will contribute to the area's overall design goals. Buildings should be placed in such a way that they provide active areas for local residents, invigorate the street, and define the street boundary.
- Locate buildings at the sidewalk edge.
- construct structures with two fronts.
- If there will be two or more buildings on a property, arrange them to create an outdoor space.

5.2 Minimum Setbacks

Building designs for the riverside are open to interpretation, but will be limited by the Zoning District. The pedestrian nature of the area should be reinforced through building setbacks. Buildings should line up along the street's edge, with stores and other visually appealing characteristics.

5.3 Service areas

If at all feasible, drivers should be diverted away from service entrances and rubbish disposal places, as well as the shoreline and roadway.

5.4 Pedestrian Connectivity

When possible, efficient pedestrian connection between the street and the waterfront should be given on bigger properties to promote accessibility to both regions.
- When possible, provide pedestrian access to larger locations.
- Connect the waterfront and the roadway in a perpendicular manner.
- Create a continuous outside river walk that connects the site to neighbouring properties.
- Make these paths as secure and convenient as possible.

5.5 Surface Parking

Surface lots should be designed to be appealing, complementary extensions to the waterfront experience to reduce the negative visual consequences of cars parking on the site. Parking lots along the waterfront are discouraged, and other locations for future parking lots at the site should be investigated if necessary.

5.6 Views

Views from the public way to significant natural and cultural resources should be maintained when feasible. Site improvements should be planned to enhance such views. These view opportunities should be identified for all major site developments before the onset of the project.

5.7 Architectural Character

New buildings and renovations should be appropriate with the traditional surroundings, but they should not repeat previous architectural styles. New construction should be distinguishable from historic structures in terms of style.
It should be on a similar scale and include character-defining traits that are compatible with conventional structures.
Traditional architecture styles are encouraged to be interpreted in new ways. In new building, contemporary interpretations of traditionally used architectural components are encouraged.

5.8 Building Materials

The principal building methods were wood frame and concrete. These should be used in new building as well. When more modern materials are compatible with those used traditionally, they may be considered.
- The scale of new materials should be conveyed.
- Building materials should have qualities similar to those previously used.

All materials utilised should be long-lasting and climate-appropriate.

5.9 Pedestrian Interest

The waterfront area should continue to grow as a pedestrian-friendly space. A pedestrian-friendly environment should be conveyed by buildings.

5.10 Public Streetscape, Riverwalk, Public Art & Plazas

The pedestrian environment should be created to stimulate and improve the experience of walking down the street or along the riverwalk. It should depict a coherent system by establishing visual continuity while also honoring a succession of experiences along the route.

5.11 Building and Site Lighting

The basic purpose of lighting is to provide safety and illumination. The fundamental purpose of lighting in Juneau is to ensure that it does not harm the surrounding environment or the general ecosystem while yet providing a safe atmosphere.

5.12 Landscaping

Keep existing mature trees and other vegetation on the property.
- Encourage the utilisation of native species.
- Provide a landscaped edge along Egan Drive.

6. Outdoor Public Spaces

In order to improve the waterfront as a pedestrian destination, the creation of outdoor public areas should be encouraged. Outdoor public spaces should be built into buildings and other site purposes, and the development of spaces connected to other activities is encouraged.

6.1 River walk

Expanding the river walk in areas where docks, ramps, floats, and piers connect should be considered. Plazas, parks, and commercial institutions should all be built to add to the experience.

6.2 Water Access

Along the river path, provide a variety of options to feel the water.
Create spaces where people can enjoy the water from the riverwalk and, if possible, from the shore.
- Docks, ramps, stairs and overlooks should be considered.
- Kayak or small craft launch zones should be considered at appropriate locations.

6.3 Seasonal Kiosks

Seasonal kiosks are small-scale, temporary constructions that are mainly meant for one or two persons. During the tourist season, they are used for commercial or informational reasons. The river's incorporation into the urban fabric development has been developed in an environmentally conscientious manner.
Many well-known cities are found at the confluence of rivers and seas. These elements facilitate multi-cultural integration as well as convenient transit. Water is the source of human life and civilisation, so the riverbank in many of these cities holds a special allure.

7. Recommendations for Waterfront Development

WEDG's guiding principles are a set of key beliefs for optimum waterfront design practises. Waterfront access, resiliency, and ecological benefits are all part of a well-designed edge.

Incorporated into a well-thought-out plan while each location and project has its unique qualities and objectives that guide its outcome

The following principles provided a foundation for MWA to create WEDG in collaboration with the interdisciplinary task force and end users

7.1 Enhance Ecology

Waterfront edge designs should preserve existing aquatic habitats and improve the ecological function of the coastal zone by using designs, materials, and shoreline configurations that are consistent with regional guidelines.

7.2 Encourage Maritime Use

Where possible and practical, edge design should offer a waterfront that is useful by the maritime community, both commercial and recreational, optimising the marine usage and integrity of the harbour and waterfront. Water-dependent uses, marine business, maritime activity, and recreational boating should all benefit from edge design. Make use of a science-based approach

7.3 Evaluative Process for Restoration

Environmental characteristics of waterfront edge design should be considered by project decision makers using all available science.
To measure the efficacy of projects with novel ecological aspects, evidence from the literature and pre-project baseline ecological circumstances should be used.
Data collected through monitoring should be used to enhance designs over time.

7.4 Promote Resiliency

The effects of sea level rise and increased coastal flooding must be accommodated, mitigated, or adaptive in waterfront edge designs. Higher precipitation may result in increased storm-water runoff, and green infrastructure and planted-edge architecture can help improve water quality.

7.5 Encourage Cost-Effective Solutions

Climate change hazards, initial capital expenditures, continuing maintenance requirements, and other considerations should all be considered when calculating project costs. When considering cost-effectiveness, consider the project's vulnerability to and implications of changing coastal conditions owing to sea level rise and coastal flooding.

7.6 Commit to Equity and Community Input

Waterfront edge designs should be built with local community and user participation to meet the different needs of all types of neighbouring communities and land uses. Communities without coastline access should be planned with specific consideration for their needs, which should be accomplished through extensive communication and input processes.

8. The Benefits

1. Improve water quality while lowering cleaning and drinking water treatment expenses.
2. Flood damage can be reduced and flood control costs can be reduced.
3. Attract state and federal assistance, new volunteers, and a large amount of money.
4. Provide possibilities for recreation, open space, and park amenities.
5. Reduce the cost of storm water management.
6. Reduce the expense of sprawl and related infrastructure.
7. Residents should be able to work in construction and commercial businesses.
8. Increase the value of your home and create new tax money.
9. Create new housing, office, and commercial options along the downtown riverfront to attract new residents, businesses, and visitors.

CONCLUSIONS

• The goal of this study is to identify statements that could be useful for sustainable riverfront development guidelines, and then to offer riverfront development guidelines for best practise waterfront development.
• The River can be restored in a variety of ways, including the construction of infrastructure and recreational facilities. The abandoned riverbed and other annoyances in the city's centre could be transformed into popular tourist destinations.
•According to this study come up with sustainable design ideas based on the triple bottom line of sustainability (SEAD).

1. Environmental

Green neighbourhood, Brownfield redevelopment, Natural environment & ecological system, Energy efficiency, Water management, Storm water management, Waste management

2. Social

Site development, Transit-oriented development, Public accessibility, Basic facilities, Strong cultural and heritage expression

3. Economic

Increase in real estate prices, Development of new economic businesses on site, Improvement in tourism activities

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