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SERIES

WATERFRONT DEVELOPMENT

What is the impact of Lakefront/ Riverfront/ Beachfront projects in Indian Smart Cities?

Impact Assessment Study By:

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Smart City
MISSION TRANSFORM-NATION

SMART CITIES MISSION
MINISTRY OF HOUSING AND URBAN AFFAIRS

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EXECUTIVE SUMMARY

The Smart Cities Mission (SCM) launched by the Government of India in 2015 aims to transform Indian cities into sustainable and inclusive urban spaces. A critical aspect of this mission is the development of waterfront areas, which include lakefronts, riverfronts, and beachfronts. These projects are designed to enhance the aesthetic, functional and economic viability of urban areas. As of the latest assessments**, there are 203 waterfront development projects across various cities in India, with 124 lakefront, 61 riverfront, and 18 beachfront projects.** This executive summary outlines the impact assessment, and findings of the research conducted on these projects.

Key Findings

1. Environmental Impact

Positive Changes: Waterfront projects have led to significant environmental improvements, including better water quality, increased green spaces and **lower soil erosion, with management of sewage, open spaces, embankments, and activity areas along waterfronts.**

Challenges: Pollution control and efforts to mitigate environmental degradation during construction were critical but varied in effectiveness.

2. Social Benefits

Public Spaces: The projects have successfully created **vibrant public spaces that promote social inclusion and community engagement**. These areas are now hubs of recreational and cultural activities.

Accessibility: Enhanced accessibility to waterfronts has been achieved through the development of pedestrian walkways, cycle paths, and public amenities like amphitheatres and children's play areas.

3. Economic Gains

Tourism and Property Values: **The revitalized waterfronts have boosted local tourism and increased property values**. The economic infrastructure surrounding these areas has seen substantial growth, leading to new business opportunities and employment generation for locals. The projects have attracted significant investments, both from public and private sectors, facilitating further development and maintenance.

4. Project Implementation

Design and Execution: The design principles adopted emphasize sustainability, with a focus on minimizing new floodplain development, restoring natural habitats, and using smart technologies.

Smart Technologies: Implementation of smart technologies, such as Wi-Fi, smart lighting, and innovative construction materials, has **improved the functionality and user experience of waterfronts.**

5. Governance and Stakeholder Engagement

Frameworks: Effective governance frameworks were crucial for the success of these projects. Regulatory frameworks ensured efficient implementation and accountability. Stakeholder Involvement: Active stakeholder engagement, including interactions with residents, businesses, and tourists, was vital for understanding community needs and ensuring project relevance.

Recommendations

1. **Strengthening Environmental Policies**: Establish stricter environmental guidelines and monitoring mechanisms to ensure ongoing protection and improvement of water quality and habitats.

2. **Enhancing Public Participation**: Increase community involvement in the planning and execution stages to better address local needs and enhance public ownership of projects.

3. **Fostering Economic Opportunities**: Promote initiatives that link waterfront development with local economic activities, ensuring that benefits are widely distributed among the community.

4**. Leveraging Technology**: Continue to integrate smart technologies to improve infrastructure management and enhance the user experience of waterfront areas.

5. **Sustaining Governance Efforts:** Maintain robust governance frameworks to oversee project execution, ensuring transparency, accountability, and long-term sustainability.

6. **Robust Asset Management System**: An asset management system under the Smart Cities Mission is essential to efficiently oversee operations and maintenance activities, extend the lifespan of assets. This system enables proactive management, optimizing resource utilization and financial planning to support long-term urban infrastructure sustainability.

Conclusion

The waterfront development projects under the SCM have demonstrated significant potential in transforming urban landscapes. By addressing environmental, social, and economic aspects, these projects contribute to creating sustainable and inclusive urban spaces. Continued focus on effective governance, stakeholder engagement, and integration of smart technologies will be essential in maximizing the benefits and ensuring the long-term success of these initiatives.

Keywords: Smart City, Riverfront Development, Lakefront Development, Beachfront Development, Impact Assessment

FOREWORD

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FOREWORD

Smart Cities Mission, launched in 2015, aims to promote cities that provide core infrastructure and give a good quality of life to its citizens, a clean and sustainable environment and application of smart solutions. Over the past nine years, the 100 Smart Cities have implemented a wide range of projects, many of which are innovative and unique, significantly enhancing their capacity to achieve transformational goals and contribute to the Sustainable Development Goals. Throughout this journey, numerous lessons have emerged from the experiences of Smart Cities across India, which are crucial for shaping the future of urban development. It has been a privilege for School of Planning and Architecture, New Delhi to be entrusted by the Ministry of Housing and Urban Affairs (MoHUA), under its SAAR-Sameeksha series of research studies, with two research themes; (1)'Impact of lakefront/riverfront/beachfront projects under the Mission' and (2) 'The role of SCM in enhancing overall quality of public spaces/ public parks/ gardens?'. The research related to the first theme has been encapsulated in this report.

Historically, cities have had a strong relationship with their rivers and lakes that in last few decades, has been undone by pollution and degradation. Smart Cities Mission through its waterfront development projects has been able to provide an opportunity for citizen connect with urban waterbodies at a pan India scale, enabling a sense of belongingness among the citizens. Given the substantial investment and the potential impact on urban landscapes, it is crucial to assess the effectiveness of these projects in meeting their intended objectives. This assessment conducted by School of Planning and Architecture, New Delhi has provided valuable insights into best practices under the theme of lakefront/riverfront/beachfront projects.

In this research study, the impact of lakefront/riverfront/beachfront projects under the mission have been studied at the national level and examined in further detail for the cities of Coimbatore, Nashik and Puducherry for lakefront, riverfront and beachfront projects respectively. Extensive stakeholder consultations were conducted with Smart Cities officials, commercial establishments along the waterfront, user residents and tourists for complete comprehension of impact of the Smart Cities projects and the challenges faced by the implementing agency during planning and execution. The research sheds light on the

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विकसित भारत अभियान

learnings from the Smart Cities Mission at the national level and for the selected three cities taken up as case studies.

We express our gratitude to the Mission team at MoHUA for offering data support and on-ground facilitation of site visits for the project team. Also, I would like to thank **Prof. Dr. Meenakshi Dhote** and her team for contributing towards the research study. We hope that the insights and learnings from this research study will serve as a valuable resource to inform policy formulation and the planning and implementation of future lakefront, riverfront, and beachfront projects, thereby enhancing their efficacy and amplifying their positive impact on the urban landscape and local ecology.

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ACKNOWLEDGEMENTS

We extend our sincere gratitude to all the individuals and organizations that contributed to the completion of this report on the Smart Cities Mission Assessment, focusing on the riverfront project in Nashik, the beachfront project in Puducherry, and the lakefront project in Coimbatore.

We would like to thank the smart city authorities and municipal authorities of Nashik, Puducherry, and Coimbatore for their cooperation and valuable insights. Their participation in stakeholder surveys and interviews provided essential information that significantly enhanced the depth of our analysis.

We also express our appreciation to the residents of these cities for their willingness to share their experiences and perspectives. Their contributions were invaluable in understanding the impact and effectiveness of these projects.

The team is grateful to the authorities of School of Planning and Architecture (SPA), New Delhi – Prof. Dr. Virendra Kumar Paul, Director; Prof. Dr. Yogesh Singh, Vice Chancellor of University of Delhi and Former Director (In Charge) of SPA New Delhi, Prof. Dr. Sanjay Gupta, Former Dean (Research) and Prof. Dr. Sewa Ram, Dean (Research) for facilitating the approvals as and when required.

Additionally, we acknowledge the dedicated efforts of our team members, who worked diligently to gather, analyse, and compile the data presented in this report. Special thanks go to our interns, Ms. Deep Shikha Verma, Ms. Neha Sethia and Ms. Serene Maria for their hard work and commitment. Their commitment and enthusiasm contributed to the successful completion of this work.

Finally, we thank all other stakeholders who participated in this study and provided their feedback. The collaborative efforts of everyone involved have been crucial in producing this comprehensive assessment.

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1. INTRODUCTION

1.1 Background

The rapid pace of urbanization in India has introduced significant challenges in managing and sustaining urban environments. To address these issues, the Government of India launched the Smart Cities Mission (SCM) in 2015. This initiative aims to transform Indian cities into sustainable and inclusive urban spaces through the development of core infrastructure, improved service delivery, enhanced quality of life for citizens, and efficient urban management with technology.

A key focus of the Smart Cities Mission (SCM) is developing waterfronts, such as lakefronts, riverfronts, and beachfronts, to improve city aesthetics, functionality, and economic potential. The mission has funded 203 waterfront projects across India (MoHUA 2023). With over 7500 km of coastline, nearly 70,000 urban waterbodies and multiple rivers traversing the urban landscape, the initiative for waterfront development in the cities is critical for harnessing the potential and reviving the lost connections between the water resources and people.

As of the latest assessments, 124 lakefront projects, 61 riverfront projects, and 18 beachfront projects have been initiated under the SCM. These projects span various sectors such as area development, environmental management, urban transport, and economic development. Notable states with significant numbers of these projects include Karnataka, Tamil Nadu, and Andhra Pradesh for lakefront projects; Jammu & Kashmir, Tamil Nadu, and Chhattisgarh for riverfront projects; and Puducherry, Tamil Nadu, and Andhra Pradesh for beachfront projects.

Given the substantial investment and the potential impact on urban landscapes, it is crucial to assess the effectiveness of these projects in meeting their intended objectives. This assessment will provide valuable insights into best practices and inform future initiatives under the Smart Cities Mission.

1.2 Aim and Objectives

The study aims to evaluate the impact and effectiveness of the lakefront, riverfront, and beachfront projects under the Smart Cities Mission (SCM) by assessing environmental improvements, social benefits, and economic gains. It seeks to analyse the financial sustainability of these projects, review their design and implementation, and evaluate the deployment of smart technologies. Additionally, the study investigates governance frameworks and stakeholder engagement, addresses challenges faced during project execution, and identifies best practices and lessons learned to inform future initiatives.

1.3 Scope and Limitations

The team undertook site visits to three cities based on selection criteria elaborated in subsequent sections, shortlisting one city under each category given the limited time and scope of the study. Additionally, to strengthen the analysis, both national and international case studies were included based on a desk review of publicly available information on similar projects. However, the study faces limitations such as incomplete data, temporal constraints, geographical variability, limited stakeholder engagement, and technological and methodological challenges that may affect the comprehensiveness and generalizability of the findings.

2. LITERATURE REVIEW

Water has always played a crucial role in the development and sustenance of human settlements. Its importance is evident in the historical structures and urban morphologies of cities around the world. The relationship between a city and its waterfront is dynamic, shaped by the changing functions and needs of the adjacent land (Basak and Anand 2020). Historically, waterfronts have driven distinct urban development, leveraging their unique resources to create specific landscapes optimized for these benefits (Davidson 2009). Waterfront development has immense potential to revive the ecological landscape of the Indian cities. In addition to providing multifunctional spaces, there are several environmental, social and economic benefits of such projects (NMCG and NIUA, 2022). Projects under waterfront development can substantially improve the ecological health of the waterbodies and the surrounding vegetation, add to significant spaces for community engagement and strengthening of culture and tradition. Furthermore, they also have the potential to become additional sources of revenue for the urban authorities. In addition, waterfront development plays a crucial role in meeting India's Sustainable Development Goals (SDG) commitments. They particularly address SDG 1 (No Poverty), SDG 6 (Clean Water and Sanitation), SDG 11 (Sustainable Cities and Communities), SDG 13 (Climate Action) and SDG 15 (Life on Land).

2.1 Waterfront Development in India

In India, there are ongoing efforts to integrate waterfront development into urban planning. The "Guidance Note for Environmentally Sensitive, Climate Adaptive and Socially Inclusive Urban Riverfront Planning and Development" (Basak et al., 2021) highlights the need for environmentally sensitive, climate-adaptive, and socially inclusive riverfront development. This guidance note provides a framework for appraisal, guidance, operation, and maintenance.

Further, the "Eco-friendly Interventions for Riverfront Development" (NMCG and NIUA 2022) suggests environmentally friendly, socially inclusive, and economically vibrant interventions at the design scale. Additionally, the "Urban River Management Plan" (NMCG and NIUA 2020) aims to guide riverfront development in Indian cities.

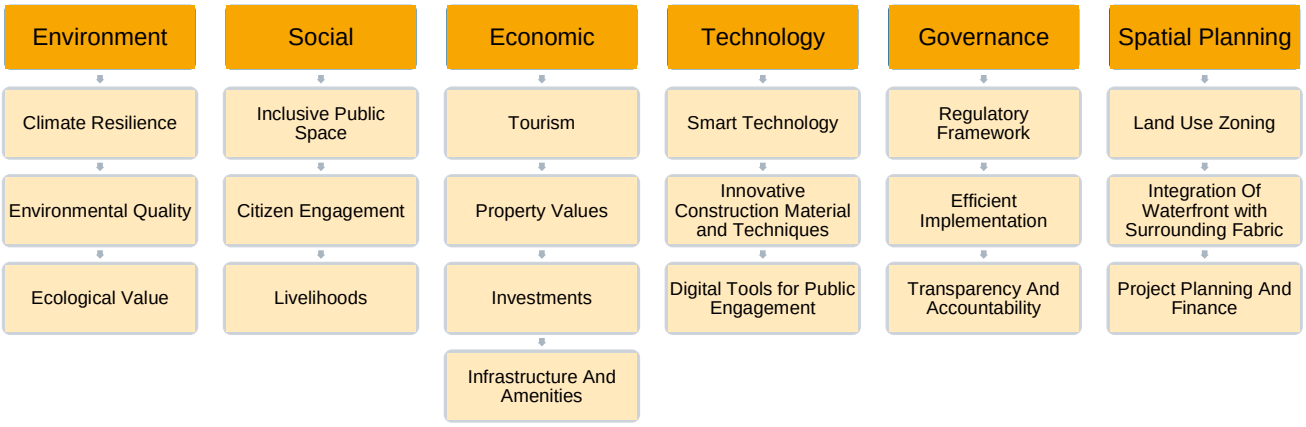
Relevant frameworks for assessing urban setups were also studied, with the Municipal Performance Index (MPI) by the Ministry of Housing and Urban Affairs (MoHUA) being adopted for this evaluation. The MPI provides various verticals to assess municipalities, including Services, Finance, Planning, Technology, and Governance (MoHUA 2020). This index serves as the theoretical underpinning for evaluating lakefront, riverfront, and beachfront projects undertaken within the Smart Cities Mission (SCM).

2.2 Parameters for Waterfront Development

Based on the literature review, a set of dimensions and parameters were extracted to guide further study as shown in Figure 1. These parameters include environmental impact, social benefits, economic gains, project implementation effectiveness, governance frameworks, and stakeholder engagement.

The consultant team also conducted site visits to three cities, selecting one city under each category (lakefront, riverfront, and beachfront) based on criteria detailed in subsequent sections, considering the study's limited time and scope. To strengthen the analysis, additional national and international case studies were included based on desk reviews of publicly available information on similar projects.

Figure 1: Dimensions and Parameters for Waterfront Development Project Assessment



Source: Compiled by SPA Delhi, 2024

3. NATIONAL/INTERNATIONAL CASE STUDIES

As per the terms of service, two case studies, one national and one international—were evaluated to understand waterfront characteristics, identify challenges, and derive key learnings. Along with a comprehensive literature review, these case studies have informed the impact evaluation of lakefront, riverfront, and beachfront developments in Coimbatore, Nashik, and Puducherry.

3.1 Ganga Riverfront Development, Patna

The Ganga Riverfront Development Project (GRFDP) in Patna, Bihar, India, is a significant initiative aimed at revitalising the riverfront area. The project, implemented in phases, began in 2015 and saw its first phase completed in 2019, covering the stretch from Gandhi Ghat to Rajendra Ghat (6 km). With an estimated cost of ₹480 Crore in 2015, the actual expenditure for the first phase amounted to ₹436 Crore by 2019. The total project cost stands at INR 243.27 Crore.

Figure 2: Ganga Riverfront Development, Patna

Source: Voyants. 2014

Key features of the project include the development of 20 Ghats, promenades with kiosks, community and cultural centers, landscaping in precinct zones, and the transformation of Gulbi Ghat into an electric crematorium. Other significant improvements involve the development of interceptor drains, toilet complexes, pedestrian walkways, cycle paths, green spaces, and public amenities such as amphitheaters, plazas, and children's play areas. The project also focused on enhancing drainage and sanitation infrastructure and integrating smart technologies like Wi-Fi and smart lighting.

However, the project faced several challenges, including the relocation of informal settlements along the riverfront, ensuring minimal environmental impact during construction, integrating the development with the existing urban fabric and transportation networks, and maintaining long-term financial sustainability for operations and maintenance.

From the GRFDP, several key learnings have emerged. The project has significantly enhanced recreational facilities, improved public transport connectivity, and addressed waste management issues. Although a comprehensive financial analysis is pending, anecdotal evidence suggests potential increase in property values and economic activity. The project aligns well with Patna's Smart City Master Plan by creating public spaces and improving riverfront access. Technologically, smart lighting has improved safety, and Wi-Fi enhances public access to information and communication. Effective management practices, including regular maintenance, have ensured the cleanliness and functionality of the developed area.

3.2 Srinagar Waterfront Development

The Srinagar Smart City initiative aims to revitalize its iconic waterfronts, particularly around Dal Lake and the Jhelum River, enhancing urban livability, tourism, and environmental sustainability. With a total project budget of approximately ₹3000 crores, key waterfront projects include a 9.3 km pedestrian and cycling walkway along Boulevard Road, the Dal Lake Sunset Plaza, and the Eco Park at Shalimar. These developments have transformed neglected areas into vibrant public spaces with amenities like landscaped areas, seating, and interactive kiosks.

Key Environmental Benefits

- Eco-restoration efforts: Cleaning and maintaining Dal Lake and its surroundings have improved water quality and biodiversity.
- Green Infrastructure: Emphasis on greenery along the lake and riverfront helps reduce urban heat and promotes sustainability.
- Sustainable Mobility: New walkways and cycle paths promote non-motorized transport, reducing air pollution and congestion.

Cost and Funding

- The Sunset Plaza project was developed with ₹80 lakhs, introducing public amenities and spaces for social interaction.
- Eco Park was developed under the AMRUT mission at a cost of ₹1.97 crores, providing a recreational area for residents and tourists.
- The Boulevard Road Walkway from Badyari Chowk to Nishat Bagh cost ₹14.19 crores, offering universal access and public plazas.

Benefits to Local Residents

- Improved Public Spaces: Accessible walkways, parks, and open spaces foster social interaction and leisure activities.
- Boost to Tourism: The revitalized lakefront is expected to attract more tourists, boosting local businesses and creating employment opportunities.
- Enhanced Urban Mobility: Cycling tracks and pedestrian pathways encourage sustainable transport and ease traffic congestion.

Key Learnings for Smart City Implementation

- Integrated Planning: Collaboration between government bodies (e.g., Srinagar Municipal Corporation) ensures seamless execution.
- Public Engagement: Local input and partnerships with startups for food kiosks and public amenities enhance community participation.
- Focus on Maintenance: Ongoing maintenance of green spaces and public infrastructure is essential to sustain project benefits.
- Adaptive Approach: The project highlights the need for adaptive policies to balance development and heritage conservation, especially around sensitive areas like Dal Lake.
- This transformation demonstrates how Srinagar is not only restoring its ecological assets but also reshaping itself into a more inclusive and sustainable urban environment, laying a foundation for long-term growth and livability.

3.3 Urban Redevelopment of the Singapore City Waterfront

The redevelopment of Singapore's city center transformed it into a modern financial hub through strategic planning and public-private collaboration. Key areas like the Golden Shoe District, Singapore River, and Marina Bay were revitalized with modern infrastructure, public spaces, and iconic landmarks. The project balanced development with conservation, integrating greenery, historic preservation, and environmental strategies. Challenges included land acquisition, resettlement, and coordinating conservation efforts, requiring strong leadership and innovative policies.

Figure 3: Waterfront Development, Singapore (Source: Davidson, 2009)

Key findings from Singapore's redevelopment include the importance of a long-term vision balanced with pragmatic policies for success, effective execution by government agencies, and essential public-private collaboration to leverage resources and expertise. The integration of environmental strategies, or the "blue and green" approach, significantly enhanced urban liveability and attractiveness. These strategies enabled Singapore to transform its city waterfront into a thriving urban area that balances economic growth, environmental quality, and social inclusivity.

4. OBSERVATIONS

Based on consultation with citizens, 64 out of the 100 smart cities have undertaken waterfront development projects. Out of the 64 cities, 25 have only lakefront development, 19 cities have only riverfront development, and 6 cities have only beach front development while 13 cities have both lakefront and riverfront development, and 1 city has both riverfront and beachfront development.

Table 1: Smart Cities by Type of Waterfront Development

Type of Waterfront Development	Smart City (No.)	Smart City (Name)
Beachfront	7	Diu, Kochi, Panaji, Port Blair, Puducherry, Thoothukkudi and Visakhapatnam.
Lakefront	38	Agartala, Ajmer, Atal Nagar, Bareilly, Belagavi, Bengaluru, Bhopal, Bhubaneswar, Bilaspur, Coimbatore, Davanagere, Faridabad, Greater Warangal, Hubballi-Dharwad, Jabalpur, Jaipur, Kalyan-Dombivali, Kanpur, Karnal, Mangaluru, Muzaffarpur, Patna, Raipur, Rajkot, Ranchi, Sagar, Salem, Satna, Solapur, Srinagar, Thane, Tirunelveli, Tirupati, Tumakuru, Udaipur, Ujjain, Vadodara, Vellore.
Riverfront	27	Ahmedabad, Ajmer, Amravati, Bilaspur, Dahod, Davanagere, Imphal, Indore, Itanagar, Jammu, Kalyan, Madurai, Mangaluru, Nashik, Panaji, Pasighat, Patna, Prayagraj, Saharanpur, Salem, Shivamogga, Srinagar, Tiruchirappalli, Tirunelveli, Tiruppur, Udaipur, Varanasi.

Source: Ministry of Housing and Urban Affairs, Government of India, Compiled by SPA Delhi, 2024

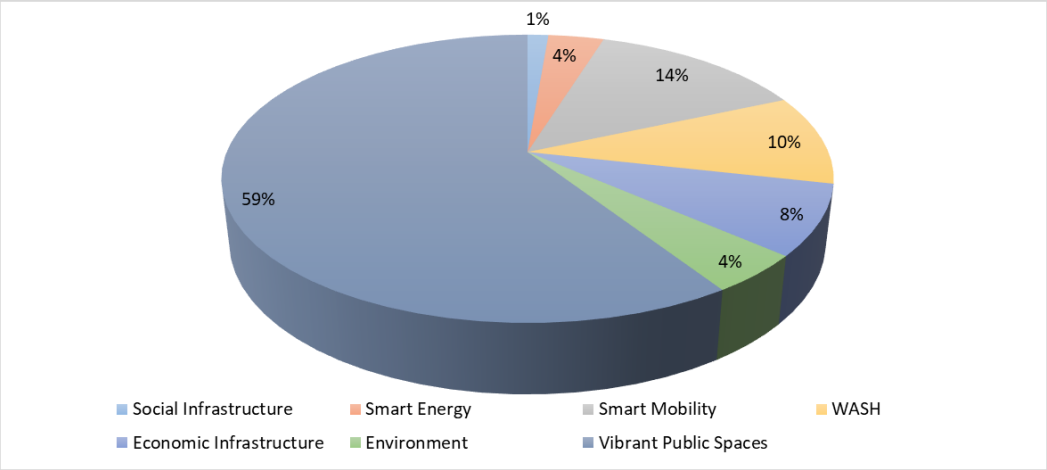
The mission aims to transform these waterfronts into vibrant public spaces, with 60% of the projects focusing on such enhancements. Other key project categories primarily focussed on achieving smart mobility (14%), WASH (10%), and economic infrastructure (8%) as seen in figure 4. Lakefront projects particularly emphasize public spaces (68%), while riverfront and beachfront projects also integrate mobility initiatives. Sustainability and safety have been prioritized, with 75% of cities developing multi-use public spaces, 67% embedding cultural elements, and 63% improving security through CCTV and smart lighting. Additionally, 42% of the cities use GIS to map urban wetlands for better environmental planning

Tourism and employment have seen significant growth as a result of these developments. Cities such as Indore, Ujjain, and Srinagar report a 5-8x increase in visitor footfall post-project. Employment generation is also notable, with Mangalore adding 2,000 new jobs and Coimbatore creating 688 roles. However, only 23% of cities, including Srinagar, Puducherry, Coimbatore, and Visakhapatnam, report earning revenue from these projects, highlighting an area for improvement in long-term financial sustainability.

Overall, these projects reflect a strategic integration of environmental sustainability, cultural heritage, and public engagement. However, the challenge remains in balancing increased

tourism with sustainable infrastructure management, ensuring that the economic potential of these waterfronts is fully realized without compromising environmental goals.

Figure 4: Development Category of Waterfronts Projects under SCM



Source: Ministry of Housing and Urban Affairs, Government of India, Compiled by SPA Delhi, 2024

The breakup for cities with riverfront (data available for 32 cities including 5 cities with convergence projects), lakefront (data available for 33 cities) and beachfront development (data available for 6 cities) is given in Figure 5, 6, 7 and 8. (Data collected with secondary questionnaire.

Figure 5: Status of Key Parameters- Waterfront Development

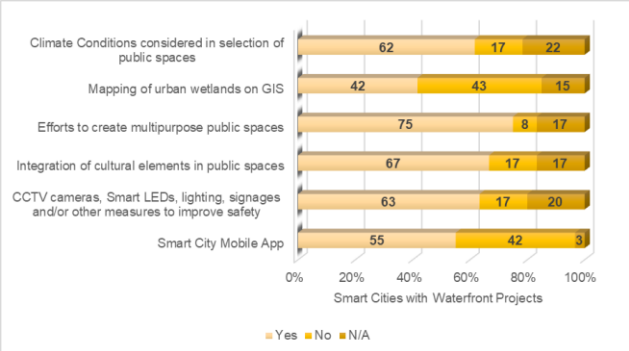


Figure 6: Status of Key Parameters- Lakefront Development

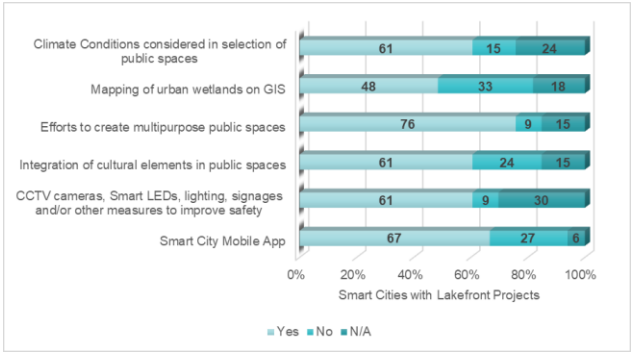


Figure 7: Status of Key Parameters- Riverfront Development

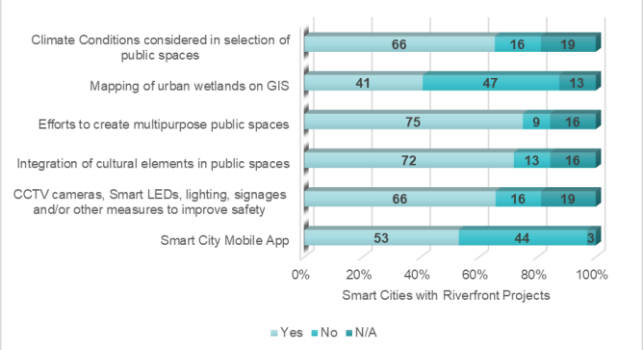
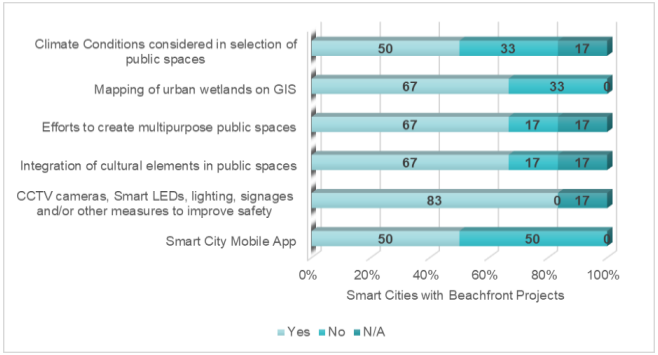


Figure 8: Status of Key Parameters- Beachfront Development



Source: Ministry of Housing and Urban Affairs, Government of India, Compiled by SPA Delhi, 2024

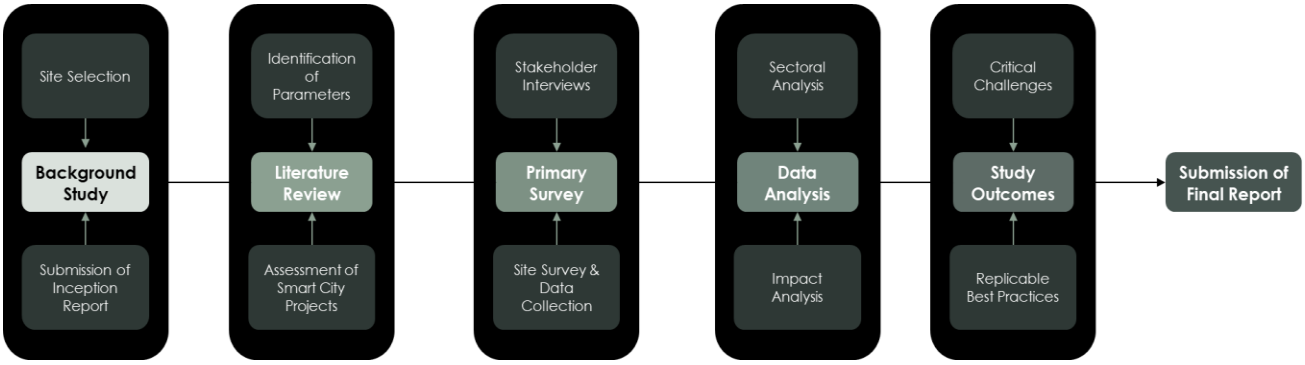
The theme of waterfront development in India is very significant particularly in the present times when cities are grappling with multiple issues of pollution, biodiversity loss and extreme pressure on open spaces. Per capita open space in Indian cities is grossly inadequate and well below the Urban Regional Development Plans Formulation and Implementation (URDPFI), 2014 norms of 10 to 12 Sqm. of open space per person. Further, the urban waterbodies and the immediate adjoining areas also need focus. Waterfront development has a vast potential for strengthening and enhancing the environmental, social, cultural and economic values of a city. It leads to an increase in available and usable open spaces, re-establishing the lost connection between the citizens and the waterbody, increase in livelihood options and property prices in addition to cleaner and ecologically vibrant waterbodies.

5. METHODOLOGY

This research aims to evaluate the impact of lakefront, riverfront, and beachfront projects under the Smart Cities Mission in India. The national scenario of interventions and the probable impacts under the theme of lakefront/riverfront/beachfront development has been assessed based on secondary data, furthermore, three cities (Nashik in Maharashtra; Coimbatore in Tamil Nadu; and Union Territory of Puducherry) have been studied in detail. The subsections below outline the steps to be followed in accordance with the terms of service.

The methodology for the study has been provided below:

Figure 9: Study Methodology



Source: SPA Delhi, 2024

5.1 Selection of Study Sites

For selection of the cities to be taken up for detailed study under each theme of lakefront development, riverfront development and beachfront development, preferences were given to the smart cities with higher share of completed projects under each theme. A consultation with the Smart Cities Officials was done to ensure coordination in site selection, thereby preventing any overlaps in the impact assessment study (Annexure 9.1). Subsequently, Coimbatore, Nashik and Puducherry were selected for studying the impact of lakefront, riverfront and beachfront respectively.

5.2 Literature Review

A comprehensive literature review was conducted on waterfront development projects in Nashik (riverfront), Coimbatore (lakefront), and Puducherry (beachfront), focusing on their objectives, strategies, and outcomes. The review draws on a range of sources, including official reports, academic articles, and media publications, to capture the diverse aspects of these initiatives.

This literature review establishes a solid framework for understanding the complexities of waterfront development, showcasing how these projects balance ecological priorities with urban rejuvenation and public engagement.

5.3 Field Visits

During the field visits to the selected waterfront projects in three cities, a series of systematic activities were conducted to gather comprehensive data and firsthand insights into the projects' impacts. These activities included detailed site inspections, stakeholder interactions, and documentation efforts.

5.3.1 Site Inspections and Observational Studies

Relevant secondary information was collected prior to conducting field visits. Further, comprehensive site inspections of the waterfront areas were undertaken. The process involved examination of the entire project site, documenting physical infrastructure, public amenities, green spaces, and ongoing construction activities. Emphasis was placed on the condition and usability of public spaces, including parks, walkways, recreational areas, and commercial zones. Observational studies assessed public usage patterns, peak usage times, activity types, and user demographics. The physical condition, maintenance, and environmental impacts, such as pollution, waste management practices, were also recorded. This observation was supplemented with photographs for visual documentation of the current project state.

5.3.2 Stakeholder Interactions and Informal Interviews

A key aspect of the field visits was engaging with diverse stakeholders, including residents, business owners, tourists, and municipal officials, through informal interviews. These interactions aimed to gather qualitative insights on the benefits and challenges of the waterfront projects. Tourists provided feedback on their visit motivations, amenity satisfaction, and overall experience. Municipal officials and project managers offered perspectives on planning, implementation, and maintenance. These semi-structured interviews facilitated a comprehensive understanding of successes, areas for improvement, and lessons learned from the smart cities mission projects.

5.3.3 Questionnaire Design

The questionnaire (Annexure 9.3, 9.4, 9.5 and 9.6) was developed to comprehensively evaluate the multifaceted impacts of waterfront projects under the Smart Cities Mission in India. Guided by a thorough review of relevant literature and secondary data, the questionnaire addressed key themes: environmental gains, economic impacts, financial management, inclusiveness in planning, technological effectiveness, and governance challenges. These themes were translated into specific questions to elicit both quantitative and qualitative responses.

5.3.4 Data Collection

The data collection for the study on waterfront projects under the Smart Cities Mission in India combined both primary and secondary sources. Secondary data, such as urban planning reports, financial documents, and environmental monitoring data from State Pollution Control Boards, validated the findings. Government databases, including the Smart Cities Mission website, supplemented the analysis, ensuring a comprehensive evaluation of project impacts by aligning stakeholder experiences with documented outcomes. Primary data collection was as mentioned in section 5.3.1 and 5.3.2.

5.4 Expected Outcomes

The present study seeks to address the following research questions formulated within the larger framework of Municipal Performance Index to assess the impact of the projects under Smart Cities Mission holistically.

Services:

Q1. Have there been measurable improvements in environmental indicators, such as water quality, air quality, or biodiversity since project completion? (Understanding environmental gains)

Q2. Has the project led to a quantifiable increase in tourism and economic activity in the surrounding area? (Evaluating economic impact)

Finance:

Q3. How did the project manage any financial constraints encountered during execution? Were there instances of cost overruns? If so, what strategies were employed to stay within budget or secure additional funding?

Q4. Is the project generating revenue, and are the financial models implemented proving to be sustainable? (Assessing ongoing financial viability)

Planning:

Q5. To what extent are the needs of various user groups (e.g., children, the elderly, people with disabilities, women) reflected in the design and use of the space?

Q6. Does the completed project successfully align with the original goals and objectives outlined in the Smart City proposal? (Checking for adherence to the original vision)

Technology:

Q7. Are smart technologies deployed in the project functioning effectively, and are they being used as intended? (Evaluating the effectiveness of tech solutions)

Governance:

Q8. What were the major challenges (e.g., land acquisition, funding delays, community opposition, environmental concerns) faced during the execution of the project, and how were they addressed?

Q9. To what extent has citizen feedback been incorporated to improve and adjust project features post-completion? (Reflecting on citizen input and responsiveness)

Q10. Are effective and transparent mechanisms in place for the ongoing operation and maintenance of the completed project? (Evaluating long-term governance strategies and monitoring of project)

6. IMPACT ASSESSMENT

6.1 National Level Theme Based Impact Assessment

6.1.1 Overview of Lakefront/ Riverfront/ Beachfront Development Projects

National level aggregate data for the smart cities with lakefront/riverfront/beachfront development has been shown in table 2.

Table 2: National level figures for waterfront development

S.No	Item	Unit
1	Total Length of waterfront development	248 Km
2	Population of cities with waterfront development	7.9 Crore
3	Smart cities Mission Funding for waterfront development projects	Rs. 4,067 Crore

Source: Ministry of Housing and Urban Affairs, Government of India, Compiled by SPA Delhi, 2024

Characteristics of the smart cities under the theme have been analyzed with respect to various parameters such as location, population, climate, hazard etc.

Table 3: Classification of Smart Cities by type of Waterfront Development

State	Beachfront Development	Lakefront Development	Riverfront Development	Total
Andaman and Nicobar Islands	1	-	-	1
Andhra Pradesh	1	1	1	3
Arunachal Pradesh	-	-	2	2
Bihar	-	2	1	3
Chhattisgarh	-	3	1	4
Daman and Diu	1	-	-	1
Goa	1	-	1	2
Gujarat	-	2	2	4
Haryana	-	2	-	2
Jammu and Kashmir	-	1	2	3
Jharkhand	-	1	-	1
Karnataka	-	6	3	6
Kerala	1	-	-	1
Madhya Pradesh	-	5	1	6
Maharashtra	-	3	2	5
Manipur	-	-	1	1
Odisha	-	1	-	1
Puducherry	1	-	-	1
Rajasthan	-	3	2	5
Tamil Nadu	1	4	5	9
Telangana	-	1	-	1
Tripura	-	1	-	1
Uttar Pradesh	-	2	3	5

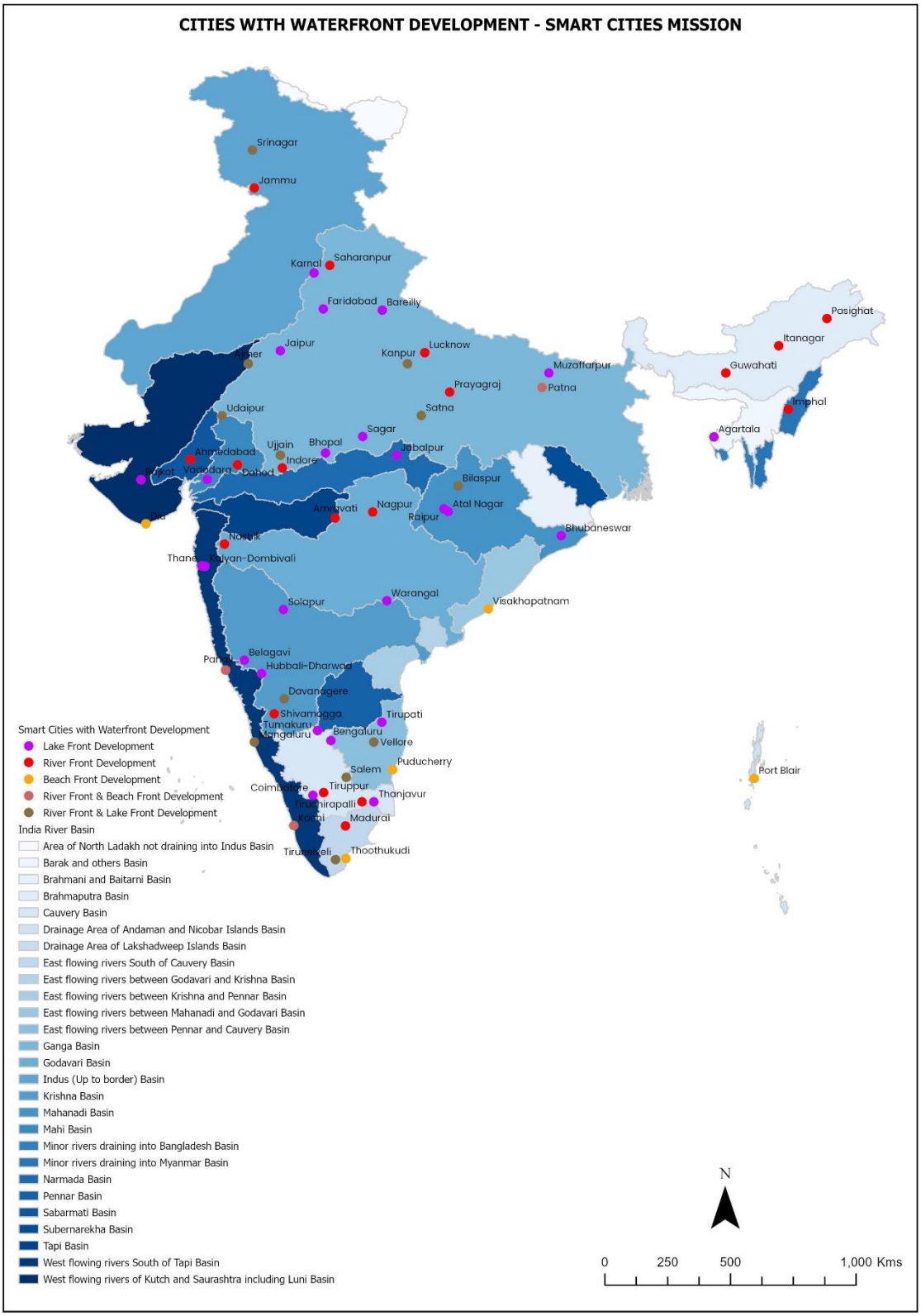
Source: Ministry of Housing and Urban Affairs, Government of India, Compiled by SPA Delhi, 2024. Note: The same city may be appearing more than once in different type of waterfront development

Tamil Nadu (9) has the highest number of smart cities under the theme of waterfront development followed by Karnataka (7). Further, Karnataka (6) has the highest number of smart

cities with projects under lakefront development while Tamil Nadu (5) has the highest under riverfront development.

The smart cities were also classified by the type of waterfront development and population size (As per Census of India, 2011 classification).

Figure 10: Cities with Lakefront/Riverfront/Beachfront Development and River Basins of India



Source: Based on Data from Ministry of Housing and Urban Affairs, Government of India

Table 4: Classification of Smart Cities by Type of Waterfront Development and Population Size

Type of Waterfront Development	Million Plus	Class I	Class II	Class III	Class IV	Total
Beachfront	2	3	2	-	-	7
Lakefront	16	21	1	-	-	38
Riverfront	9	15	2	1	-	27

Source: Ministry of Housing and Urban Affairs, Government of India, Census of India, 2011, Compiled by SPA Delhi, 2024. Note: The Same city may be appearing more than once in different type of waterfront development

The majority of the cities with lakefront development (21 No.) and riverfront development (20 no.) are Class I cities as per Census of India, 2011 Population. Class I cities are Agartala, Ajmer, Bareilly, Belagavi, Bhubaneswar, Bilaspur, Dahod, Devanagere, Greater Warangal, Guwahati, Hubballi-Dharwad, Imphal, Jammu, Karnal, Kochi, Mangaluru, Muzaffarpur, Port Blair, Puducherry, Saharanpur, Salem, Salem, Satna, Shivamogga, Solapur, Thanjavur, Thoothukudi, Tiruchirappalli, Tirunelveli, Tirupati, Tiruppur, Tumakuru, Udaipur, Ujjain, Vellore. The Million plus cities are Ahmedabad, Bengaluru, Bhopal, Coimbatore, Faridabad, Indore, Jabalpur, Jaipur, Kalyan, Kanpur, Lucknow, Madurai, Nagpur, Nashik, Patna, Prayagraj, Raipur, Rajkot, Sagar, Srinagar, Thane, Vadodara, Visakhapatnam and Ranchi.

Table 5: Classification of Smart Cities by Type of Waterfront Development and Climate (Koppen's climate classification)

Type of Waterfront Development	Af (Tropical rainforest)	Am (Tropical monsoon)	Aw (Tropical savanna)	BSh (Hot semi-arid)	BWh (Hot desert)	Cwa (Humid subtropical with dry winter)	Cwb (Humid subtropical with dry winter)	Total
Beachfront development	1	2	4	-	-	-	-	7
Lakefront development	-	3	12	2	4	16	1	38
Riverfront development	-	3	7	3	1	11	2	27

Source: Ministry of Housing and Urban Affairs, Government of India, Compiled by SPA Delhi, 2024; Note: The same city may be appearing more than once in different type of waterfront development

Interestingly, several smart cities with waterfront development projects are concentrated in the humid subtropical with dry winter climatic (Cwa) regime characterized by hot summers and monsoon rains. Judiciously designed waterfront development would be beneficial particularly in such climatic regimes for mitigating urban heat islands and regulating floods.

Table 6: Hazard resolution associated with various SCM Projects

Type of Hazard	Beachfront development	Lakefront development	Riverfront development	Total
Floods	1		1	2
Droughts, heatwaves		2	1	3
Floods, cyclones		5	3	8
Floods, droughts		20	8	28
Floods, landslides		1	1	2
Tsunami/Cyclone	1			1
Cyclone/ Flood/ Earthquake	1			1
Cyclone, Flood, Tsunami	1			1
Floods, droughts, heatwaves		6	5	11
Floods, landslides, cyclones		3	3	6
Floods, landslides, earthquakes			3	3
Floods, cyclone, Sea erosion	1			1
Flood, Cyclonic Storms, Earthquake, Landslide	1			1
Tsunami/Cyclone/Floods	1			1
Floods, landslides, earthquakes, avalanches		1	2	3

Source: Refer Annexure 9.2, Compiled by SPA Delhi, 2024; Note: The Same city may be appearing more than once in different type of waterfront development

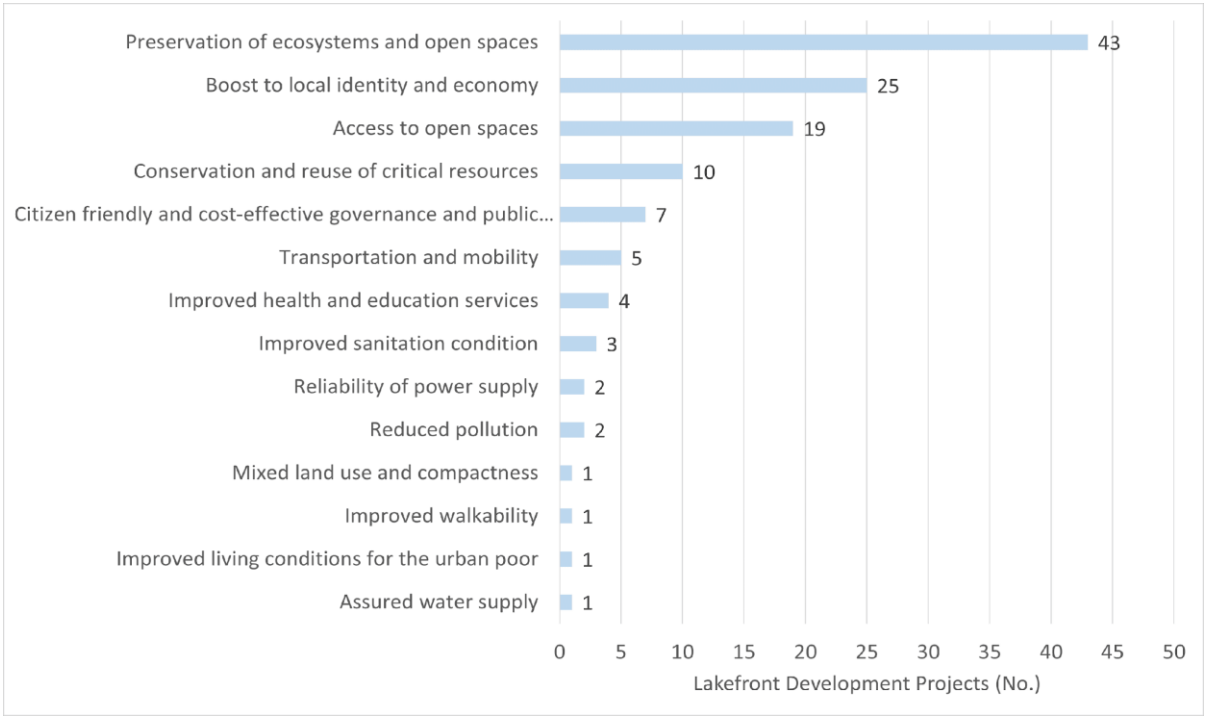
Several cities under the selected theme are located in regions that experience both floods and drought further justifying the need of waterfront development in those cities, keeping in mind environmental principles.

6.1.2 Expected Impact of the Projects

The envisaged impact of the projects under the theme would contribute to achieving the objective of SCM i.e., to promote cities that provide core infrastructure and give a decent quality of life to its citizens, a clean and sustainable environment through the application of 'Smart' solutions. It is interesting to note that overall, while the envisaged impact focuses on preservation of ecosystems and open spaces for lakefront development, the focus is on boosting local economy for riverfront and beachfront development. This also reflects the pre-project scenario and need for certain types of projects.

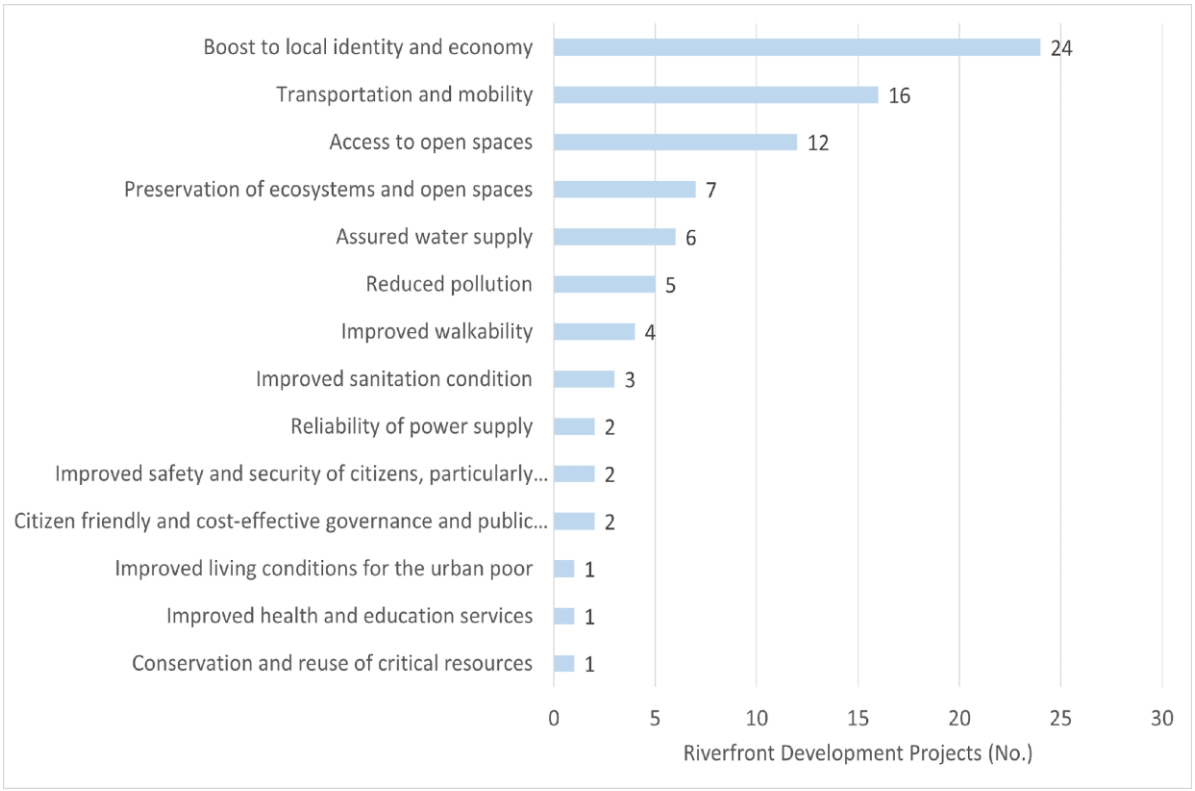
The expected impact of nearly one-third of the lakefront development projects is preservation of ecosystems and open spaces followed by boost to local economy (20%) and access to open spaces (15%).

Figure 11: Envisaged Impact of Lakefront Development Projects



Source: Ministry of Housing and Urban Affairs, Government of India, Compiled by SPA Delhi, 2024

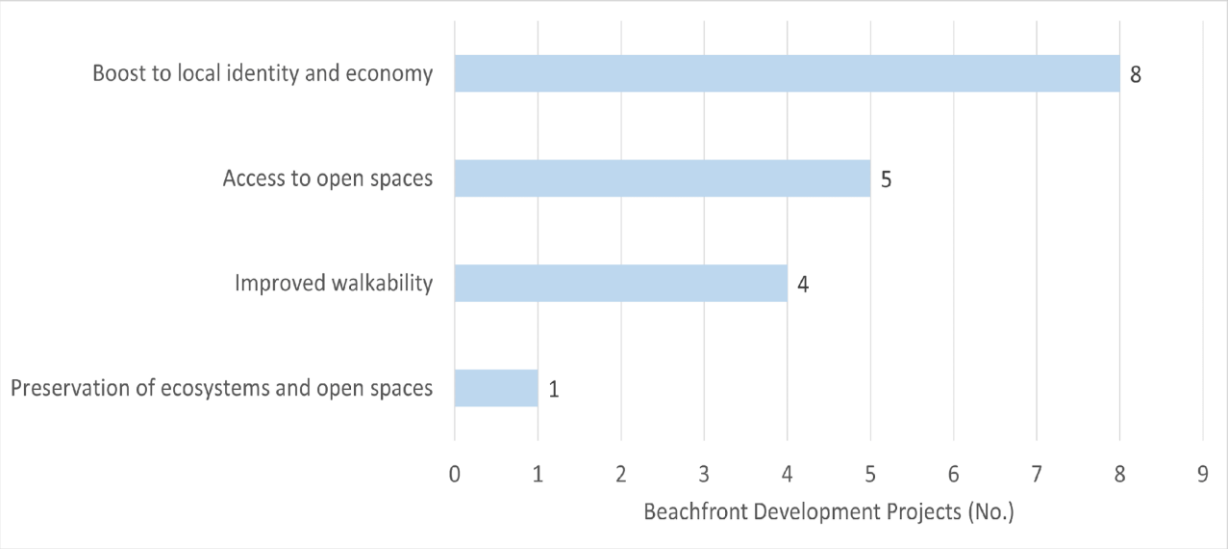
Figure 12: Envisaged Impact of Riverfront Development Projects



Source: Ministry of Housing and Urban Affairs, Government of India, Compiled by SPA Delhi, 2024 (data from 32 cities, including 5 cities with convergence projects).

With respect to riverfront development projects, the envisaged impact of 28% of the projects is to boost the local economy followed by 18% of the projects seeking to have an impact on transportation and mobility improvement. Access to open spaces was expected to be the major impact for around 14% of the projects.

Figure 13: Envisaged Impact of Beachfront Development Projects



Source: Ministry of Housing and Urban Affairs, Government of India, Compiled by SPA Delhi, 2024

The expected impact of nearly 44% of the beachfront development projects includes boost to local economy followed by access to open spaces (28%) and improved walkability (22%).

The national-level theme-based impact assessment reveals that there are 64 smart cities with waterfront development projects. Out of the 64 cities, 25 have only lakefront development, 19 cities have only riverfront development, and 6 cities have only beach front development while 13 cities have both lakefront and riverfront development, and 1 city has both riverfront and beachfront development. Most of these projects are in Class I and Million Plus cities, situated in Tropical Savanna (Aw) and Humid Subtropical with Dry Winter (Cwa) climates, highlighting the need for solutions to address heat, heavy rains, and potential water scarcity. Around 40% of the smart cities face both floods and droughts, emphasizing the necessity for resilient waterfront development. State-wise, Uttar Pradesh, Rajasthan, Maharashtra, and Karnataka have shown 100% completion in lakefront projects, whereas Odisha lags. For riverfront projects, Arunachal Pradesh and Andhra Pradesh have completed all their projects, while Bihar and Assam have none. In beachfront projects, Tamil Nadu, Kerala, and Andhra Pradesh have completed all projects, with Goa, Daman, and Diu falling behind. The expected impacts of these projects vary: lakefront projects primarily aim at ecosystem preservation, riverfront projects focus on economic boosts and mobility improvements, and beachfront projects target economic boosts and improved walkability. Overall, these initiatives aim to enhance city infrastructure, improve quality of life, and create sustainable urban environments.

6.1.4 Examples from Cities other than Site visits

Taking forward the national level impact assessment, cities were selected for impact assessment of the Smart Cities Project based on the geographical representation across 22 river basins as delineated by the Central Water Commission, India, since the theme is lakefront/riverfront/beachfront development which is intrinsically linked to the water resources. Few smart cities with lakefront/riverfront/beachfront development within each of these river basins have been selected for maintaining optimum spatial coverage across the country and arriving at a broad national level assessment based on available secondary data.

a) Indus Basin and Luni Basin

SRINAGAR, UT of Jammu and Kashmir

Figure 14: Pathways and Cycle Tracks along Jhelum Bund, Srinagar

Outcome and Impact: Enrich local tourism and promote health & well being of citizens.

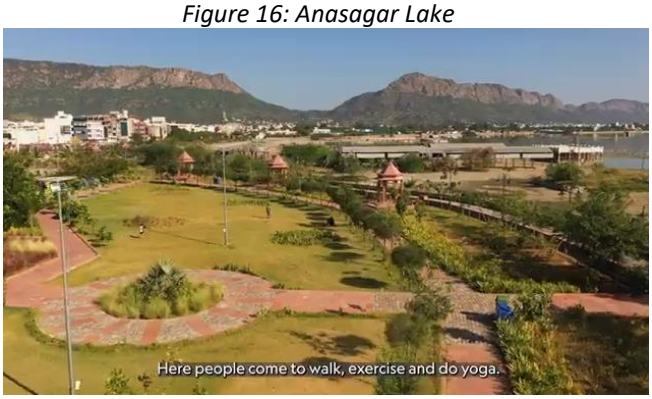
Figure 15: Lighting installed along riverbanks

Outcome and Impact: Improvement in visibility and enhancement of the aesthetic character of the river banks. Enhancement in the sense of Security at night

Source: https://srinagarsmartcity.in/

AJMER, Rajasthan

Figure 16: Anasagar Lake



50 acres land redeveloped with 8 km walkway and 5 km long cycle track along the Anasagar lake. STP powered by 320 KW solar plant treats 11 MLD sewage keeping the lake clean.

Figure 17 : 7 Wonder Park

The 7 Wonder Park is a tourist attraction and boosts the local economy.

Source: https://www.youtube.com/@SmartCitiesMission

b) Ganga and Subarnarekha Basin

VARANASI, Uttar Pradesh

Figure 18: Namo Ghat

Outcome and Impact: The ghat is located on the banks of the Ganges River and is spread over an area of 21,000 square meters. It is a modern ghat with facilities for tourists, including a viewing deck, a cafeteria, and a parking lot. Namo Ghat is expected to be a major tourist attraction in Varanasi and is expected to boost the local economy.

Source: https://varanasismartcity.gov.in/

PATNA, Bihar

Figure 19: Adalatganj Lake

Outcome and Impact: Area of this lake is 11368 Sq.mm having a catchment area of 7834 Sqm with depth of 5m from nearest road levels. Development of Adalatganj Lake has led to increase in open green space, water quality protection and potential source of revenue generation.

Source: https://smartpatna.co.in/home.aspx

UJJAIN, Madhya Pradesh

Figure 20: Rejuvenation of Rudrasagar Lake

Outcome and Impact: Chhota Rudrasagar cleaning & excavation, Parking, Pathway & landscaping
and Gates. Increase in recreational area and better lake water quality

Source: https://ujjainsmartcity.com/en/

RANCHI, Jharkhand

Figure 21: Beautification and Rejuvenation of Swami Vivekanand Sarovar/Bada Talaab

Outcome and Impact: Pathway & landscaping. Increase in recreational area.

Source: https://www.rsccl.in/

c) Brahmaputra Basin and Mahanadi Basin

Figure 22: Brahmaputra Riverfront Development

GUWAHATI, Assam

Outcome and Impact: Development of Walkway, Cycle track, Jogging track, Bank protection measures, landscaping. The work is ongoing.

Source: https://gscl.assam.gov.in/

Figure 23: Beautification and Development of Sendh Lake, Sector IV

ATAL NAGAR, Chhattisgarh

Outcome and Impact: Increase in recreational spaces and improvement in waterbody-citizen connect. Conservation of the lake

Source: https://navaraipuratalnagar.com/

d) Godavari, Cauvery, Krishna and Narmada Basin

THANJAVUR, Tamil Nadu

Figure 24: Redevelopment of Ayankulam Pond

Outcome and Impact: Focus on heritage elements. Strengthening of retaining walls and addition of walking path. Improvement in water quality. Positive impact on heritage, environment and residents.

Source: https://thanjavurcorporation.org/

DAVANAGERE, Karnataka

Figure 25: Beautification and Rejuvenation of Kundawada Lake

Outcome and Impact: Revived as an important reservoir for water storage for water supply to the city of Davanagere. Provides habitat to aquatic and avifauna. Developed as an excursion point for residents of the city and surrounding areas

Source: https://dvg.karnatakasmartcity.in/

JABALPUR, Madhya Pradesh

Figure 26: Gulauaa Talab development and Musical fountain

Outcome and Impact: Walking path and lighting around the lake has improved ease of access to the lake.

Source: https://jscljabalpur.org/

GREATER WARANGAL, Telangana

Figure 27: Bhadrakali Lake Regeneration and cleaning

Outcome and Impact: Development of 3.8 km promenade with plazas, viewing deck, children play area etc, geo-bio-diversity and cultural park. Increase in recreation areas, enhance tourism and heritage, protect lake from encroachment.

Source: GWSCCL

Citizen Testimonials

Text Box 1

LAKE FRONT DEVELOPMENT AT VISHRAM STHALI, AJMER (RAJASTHAN)

"The Park is Beautifully designed which helps us to do our exercise regularly amidst the lush green Environment".

-Nisha And Neeta Motwani, Social Media Influencers

ADALAT GANJ LAKE REDEVELOPMENT, PATNA (BIHAR)

"This place has changed the whole environment" -Munna Kumar

"This place is used almost daily by me for morning walk and play space for my child" -Chandan Kumar

CANAL CORRIDOR PROJECT, SURAT (GUJARAT)

"There is a huge change in entire area. We have literally witnessed changes before and after development. We feel now more secure with family to come for walk in morning or evenings. Very good lightings, security guards have kept nuisance away and quality of air due to greenery has improved. Also land values of surrounding increased after development of canal corridor."
-Zeba Kapadwala, Nodal Officer, SSCDCL

CONSERVATION OF POND -AYYANKULAM, THANJAVUR (TAMIL NADU)

"The carvings along the pond indicated the cultural value of the Tamilians. The upcoming generation can see and learn from wall paintings and hoardings. Each hoarding or painting provides the value of ancient culture & art. Coming to the vicinity provided peace and refreshment. All ponds in the city should be rejuvenated".
-Vignesh, Student

6.2 City Visits & Detailed Primary Assessment

6.2.1 Overview and Objectives of Site visits.

The site visits aimed to gather comprehensive data on the impact of smart city developments on urban growth, sustainability, and residents' quality of life. Key objectives included assessing project implementation, evaluating urban development impacts, analyzing environmental sustainability, engaging stakeholders, and identifying socio-economic benefits. These insights will inform decision-making and guide future improvements within the Smart Cities program.

6.2.2 Explanation of the themes for impact assessment

The impact assessment themes for smart city developments focus on evaluating the effects on lakefront, riverfront, and beachfront areas. These themes are crucial for understanding how urban development affects environmental sustainability, socio-economic growth, and quality of life. **Lakefront development** examines the restoration of lakes for flood control, irrigation, and urban ecosystem support, with an emphasis on recreational spaces and biodiversity. **Riverfront development** assesses ecological improvements like water quality and biodiversity, while considering cultural spaces, tourism, and flood resilience. **Beachfront development** focuses on coastal management, erosion control, habitat preservation, and the promotion of tourism and socio-economic growth through recreational facilities. Together, these assessments help evaluate the broader impact of smart cities initiatives.

6.2.3 Overview of Selected Cities

Nashik is a historically and culturally significant city in Maharashtra, located along the Godavari River. Known for its association with the Kumbh Mela and as the “Wine Capital of India,” the city’s riverfront development aims to blend ecological restoration with urban revitalization. The project focuses on flood management, beautification, and creating recreational spaces to promote tourism and improve residents' quality of life, contributing to both aesthetic appeal and economic growth.

Puducherry, a Union Territory with French colonial heritage, is renowned for its scenic beaches, spiritual centers, and vibrant culture. Its beachfront development under the Smart Cities Mission enhances tourism, sustainable coastal management, and environmental conservation. Projects like infrastructure upgrades and beautification aim to balance economic growth with natural preservation, transforming the coastline into a sustainable tourist attraction and a valuable public space for locals.

Coimbatore, known as the “Manchester of South India,” is an industrial and educational hub with a rich history of water management. The city's lakefront development revitalizes ancient man-made lakes, which serve as flood buffers and irrigation sources. The Smart Cities initiative focuses on ecological restoration, water quality improvement, and community engagement by developing recreational spaces around the lakes. These efforts aim to tackle urban environmental challenges, enhance sustainability, and promote a healthy lifestyle among citizens.

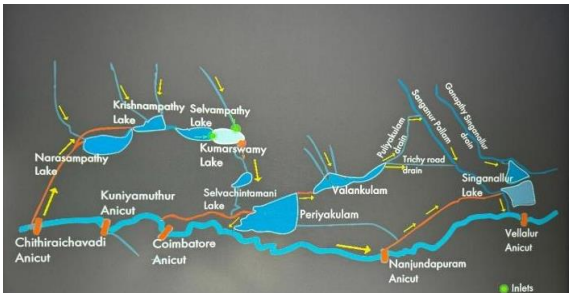


Figure 28: Lakes Network in Coimbatore

These interconnected water bodies were designed with multiple purposes in mind, such as flood control and irrigation, making them vital components of the city's infrastructure as depicted in the schematic diagram below.

6.3 Nashik Riverfront Development

6.3.1 Overview

Nashik is one of the 100 cities shortlisted for smart cities development in India and was ranked 11th in the second round of the smart cities challenge. Nashik Smart Cities Proposal (SCP) consists of 51 projects. The total cost of SCP has been envisaged to be around Rs.2194 crores. The budget for Area Based Development (ABD) is Rs. 1214.68 Cr. and that for Pan City is 979.04 Cr. Total cost with O&M is Rs.2554 Cr.

6.3.2 Smart City Proposal and Current Status

The SPA, New Delhi team of three members visited Nashik from 18th June 2024 to 20th June 2024. One member stayed back in Nashik till 23rd June 2024 for completing the stakeholder consultations. During the visit, various stakeholders including the officials, and the local community were consulted.

Figure 29: Meeting of SPA, Delhi team with Officials of Nashik Smart City Development Limited, Nashik 19th June 2024

Source: Field Visit, Nashik, June 2024

Under the Smart Cities Mission, projects for riverfront development encompass five projects. Status of the projects that have been taken up for river front development under the Smart Cities Mission have been presented in table 9.

Table 9: Status of River Front Development Projects in Nashik, June 2024

Sl. No	Name of Project	Agency	Status	Approximate Cost (Rs.)*	Cost (Crore Rs.)
1	Project Goda riverfront area-based infrastructure development project	NMSCDL	Completed	62,48,72,146	70.00
2	Godavari Riverfront Development Civil works	NMSCDL	Completed	7,98,94,613	15.43
3	De-silting of Godavari River	NMSCDL	Completed	8,94,02,494	10.55
4	Procurement & Maintenance of Trash Skimmer	NMSCDL	Completed	2,61,65,159	2.71
5	Installation of pneumatically operated automated mechanical gates at Ahilya Bai Holkar Bridge (Victoria Bridge) across river Godavari in Nashik, Maharashtra	NMSCDL	Work in Progress	2,20,475,707	26.02

*Source: NMSCDL (*Respective Work orders)*

Project Goda riverfront area-based infrastructure development has both retrofitting and Greenfield projects i.e., Panchavati area for retrofitting and Hanumanwadi for 319 acres of Greenfield development as a part of Area Based Development solution. The part of Godavari riverfront that has been selected for retrofitting under ABD projects is the main part of Godavari River in Nashik that passes through the old Nashik. Project Goda was envisaged to develop the area with cultural and religious importance with the 'Kumbh Mela' as the backdrop for development and to transform the area into sociocultural-recreational destination of the city.

6.3.3 Salient Features and Innovative Practices

a. Services

Under the Smart Cities Mission project of Goda River Front Development and Beautification, the Godavari riverbed has been de-concretized except Ram Kund and Gandhi talao. The reasons cited for not de-concretizing by the officials pertained to the risk of the structures at the edge of Ram Kund getting damaged due to heavy machinery movement during the process of de-concretization. As per the officials, a committee has been formed to advise on the matter.

Figure 30: Gandhi talao, June 2024

Figure 31: Ram Kund, June 2024

Figure 32: Goda Park – Entrance

Figure 33: Goda Park- Mural depicting scene from Ramayana

Figure 34: Goda Park- Ramp

Figure 35: Goda Park- Children's play area

Source: SPA Delhi team, June 2024

Goda Park and Goda walk have been developed adjoining each other. Goda park has several interesting features like a children's play area, story of certain sections of Ramayana etc. It also has a combination of a wide ramp and steps to access the park. It had not been handed over to NMC and was not open to the public during the field visit.

Goda walk starts from the small bridge over Lendi nallah and reaches up to Holkar Bridge. It was open to public during the time of the field visit. Goda Walk falls within the blue and the red lines that signify the flood level corresponding to 25 year and 100-year return period respectively, thus the area needs to be flood resilient. As per officials, the drainage system has been made to discharge flood water quickly to prevent flooding of the area.

Figure 36: Goda Walk, Before SCM Project

Figure 37: Goda Walk, After SCM Project

Figure 38: Open Gym in Goda Walk

Figure 39: Smart Toilet in Goda Walk

Source: SPA Delhi team, June 2024

Sambaji Udyan has been developed on the eastern bank of Godavari River respectively. According to NMSCDL, Goda Park and Sambhaji Udyan have been developed based on NEERI's guidelines of limit on hardscaping of 15 percent (NEERI, 2018). However, the percentage of total hardscaping observed is around 65 percent against the requirement of 15 percent maximum. Certain interesting elements have also been included in both the parks incorporating tactile garden and the potential activities in the play area.

Figure 40: Entrance of Sambhaji Udyan

Figure 41: View from Sambhaji Udyan

Source: SPA Delhi team, June 2024

Figure 42: Children's play area in Sambhaji Udyan

Figure 43: Tactile lawn and seating in Sambhaji Udyan

Source: SPA Delhi team, June 2024

Under the Goda river front beautification project, the ghats steps have also been replaced with basalt stone. Two Jetty structures have also been made, one adjoining Goda Park and the other near Sambhaji Udyan.

Figure 44: Goda Ghat Steps constructed under SCM

Figure 45: Cars parked beyond the bollards

Source: SPA Delhi Team, June 2024

Procurement of trash skimmer was done under the Smart Cities Mission and has been handed over to Nashik Municipal Corporation. An average of 480 MT per month of trash and water hyacinth (based on available data from January-June 2023) was removed from Godavari River. Further, desilting of the river between Ramwadi bridge and Holkar bridge (3.2 km stretch) was undertaken to enhance the carrying capacity of the river and reduce the chance of flooding.

Under the Smart Cities Mission, Lendi (Ramwadi) nallah has been diverted to Sewage Treatment Plant at Ganeshwadi and Malharkhan nallah has been diverted to a nearby STP.

b. Finance

The funds for the projects were from the Smart Cities Mission. Among the projects completed under the purview of river front development in Nashik, Goda Park is envisaged to generate funds through ticketing system once it is handed over to Nashik Municipal Corporation.

c. Planning

The Development plan of Nashik 2016-2036 was sanctioned in 2017. The vision of the plan is to achieve planned, comprehensive, participative, stakeholder friendly, rational, sustainable and growth driven development of Nashik City and make citizen-oriented policies, so that Nashik city should emerge as an orderly developed city on the map of India. Projects under the Smart Cities Mission in the city contribute to the achievement of the vision.

Under the Development Plan, the Godavari riverside development plan was also prepared. The flood lines for Godavari River i.e. Blue line (Prohibitive zone) and Red line (Restrictive Zone) are earmarked on plan as low flood lines and high flood lines. In the plan, the main proposed land uses include religious, commercial, parking, and residential. Designated parking has been provided between Naro Shankar temple and Gadge Maharaj Bridge, and on the east of Gandhi talao. Under the Smart Cities Mission, as a part of the River Goda Beautification project, bollards have been constructed to prevent cars from parking close to the river.

d. Technology

Pneumatically operated automated mechanical gates at Ahilya Bai Holkar Bridge is expected to reduce silting and subsequently the floods. The foundation was under construction at the time of the field visit.

Figure 46: Weir at the Ahilya Bai Holkar bridge

Figure 47: Construction of foundation for Pneumatically operated automated mechanical gates at Ahilya Bai Holkar bridge

Source: SPA Delhi Team, June 2024

e. Governance

Few projects envisaged in the Detailed Project Report have not been executed. Trees were to be planted and shaded seating was to be provided along the ghats, but it could not be executed. The paving of the ghats had to be avoided in certain areas, particularly around the temple building as that belonged to private temple trusts, resulting in uneven paving. The vending zone had to be demarcated but vendors were scattered along the ghats during the site visit. At the time of the visit present, there was difficulty being faced in the handover of the assets created under Smart Cities Mission to the parent organisation. The officials believed the guidelines for the handover could be made clearer for better coordination between NMSCDL and the parent organisation.

6.3.4 Impact on Local Community and Environment

To capture the impact of Smart City projects on the local community, a primary survey of 50 persons visiting the Goda ghat, Goda walk and Sambhaji Udyan was conducted between 20th June 2024 to 23rd June 2024. In addition to the questions canvassed to assess the impact, few other questions were also asked to understand people's experience as visitors view it in a holistic manner. In addition, local street vendors were also interviewed. Major findings from the observation and primary survey have been presented in Table 10.

The average age of the respondents was 32 years old with the least age being 10 years and the highest being 66 years old. The opinion of people younger than 12 years was particularly taken for Sambhaji Udyan as the park has play facilities for children. In terms of occupation, 50 percent of the respondents were self-employed while 35 percent were students. The remaining were either salaried, homemakers or unemployed. Further, 77 percent of the respondents were found to be residents, and the rest were tourists, if all the three survey locations were considered.

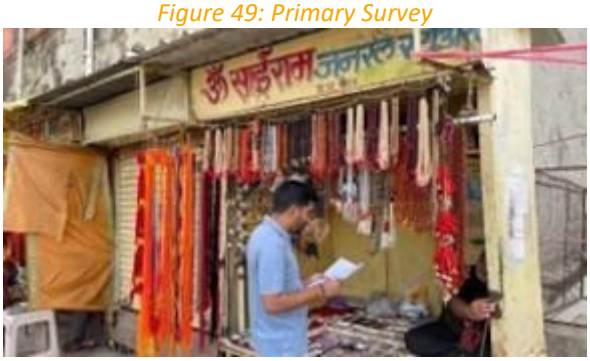
Nearly 75 percent of the of the respondents at the Goda Ghat stated that they were there for religious activities while the rest were visiting the ghat for sightseeing. On the contrary, at Goda Walk and Sambhaji Udyan, respondents were there for leisure activities such as playing, walking, jogging etc. Around 82 percent of the respondents believed there was enough parking at all the three sites. All respondents agreed that there was no provision of drinking water and clean toilets. Nearly 65 percent of the respondents claimed spending less than Rs.500 at the

Goda ghats while the ones who had spent more than Rs.2000 were there mainly for religious rites. The aesthetic appeal of the Goda ghats was rated as low by most respondents (82 percent) while 60 percent and 75 percent of the respondents rated the aesthetic appeal of Goda walk and Sambhaji Udyan very high respectively. The open gym and the walking path at Goda walk and river facing seating and lawn at Sambhaji Udyan were stated to be the main attractions. Safety was also considered good by nearly 78 percent of the respondents at all the three sites. On one hand, trees and green cover was very less at Goda ghat (96 percent respondents), on the other hand, all respondents believed there were enough trees and green cover at Goda walk and Sambhaji Udyan. Around 90 percent of the respondents agreed that there were opportunities for hosting events and festivals at all the three sites.

Vendors at Goda Ghat were also interviewed during the visit. They believed a designated place for the vendors should be earmarked where they can conduct their business without being asked to move often, especially during arti in the evening.

Figure 48: Site visit with NMSCL Official

Figure 49: Primary Survey



Source: SPA Delhi Team, June 2024

Table 10: Impact of Nashik Riverfront Development Projects

	Goda Ghat	**Goda Walk**	**Sambhaji Udyan**
Before Development	• Uneven surface increases injury risk. • High pedestrian vehicular conflict due to parking at the edge of the river • Broken concrete steps at the ghat leading to injuries.	• Less visited. • Broken jogger's track • Muddy during monsoon season	• Park with less facilities
After Development	• Smoother surface for community events like Rangoli making etc. • Reduction in pedestrian-vehicular conflict • Reduced potential injuries due to new steps.	• Improvement in quality of open space • Better drainage system to manage floodwaters. • Open gym for healthier lifestyle • Walking/ jogging • Seating facilities • All weather facilities • Re-establish connect between river and citizens	• Improvement in quality of green space. • Seating provided in the park along the river. • Tactile lawn • Children's play area • Re-establish connection between river and citizens.

	Goda Ghat	Goda Walk	Sambhaji Udyan
Suggestions from Respondents	• Improvement in water quality in the kunds • Planting of trees • More seating facilities in shade • Better solid waste management • Designated spaces for parking and vendors • The sound volume of one of the evenings arti could be reduced to maintain a pleasant environment. • Cleaner toilets	• Could have been for a longer stretch. • Covered seating for protection from rains	• Covered seating for protection from rain.

Source: Primary survey, SPA Delhi team, June 2024

With respect to Environmental improvement, the diversion of Lendi Nallah might have improved the water quality of Godavari River. Lendi nallah is at a distance of 700 m approx. from Ram Kund. Water quality values in terms of faecal coliform at Ram Kund, Nashik was compared for March 2021 (before diversion of Lendi Nallah) and March 2024 (After diversion of Lendi Nallah) to understand the probable impact. Faecal coliform decreased from 14 MPN/100 ml in March 2021 to 4 MPN/100 ml in March 2024 (MPCB, 2021 and MPCB, 2024), that may have happened due to the intervention. In addition, de-concretization of the riverbed and removal of ghats in the middle of the river would have restored the free flow of River Godavari to some extent. The trash skimmer might have also improved the quality of water by removing water hyacinth upstream of the Ahilya Holkar bridge. In the absence of water quality data pertaining prior to intervention, it is difficult to quantify the change in water quality. The impact of the mechanical gate is yet to be observed as it was yet to be installed as of 21st June 2024.

6.3.5 Key Findings and Learnings

The impacts envisioned at the commencement of the projects were:

- Boost identity and local economy.
- Preservation of ecosystems and open spaces

Post project impacts are in consonance with the envisaged impacts. The river front development project and other projects for improvement of water quality of Godavari River have been very important for Nashik as the identity of the city is intrinsically associated with the river. De-concretization of the riverbed, desilting of the river, operation of the trash skimmer and diversion of nallas would have been pivotal in preservation of ecosystems. The establishment of Goda park, Goda walk and Sambhaji Udyan have also added to the open spaces in the city, at the same time, re-establishing a connection of the citizens with the river, as already re-affirmed by the respondents of the primary survey. The projects have also improved the visitor experience at the ghats by reducing pedestrian-vehicular conflict, improving the surface quality thus reducing injuries etc.

The major learnings of the Smart Cities Mission in Nashik would be:

- Some of the projects were delayed due to legal issues like encroachment. This delay had not been taken account of while framing the project completion timeline.
- Few project components mentioned in the DPR were shelved due to technical or financial non-feasibility.
- Stakeholders like some of the temple trusts did not come on board for paving around the temples leading to patchwork paving.
- The capacity of parent organizations for maintaining assets created under Smart Cities Mission needs to be assessed and strengthened.
- Review the process of handing over the assets to the parent organisation and have more clarity for both the SPV and the parent organisation.
- Address officials' concern about the uncertainty related to the future of the SPV and to take them into confidence.

6.4 Puducherry Beachfront Development

6.4.1 Overview

Puducherry was selected in round 3 of Smart Cities Mission Challenge. Based on people's aspirations, the boulevard and the surrounding areas were selected for Area Based Development (ABD). The total proposed cost of Puducherry Smart City was estimated to be INR 1827.82 Cr, of which INR 1633.64 Cr was proposed for Area Based Development (ABD) focusing on Retrofitting and Redevelopment approach and INR 194.19 Cr worth of Pan City Solutions.

In Puducherry, the focus of beachfront development is on the beach promenade and the Pondy marina beach. The former is also part of the heritage boulevard area and a critical component of the ABD. It was made during the French rule and later taken up for beautification in consultation with INTACH, PWD and Tourism Department and reopened to the public in 2011. Before the Smart Cities Mission intervention, it extended to 1.2 km abutting the French quarters or the white town area. Now, the promenade has been extended by around 700 meters under the SCM. The promenade has popular tourist spots, hotels, cafes, restaurants, and shops. It remains heavily crowded during the weekends and the tourist season.

Figure 50: Rock Beach Promenade: Upper level

Figure 51: Rock Beach Promenade: Lower level

Source: SPA Delhi team, June 2024

6.4.2 Smart City Proposal and Current Status

The SPA, New Delhi team visited Puducherry from 25th June 2024 to 28th June 2024. During the visit, various stakeholders including the officials, and the local community were consulted.

Figure 52: Meeting of SPA, Delhi team with Officials of Puducherry Smart City Development Limited, Puducherry, 26th June 2024

Source: SPA Delhi team, June 2024

Under the Smart Cities Mission, projects for beachfront development encompass nine projects. Status of the projects that have been taken up for beach front development under the Smart Cities Mission have been presented in table 11.

Table 11: Status of Beach Front Development Projects in Puducherry, June 2024

Sl. No.	Name of Project	Agency	Status	Cost (Rs. Crore)	Completion Date
1	Extension of beach promenade by 1.7 km	PSCDL	Work Completed (for stretch granted CRZ clearance)	0.89	31.03.2023
2	Urban Entertainment Village at old port phase I and Phase 2	PWD	Work Completed	13.34	28.02.2024
3	Providing and fixing of granite stone benches at Beach Promenade in Puducherry	PSCDL	Work Completed	0.37	30.09.2021
4	Providing and fixing Architectural dynamic LED light for Illumination to the Rocky Fountain, Beach Road, Puducherry	PSCDL	Work Completed	0.05	31.12.2021
5	Providing & fixing Architectural dynamic LED light for Illumination to the Kargil War Memorial, Beach Road, Puducherry	PSCDL	Work Completed	0.11	31.12.2021
6	Installation testing and commissioning of image Projection LED lights in Southern Promenade, Beach Road, Puducherry.	PSCDL	Work Completed	0.29	31.12.2021
7	Provision of Decorative LED lighting in Beach Promenade-Phase1	PSCDL	Work Completed	0.10	August 2021
8	Reconstruction of Pudumai Building on the Beach Road	NBCC	Work in Progress	3.30	-
9	Improvement and Renovation of Le Cafe Building, Beach Road, Puducherry	PSCDL	Work Completed	0.50	30.06.2023

Source: PSCDL, June 2024

Among the beach front development projects proposed at the commencement of the Smart Cities Mission, one project (Reconstruction of Pudumai Building on the Beach Road) is still under construction, while the others are completed. For the project of Extension of beach promenade by 1.7 km, environmental clearance and CRZ approval was granted for 630 m and not for the remaining 1070 m, thus only 630 m of road was constructed along the beach.

Figure 53: Pudumai building under Construction

Figure 54: Extension of beach promenade

Source: SPA Delhi team, June 2024

Nippon Koei-PwC were appointed as Project Management Consultant for execution and implementation of the Smart City project in 2018. Further in May 2023, the execution of 'Reconstruction of Pudumai Building on the Beach Road' was handed over to NBCC (India) Ltd, a Central Public Sector Enterprise (CPSE) under the Union Ministry of Housing and Urban Affairs and 'Urban Entertainment Village at old port phase I and Phase 2' was executed by Public Works Department, Puducherry. The rest of the projects for beach front development were executed by PSCDL.

6.4.3 Salient Features and Innovative Practices

a. Services

The Urban entertainment village at the old fort has been constructed under the scheme "Development of Adaptive Re-use of the Beach Pathway and Warehouses as a Tourist Experience Centre", Directorate of Tourism, Government of Puducherry. The 4-ha land had 7 warehouses that were unused. These have been integrated into the design, thus utilising resources judiciously. The drawback of the amphitheatre is that it can be accessed through steps. In the absence of a ramp, accessibility for the elderly and physically challenged persons would be restricted.

Figure 55: Amphitheatre in Urban Entertainment Village

Figure 56: Adaptive Reuse of Old Warehouses in Urban Entertainment Village

Figure 57: Lighting on Beach Promenade

Figure 58: Ramp at the northside of Rock Beach Promenade

Source: Primary survey, June 2024, SPA Delhi team

The lower level of the beach promenade is at the same level as the access road and is pedestrianized. Access to the upper level of the beach promenade from the lower level is through steps located at unequal intervals and a ramp located at the end of the promenade. In addition, there is absence of tactile strips for the visually challenged visitors.

The provision of Decorative LED lighting in Beach Promenade-Phase1 has led to adequate lighting on the beachfront. Choice of LED for lighting would have also contributed to lower electricity consumption as compared to halogen or CFL bulbs. It is maintained by the Electricity Department, Government of Puducherry.

b. Finance

In the case of Puducherry, in the absence of the PMC, line departments were responsible for executing most of the Beach Front Development Projects. The funds for the projects were from the Smart Cities Mission. Some of the projects were financed through convergence with other schemes. For example, Extension of beach promenade by 1.7 km was constructed with funds from Bharat Darshan 2.0 scheme and Smart Cities Mission.

Figure 59: Le Café, Rock Beach Promenade

Source: SPA Delhi team, June 2024

At present, among all the projects, only Le Café generates revenue as it is being utilized as a restaurant by Puducherry Tourism Development Corporation. Urban Entertainment Village at old port is envisaged to generate revenue in the future. Further, Pondy Marina beach is envisaged to be developed as a food themed beach with food courts etc by the Tourism

Department. 'Extension of beach promenade' project would enable development of Pondy Marina beach and distribute the crowd during weekends and peak tourist season and thus is expected to reduce the pressure on the rock beach promenade.

c. Planning

The Smart city proposals for beachfront development like the beach promenade and the urban entertainment village are in consonance with the Comprehensive development plan for Puducherry Planning Area – 2036. Both have been identified as recreational/tourism zones in the Plan. Thus, the smart city projects would also be contributing to the implementation of the development plan.

d. Technology

LED lights have been installed on the promenade and Pondy Marina beach.

e. Governance

The beach promenade extension project could not be completed as envisaged due to a section of the road alignment not getting CRZ approval by CZMA. In addition, discontinuation of the PMC was partially responsible for the delay in the progress of the projects.

6.3.4 Impact on Local Community and Environment

For the purpose of capturing the impact of Smart City projects on the local community, a primary survey of 60 visitors was conducted on the beach promenade between 4.30 pm and 7.30 pm from 25th June 2024 to 27th June 2024. In addition to the questions canvassed to assess the impact, a few other questions were also asked to understand people's experience. Major findings are presented in table 12.

The average age of the respondents was 30 years old. Out of the 60 respondents, 38 (63%) were below 25 years of age and six (10%) respondents were of more than 60 years of age. Further, 50 percent of the respondents were found to be tourists, mainly from the nearby states of Tamil Nadu, Kerala and Andhra Pradesh. There were two international tourists among the respondents, one from South Africa and the other from France. The spending at the promenade also varied for the residents vis a vis the tourists. While 74 percent of the residents spent less than Rs.100 per visit, two-third of the tourists spent more than Rs.500 per visit.

Figure 50: Primary Survey at Rock Beach Promenade

Source: SPA Delhi team, June 2024

Nearly 26 percent of the respondents reported that they visit the promenade daily and a similar percentage (26 percent) reported that they visited once a week usually on the weekends. Around 20 percent responded that they visited once a month, and the rest visited less than once a month. During interaction with the local community, it was found that residents avoid the promenade during tourist season as it gets very crowded. Among the residents, nearly 87% responded that they visit the promenade for walking and experiencing the openness of the sea.

This also highlighted the importance of the promenade as an open space in the lives of the Puducherry residents.

With respect to the facilities executed under Smart Cities Mission on the beach front, 80 percent stated that the lighting was adequate in the rock beach promenade since in addition to the light from the lamp posts installed under the Smart Cities Mission, light from the commercial establishments also illuminated the promenade. They stated that they felt safe and secure on the promenade. Lighting in the areas near the Kargil War Memorial, at the northern end of the promenade, was found to be inadequate, leading to a perception of an unsafe environment. It was also mentioned that the lights required regular maintenance as a few were not functioning. Further, nearly 250 stone benches have been set up along the rock beach and the Pondy Marina promenade under the Smart Cities Mission. While these benches have substantially added seating space, many felt that they need to be maintained as well, as a few were found to be broken and dismantled. Some people were also of the opinion that more benches should be added at the lower level of the promenade as well.

In addition to the responses specific to the Smart City Projects on the beach front, opinions about the other aspects of the beachfront were also sought. 73 percent of the respondents stated that there is adequate parking space, the rest were of the opinion that car parking is an issue. In addition, the respondents also noted that the public transport needs to be strengthened to improve the connectivity to the promenade so that a smaller number of private vehicles are brought to the promenade. Further, 78 percent of the respondents stated that drinking water was not available easily and 55 percent responded that washrooms were not maintained properly. Nearly 70 percent of the respondents stated that the promenade and the related facilities like restrooms were not easily accessible for the differently abled persons.

Nearly 60 percent of the respondents also indicated that though the promenade was clean, the beach was dirty. It was suggested that the number of garbage bins at the promenade be increased. Nearly two-thirds of the respondents felt that there was not enough shade on the promenade and suggested that shady trees could be planted.

Figure 61: Non-functional lights at Rock Beach Promenade

Figure 62: Broken Benches at Southern Promenade

Source: SPA Delhi team, June 2024

Table 12: Impact of Beachfront Development Projects in Puducherry

Before Development	• Poorly lit Promenade • Limited seating space
After Development	• Improvement in lighting • Enhanced sense of safety and security • More seating space

Suggestions	• Car parking needs to be improved. • Strengthening of public transport to improve the connectivity to the promenade. • Provisioning of drinking water • Regular Maintenance of washrooms • Integration of Universal accessibility in design • Requirement More benches at the lower level of the promenade • Better maintenance of lights • Protect benches against vandalism. • Put more dustbins on the beach. • Planting of shady trees

Source: Primary Survey, SPA Delhi team, June 2024

In terms of the environmental impact, the projects have been executed after taking CRZ and environmental clearance, thus they are expected to have minimum adverse impacts right now, provided the environmental management plan has been followed. But the scale activities will have to be managed judiciously in the future to not harm the environment, particularly in the Pondy Marina beach area as it is close to the mangroves in the Thengaithittu estuary.

6.4.5 Key Findings and Learnings

The Smart city projects (beach front development) have contributed to impact as envisaged for the projects. Development of Pondy Marina beach and urban entertainment village would increase the percentage of city area developed as recreational facility, open and green space. The provisioning of benches and lighting would also enhance the quality of the beach promenade and Pondy Marina beach as recreational spaces. Renovation of Le Café and construction of Pudumai building, besides enhancing recreational options in the beach promenade, will be adding to the percentage of street kms having mixed land use as well. In addition, all these projects would also enhance the local identity and economy.

The major findings of the Smart Cities Mission in Puducherry would be:

- The implementation of the Smart Cities Mission has been done by a Special Purpose Vehicle (SPV) set up at city level in the form of a limited company under the Companies Act, 2013 and was promoted by the UT and the Urban Local Body (ULB) jointly both having 50:50 equity shareholding. This division was considered to be high by the officials for Puducherry as Puducherry is a Union Territory and has limited revenue generation options. Many of the projects had to be abandoned as the UT could not garner its own share of the required financial commitment.
- Assets that have been created under the Smart Cities Mission need regular maintenance after the handover to the respective O&M agency, again for which funds are required.
- Puducherry was selected as a smart city in round 3 in the year 2017 and the PMC came on board in the latter half of 2018. As per the officials, it took time for the Smart Cities Mission projects to get kickstarted and the project implementation was further delayed by the Covid lockdown.
- The PMC was supposed to implement the projects, but they were discontinued. In the absence of PMC, officials from various line departments were brought into the SPV and the project implementation responsibility was handed over to the respective line departments. Fifteen interns were also hired under the Smart Cities Mission. The officials stated that lack of staff also impeded the progress of the projects.

6.5 Coimbatore Lakefront Development

6.5.1 Overview

Coimbatore was among the 12 cities nominated from Tamil Nadu under this program. Coimbatore was selected in the first round of 20 cities, evaluated based on existing service levels, institutional capacities, and past track records.

The inclusiveness plan aimed to provide affordable housing, livelihood/skilling support, and social infrastructure for approximately 4,500 low-income households along the lakes. The city developed the 'Slum-Free City Plans of Action' for 10,800 dwelling units for Economically Weaker Sections (EWS) under the now-discontinued RAY. However, the Smart Cities Mission did not specifically engage with underprivileged groups and residents of informal settlements.

6.5.2 Smart City Proposal and Current Status

The Coimbatore Smart City proposal, part of India's Smart Cities Mission launched in 2015, aims to transform Coimbatore into a model urban area by leveraging technology and sustainable practices to enhance residents' quality of life. Coimbatore was selected as one of the first 20 cities in the initial round of the program, based on its existing service levels, institutional capacities, and track records. Detailed project information is available in Annexure-1.

Coimbatore's Smart City initiative encompasses various projects focused on lake ecosystem rejuvenation, urban infrastructure, sustainability, and quality of life. Notable projects include:

- City Sense and Air Quality Monitoring IoT Device: Improves transportation and mobility through air quality monitoring (INR 0.11 crore).
- Restoration and Rejuvenation of Periyakulam Lake: Preserves ecosystems and open spaces (Rs 61.60 crore).
- 24x7 Water Supply Project (Phase I and II): Ensures a reliable water supply (INR 175.73 crore).
- Solar Power Plant at Ukkadam Sewage Farm: Reduces energy dependence and promotes conservation (INR 5.77 crore).
- Multi-level Parking at R.S Puram: Enhances transportation and mobility (INR 41.67 crore).

Key amenities developed include 5 amphitheaters, 3 food courts (not yet fully operational), numerous food kiosks, a learning centre and smart city experience centre (closed for maintenance during site visits), a sound and light show (during weekend /once a week), boating and water sports activities, and an art and craft bazaar (not operational yet).

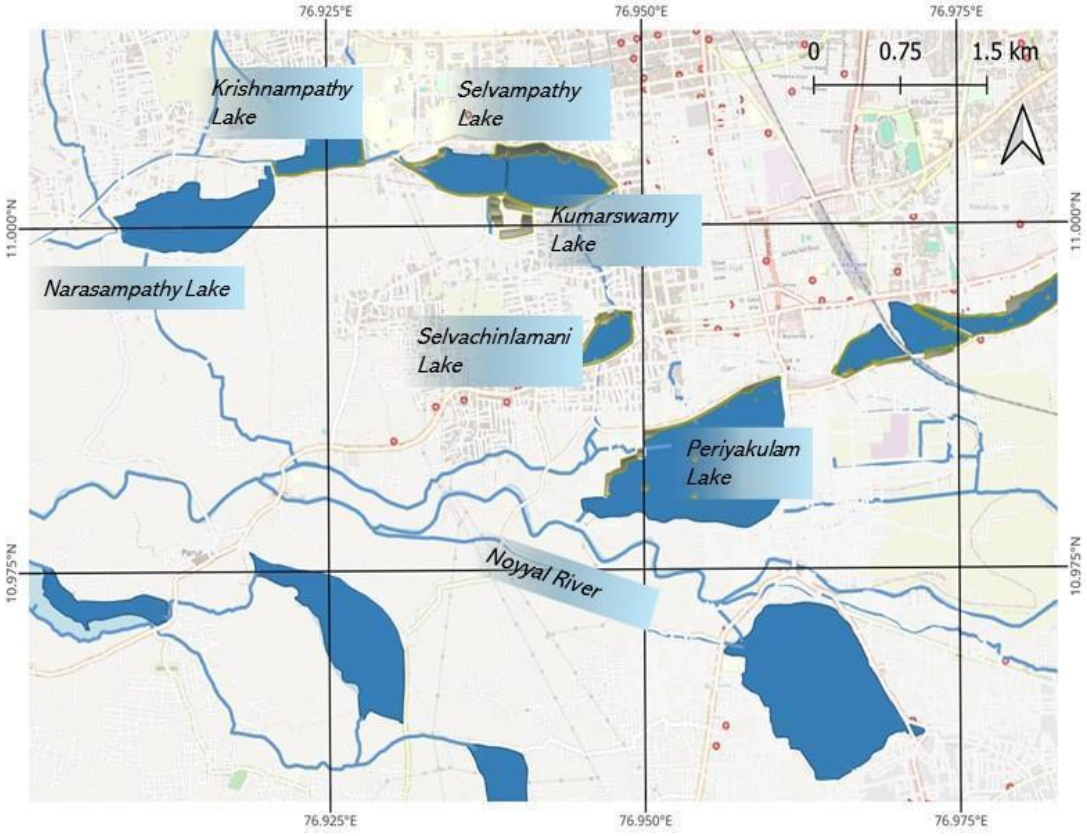
The funding structure for these projects includes:

1. Central and state government contributions: INR 490 Cr and INR 499 Cr respectively
2. Display board & air quality monitoring done on public-private partnerships (PPP) and Private investments with revenue share to CSCL.
3. Convergence initiatives (with AMRUT and other schemes): 24x& water supply, STP among others Rs 163 crore.

During the site visits conducted by the team from SPA, it was observed that all smart city projects were completed. The process of finalizing the O&M agency, preparation of asset inventory for handover to O&M agency was in the process. All construction activity was completed as of December 2023, though some sites were not yet operational.

One key project was the Restoration and Rejuvenation of the lake/reservoir ecosystem, addressing issues like siltation and encroachments. An STP was constructed to treat wastewater entering the lake, & with plans for another modular STP in progress. The STP is expected to improve overall water quality, though no data was available to validate the assumption. Manmade wetlands were also constructed at the edge of the Periyakulam lake to treat wastewater but were not operational during the site visits.

Figure 63: Spatial distribution of reservoirs / lakes undertaken under SCM



Source: Coimbatore Smart City, 2024

The various assets developed under the smart city included leisure, water sports, walkways, etc along the lakes, is estimated to have O&M costs of INR 10 million per month. Prior to this project, the lakes located in the core city were used for dumping garbage and debris. Wastewater from domestic and commercial establishments was being discharged into the lakes, severely polluting the water. The lake bunds were also encroached by a large number of homeless poor living in unsanitary conditions.

These lakes undertaken under the Smart Cities Mission are connected by the canal network which over time became narrow due to siltation and encroachments. The ownership of these assets initially lies with the Water Resources Department. The canal water used to get mixed with domestic wastewater at certain places (four inlet locations) due to illegal discharge. An STP was also constructed under the Smart Cities Mission to tap and treat the wastewater before discharge to the lake / reservoirs. There is a proposal for a modular STP in pipeline as well as informed by the smart city officials during the site visits.

6.5.3 Salient Features and Innovative Practices

Coimbatore smart city took up the task of rejuvenation of the seven lakes under the Smart Cities Mission. This cascading system of lakes that acts as efficient flood buffers was restored to its pristine state and the lakefronts were turned into public arena. The lake system consists of 7 lakes which are integral part of the regional water network and natural reservoirs.

The smart city project led to an increase in public space availability from 2.17 sqm to approximately 4.9sqm per capita as per the baseline population. Led to the removal of 20,389 illegal dwellings on seven lake fronts reclaiming approximately 0.113 Sq. Kms. of land and put to public use. Approximately 7680 households got rehabilitated with secure tenements though convergence with other state and central government schemes.

These newly created lake front areas have an estimated footfall of approximately 2000 persons day and weekend footfall of more than 10,000+ for various activities like walking, cycling, leisure, water sports, boating, bird watching etc. Improved tourism due to boating, water sports, sound & light shows, food courts, and bird watching.

These newly created spaces provided adequate space for large events, Regular events including festivals, shopping, food festivals, and even space for corporate events generating revenue for the urban local body.

6.5.4 Impact on The Local Community and Environment

The Smart City initiatives in Coimbatore have had a significant impact on the local community and environment. Through various projects focused on urban infrastructure, sustainability, and quality of life, the city has seen noticeable improvements. Many residents and tourists have acknowledged the efforts to reduce pollution and promote environmental sustainability. The restoration and rejuvenation of the Periyakulam Lake, for instance, has not only enhanced the aesthetic appeal of the area but also contributed to the preservation of local ecosystems. The installation of a solar power plant at Ukkadam Sewage Farm and the implementation of 24x7 water supply projects highlight the city's commitment to sustainable practices, reducing energy dependence, and ensuring reliable water supply.

The ecology of the lakes has also improved significantly. In a Census study conducted by the Coimbatore Nature Society, The Nature and Butterfly Society, WWF India and Coimbatore Forest Division in 2023 and 2024, a rise in bird count was observed from 2023 (9494) to 2024 (16069). Within Coimbatore city, Krishnampathy lake rejuvenated under the Smart Cities Mission has one of the highest (1387) bird counts while low bird count was reported from Narsampathy lake. Krishnampathy lake also had the highest (101) number of bird species (New Indian Express, 2024)

6.5.5 Key Findings and Learnings

The team conducted sample surveys for two days (covering weekdays and weekend in June 2024) conducted stratified random sampling among the stakeholders visiting these newly created facilities. The type of stakeholders captured during the survey included residents, tourists, self-employed individuals from the city, and students. A summary of the observations is presented below.

Positive Points

- Overall Satisfaction: Many respondents rated the overall cleanliness of the waterfront area as "Moderately clean".
- Efforts to Reduce Pollution: Several respondents noticed efforts to reduce pollution and promote environmental sustainability.
- Amenities: There were positive comments about existing amenities such as walking paths and recreational facilities.

Negative Points

- Cleanliness Issues: Some respondents rated the waterfront area as "Dirty".
- Safety Concerns: A few respondents mentioned concerns about safety, especially at night.
- Lack of Amenities: Many respondents indicated the need for more seating, shaded areas, and garbage bins.
- Operational Issues: Some amenities and facilities are not yet fully operational, leading to dissatisfaction.

The stakeholders provided several insightful suggestions to enhance the Smart City initiatives in Coimbatore. A common theme among the feedback was the need for increased seating and shaded areas along the waterfront and other public spaces. Respondents frequently mentioned the necessity of more benches, chairs, and sunshades to improve comfort for residents and visitors. Additionally, stakeholders highlighted the importance of improving waste management practices, suggesting the installation of more garbage bins, and ensuring regular clean-up schedules to maintain cleanliness.

Figure 64: Stakeholder interactions using a semi structured questionnaire

Source: SPA Delhi Team, June 2024

Safety was another significant concern raised by the stakeholders. Many suggested enhancing lighting and security measures, particularly in areas that are frequented at night, to ensure a safe environment for everyone. Furthermore, there were recommendations for expanding recreational facilities, such as developing more playgrounds, food courts, and craft bazaars. These amenities would not only provide leisure options for the community but also promote economic opportunities for local vendors and artisans.

Based on these suggestions, several recommendations were shared by the community to address concerns and enhance the Smart City initiatives. Firstly, increasing the number of seating and shaded areas should be prioritized to make public spaces more welcoming and comfortable. This can be achieved by installing more benches and sunshades in strategic locations. Secondly, improving waste management by placing additional garbage bins and scheduling regular clean-up drives will help maintain the cleanliness of public areas.

To address safety concerns, it is recommended to enhance lighting and security measures, especially in areas with high foot traffic during the evening and night. This could involve installing more streetlights and deploying security personnel to patrol these areas. Expanding recreational facilities such as playgrounds and organizing events at food courts and craft bazaars can further engage the community and support local businesses.

Overall, these recommendations based on stakeholder feedback aim to create a more inclusive, safe, and enjoyable urban environment in Coimbatore. By addressing these suggestions, the Smart City initiatives can better meet the needs of the community and contribute to the sustainable development of the city.

7. STUDY OUTCOMES AND CONCLUSIONS

7.1 Critical Challenges

In addition to identifying the critical challenges faced during the project planning, implementation and operation, the research questions raised in the methodology section of the report within the ambit of the five verticals (Services, Finance, Planning, Technology and Governance) of Municipal Performance Index has also been addressed in this section.

7.1.1 Project Selection

In selecting projects for smart cities like Nashik, Coimbatore, and Puducherry, significant challenges arose due to the diverse needs and characteristics of each city. The projects were selected during the initial phase of the smart city competition wherein public consultations were held in each of the cities to gauge response and feedback from the residents in each city on the key issues being faced by the city.

Nashik's historical and cultural relevance posed difficulties in balancing heritage conservation with modern development. Coimbatore's challenge was integrating traditional water management practices with contemporary urban needs. Puducherry faced the complexity of preserving its unique coastal and colonial heritage while promoting sustainable tourism and infrastructure.

7.1.2 Services

With respect to Environmental improvement, in Nashik, the diversion of Lendi Nallah might have improved the water quality of Godavari River as mentioned in section 6.3.4. In addition, de-concretization of the riverbed and removal of ghats in the middle of the river, de-silting, trash skimmer might have also improved the quality of the river. In the absence of water quality data prior to intervention, it is difficult to quantify the change in water quality. In Coimbatore, the restoration and rejuvenation of the Periyakulam Lake, for instance, has not only enhanced the aesthetic appeal of the area but also contributed to the preservation of local ecosystems. In Puducherry, the impact of the SCM interventions is very evident in the domain of safety, security and comfort owing to the provisioning of proper lighting and benches at the beachfront.

The Smart City Projects are expected to have a strong impact on the tourist and local visitors' footfall. As per data given by the Smart City offices of the selected cities, the average estimated tourist footfall was expected to increase from 3000 per week (2014) to 30000 per week 2023) in Puducherry and the visitor footfall is expected to be 10,000 per day in Coimbatore. Data for Nashik for this parameter is not available. Thus, the improvement in infrastructure and services under Smart Cities Mission would cater to and benefit a large number of people.

7.1.3 Finance

In all the three cities, funds for the projects were financed mainly from the Smart Cities Mission. Few of the projects were financed through convergence with other schemes of Government of India and private investment through the Public-Private-Partnership model. Among the three cities, Coimbatore was the only city that had started generating revenue through some of its projects like the boating and water sports services at the Periyakulam and Velankulam lake, rent from space let out for shops etc and it had several more projects in pipeline for generation of revenue in the near future. In Nashik, Goda Park is envisaged to generate funds through ticketing system once it is handed over to Nashik Municipal Corporation. In Puducherry, the Urban Entertainment Centre is also expected to generate revenue once it is operational.

7.1.4 Planning and Design

The projects taken up under the Smart Cities Mission successfully align with the original goals and objectives outlined in the Smart City proposal for all the three cities, in addition to most of them complying with the Master Plan. There are a few concerns which need to be addressed. Planning waterfront developments requires careful consideration of ecological and social impacts. For instance, In Nashik, riverfront development had to ensure effective flood management, revive near-ecologically dead sections of the river due to excessive concretization, and conserve overall biodiversity. Most of Goda walk, Goda park and the Goda ghat lie within the flood lines corresponding to the 25-year return period making them flood prone, thus the development needs to be flood resilient. It should also follow the guidelines prescribed by NEERI, 2018. The Smart Cities Mission commissioned a detailed technical evaluation for the proposed riverfront development projects by NEERI. The NEERI report prohibited activities in the floodplain region such as extensive vegetation clearing, backfilling, and concretization of riverbeds, among other recommendations. A summary of the report's key points is shared in text box 2.

Text Box 2

The report evaluates the Detailed Project Report (DPR) for the proposed riverfront development of the Godavari River at Nashik, focusing on sustainable floodplain management and river ecosystem protection. It highlights that prohibited activities such as vegetation clearing, backfilling, and concretization within floodplain areas are essential to avoid further river degradation. The report emphasizes that desilting alone is insufficient for long-term siltation control and recommends additional measures like contour bunding and upstream plantation. It also raises concerns about the proposed diversion of nallahs, warning that combining stormwater with sewage could lead to overflows, suggesting instead the installation of separate lines for stormwater and sewage. The report advocates for the removal of unnecessary concrete structures to restore natural water flow and stresses the importance of installing in-situ systems to prevent sewage inflow from open drains. It recommends regular maintenance of manholes, limiting hardscaping to 15%, and ensuring proper waste management according to environmental regulations. Additionally, public awareness campaigns and the consideration of sustainable, solar-powered ozonation systems for water treatment are suggested to enhance the project's environmental impact.

In Coimbatore, lake rejuvenation projects are needed to address ecological restoration, encroachments, illegal developments including slums, and urban recreational requirements. Puducherry's beachfront development faced design challenges in sustainable coastal management, sustainable tourism development, and erosion control.

Similarly, in Puducherry, the beach road extension has been constructed in compliance with the CRZ regulations, but the commercial and recreational activities that will come up in Pondy Marina beach in the future should be regulated to minimize adverse impact on the ecosystem of the nearby Thengaithittu estuary.

Overall, the needs of the various user groups are reflected in the design and use of the space in the projects executed for lakefront/riverfront/beachfront development except for a few stray instances. In Nashik, ramp has been provided to access Goda park, the re-paving of the ghat area has smoothened the path facilitating the movement of wheelchairs and other personal mobility devices, differential paving has been provided acting like tactile strips in Goda Walk,

seating has been provided at regular intervals that is particularly beneficial for the elderly etc. Similarly, Coimbatore has developed the lakefronts with sensitivity towards the differently abled and other user groups like children, elderly and women. The promenade has universal accessibility and tactile strips, ample number of benches, children's play area (Periyakulam lake) etc. In Puducherry, ramps are there to access the upper level of the promenade though they could be placed in better location with signages showing their presence. The toilets in the waterfront development projects of all the three cities were not differently abled friendly. Lighting was also not adequate in certain stretches of the projects in all the three cities, affecting the perception of safety among users.

7.1.5 Governance

Implementation and Execution

Executing these projects highlighted several procedural and logistical challenges. In Nashik, the desilting of the Godavari River and the installation of pneumatically operated mechanical gates, the first of their kind in India, faced delays due to technical and administrative issues. Additionally, public litigation filed by civil society organizations against riverbed encroachments and excessive concretization further complicated the process. Site visits and interactions with smart city officials revealed that resistance from certain local stakeholders, driven by their own interests, also contributed to delays in the execution and completion of these projects. These experiences underscore the importance of addressing technical, legal, and stakeholder concerns to ensure the smooth implementation of such initiatives.

Puducherry's beachfront projects encountered significant delays in both construction and community engagement processes. These setbacks were primarily due to delays in obtaining the necessary clearances, including Coastal Regulation Zone (CRZ) clearance. The situation was further exacerbated by the poor performance of the initially appointed consultant team, which led to their removal from the project. To address these challenges, various line departments had to step in to support the design and implementation processes. Their intervention was crucial in streamlining the approval processes, facilitating better coordination among stakeholders, and ensuring that the project could proceed despite the initial hurdles. These experiences highlight the importance of effective consultant performance and proactive involvement of government departments in overcoming procedural and bureaucratic obstacles to successful project execution.

Coimbatore's lake restoration required intricate coordination between historical water management systems and modern engineering solutions. A dedicated team of professionals, led by the Smart Cities Mission office, effectively executed the projects within the extended timelines. (necessitated due partly to Covid pandemic and addition of revenue generation projects). The projects were executed by Coimbatore Corporation. Coimbatore Smart City Ltd (CSCL) did not have any staff on its role for major part of the mission period; At present has only skeletal staff. However, CSCL has come up with a self-sustaining O&M model harnessing the revenue potential. CSCL is already earning significant revenue through revenue share in PPP projects and other activities besides rental income. Post-completion, the disengagement of the Smart City team resulted in certain gaps and delays in the handover of the newly constructed assets to the Operations and Maintenance (O&M) agency. Additionally, the project lacked an effective asset management system, and issues with project quality controls have further

delayed the handover process. These experiences underscore the importance of continuous engagement of project management team with adequate expertise and robust asset management and quality control systems. SPV can engage competent personnel drawn from the market to ensure sustainable management of completed projects and take up new projects. In the absence of adequate personnel, the SPV has opted to outsource the O&M, augment revenue generation and meet the connected expenses.

Operational Challenges

Post-implementation, the operational phase in these three cities presented new challenges that offer valuable lessons for future projects. In Nashik, maintaining and managing the newly developed recreational areas along the riverfront has been difficult, with some features yet to be opened to the public due to minor pending works.

Coimbatore's interconnected lakes require ongoing monitoring and maintenance to prevent pollution and ensure water quality. The newly constructed information center must be consistently maintained and kept open by the O&M agency to ensure the community benefits from these investments.

Puducherry's beachfront facilities need effective management to sustain tourism and protect coastal ecosystems. Some pending projects still need completion under the Smart Cities Mission or through other funding sources to realize their full benefits.

In all three cities, the team observed damage to newly constructed facilities such as benches, streetlights, and paved surfaces, as well as theft of open gym equipment and poor upkeep by the implementing or maintenance agencies. These issues highlight the necessity of robust maintenance plans, effective asset management, and continuous community engagement to ensure the longevity and success of urban development projects.

Institutional and Governance Issues

Institutional experimentation and governance structures in these smart city projects were also critical challenges. Coordination between different government agencies, private partners, and community stakeholders was often problematic. For instance, in Nashik, the handover of assets from the Smart Cities Mission to the Nashik Municipal Corporation lacked clear guidelines, leading to management inefficiencies. Similar governance issues were observed in Coimbatore and Puducherry, where overlapping jurisdictions and fragmented responsibilities hampered effective project management.

7.1.6 Critical Review and Solutions

A critical review of these projects highlights the need for better project management frameworks, clearer institutional responsibilities, and enhanced community engagement. Solutions include establishing robust monitoring mechanisms, fostering inter-agency collaboration, and adopting flexible yet comprehensive planning approaches. Addressing these challenges is crucial for the successful implementation and sustainability of smart city projects.

7.2 Replicable Best Practices

The projects in Nashik, Coimbatore, and Puducherry offer valuable insights into replicable best practices for other Urban Local Bodies (ULBs) and smart cities.

7.2.1 Nashik's Riverfront Development

The comprehensive riverfront beautification and flood management strategies can be replicated in other riverine cities. The integration of cultural and recreational spaces along the riverfront can serve as a model for enhancing urban aesthetics and tourism.

7.2.2 Coimbatore's Lakefront Development

The ecological restoration of interconnected lakes in Coimbatore demonstrates a replicable model for urban water management in various other cities of India with similar drainage and storm water systems. The focus on flood control, irrigation support, and recreational space creation can be scaled to other cities with similar water bodies.

7.2.3 Puducherry's Beachfront Development

Sustainable coastal management practices implemented in Puducherry, such as erosion control, and habitat preservation, can be adopted by other coastal cities. The emphasis on tourism and community engagement provides a blueprint for balancing economic development with environmental conservation.

7.2.4 Scalability

These projects also demonstrate scalability in terms of financial sustainability and broader applicability. The funding structures, such as those from the Smart Cities Mission, show that with proper financial planning and resource allocation, similar projects can be scaled up to cover wider areas or more cities. The positive impacts on urban growth, sustainability, and quality of life indicate that these projects, once proven successful on a smaller scale, can be expanded to larger urban areas. The best practices from these cities also emphasize the importance of Community Engagement (Actively involving local communities in planning and implementation to ensure that projects meet their needs and gain their support.); Technological Integration (Utilizing modern technology for efficient project execution and management); Environmental Sustainability (Prioritizing ecological restoration and sustainable practices to ensure long-term benefits and resilience against environmental challenges).

7.3 Recommendations & Policy Directives

7.3.1 Recommendations

For future urban development missions, a clear strategy and policy framework are essential. Recommendations include:

1. Integrated urban & environmental planning: Developing comprehensive urban plans that integrate environmental, social, and economic aspects. This involves coordinated efforts across various sectors and stakeholders.

2. Robust Institutional Framework: Developing a robust institutional framework involves delineating clear roles and responsibilities across various institutions to ensure smooth project execution and management—a task that presents significant challenges in practice.
3. Community-Centric Approaches: Ensuring that community needs (in particular, the vulnerable sections of the society) and inputs are central to planning and implementation processes.

7.3.2 Implementation Considerations

1. Monitoring and Evaluation: Implementing rigorous monitoring and evaluation mechanisms to track project progress, identify issues early, and make necessary adjustments. This also involves having a robust asset management system in place to keep track of the investments, the life span of created assets, the funding requirements for operations and replacement of the critical assets at the end of the life span.
2. Capacity Building: Investing in capacity building for local government officials (not just hiring the consultant's team which are disengaged as the projects nears completion) and stakeholders to enhance their skills and knowledge for effective project management, operations and maintenance activities.
3. Public-Private Partnerships: Encouraging public-private partnerships to leverage private sector expertise and resources for urban development projects.

The scope for scaling up successful projects includes enhanced solutions in existing areas: providing better solutions in areas already developed under the Smart Cities Mission to further improve their impact. Empirical evidence from the projects in Nashik, Coimbatore, and Puducherry shows significant improvements in urban aesthetics, environmental sustainability, and socio-economic benefits. These improvements contribute to a better quality of life for residents, showcasing the potential of well-planned and executed smart cities projects to transform urban environments.

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9. ANNEXURES

The list of annexures is provided below:

9.1 Site Selection Parameters

9.2 Stakeholders Survey/Interview

9.3 User Survey Questionnaires

9.4 Waterfront Development Observation Survey Questionnaire

9.5 Lakefront Development User Experience Survey Questionnaire

9.1 Site Selection Parameters

The primary criteria for site selection encompassed the total number of projects undertaken within the framework of the Smart Cities Mission, with a specific focus on those under the Area-Based Development (ABD) intervention sector, scale of intervention and significance of the cities. Additionally, a mutual agreement was established between the Institute and Smart City officials to ensure coordination in site selection, thereby preventing any overlaps in the impact assessment study.

Based on in-house analysis of the smart cities, Nashik (Riverfront Development), Coimbatore (Lakefront Development) and Puducherry (Beachfront Development) were considered as potential cities for assessment of projects under Smart Cities Mission.

Table 13: Sector Wise Riverfront Development Projects in Smart Cities

Smart Cities	Area Development	Economic Development	Non-Motorised Transport and Walkability	Sewerage and Septage	Social Sectors Health and Education	Urban Transport	Water Supply	Total Projects
Ahmedabad	1	-	-	-	-	-	-	1
Ajmer	1	-	-	-	-	-	-	1
Amaravati	1	-	-	-	-	-	-	1
Bilaspur	1	-	-	-	-	-	-	1
Dahod	1	-	-	-	-	-	-	1
Davanagere	-	-	-	-	-	-	2	2
Imphal	3	-	1	1	-	-	-	5
Indore	3	1	-	-	-	1	-	5
Itanagar	1	-	-	-	-	-	-	1
Jammu	2	-	-	-	-	-	1	3
Madurai	-	1	-	-	-	-	-	1
Mangaluru	-		1			-	-	1
Nagpur	-	-	-	1	-	-	-	1
Nashik	2	-	-	2	-	-	-	4
Panaji	1	-	1	-	-	-	-	2
Pasighat	2	-	-	-	-	-	-	2
Patna	1	-	-	-	-	-	-	1
Prayagraj	1	-	-	-	-	-	-	1
Saharanpur		-	-	-	-	1	-	1
Salem	2	-	-	-	-	-	-	2
Shivamogga	2	1	-		1	1	-	6
Srinagar	2	2	-	-	-	1	-	5
Tiruchirappalli	4	-	-	-	-	-	-	4
Tirunelveli	1	-	-	-	-	-	-	1
Tiruppur	1	-	-	-	-	-	-	1
Udaipur	1	-	-	-	-	-	-	1
Varanasi	-	1	-	-	-	-	-	1
Grand Total	34	6	3	4	1	4	3	60

Source: Compiled by SPA Delhi, 2024

Table 14: Sector Wise Lakefront Development Projects in Smart Cities

Smart Cities	Area Development	Economic Development	Energy	Environment Including Pollution	Non-Motorised Transport and Walkability	Sewerage and Septage	Social Sectors Health and Education	Urban Transport	Water Supply	Total Projects
Agartala	1		1							2
Ajmer	2									2
Atal Nagar	2									2
Bareilly						1				1
Belagavi	4									4
Bengaluru							1			1
Bhopal			2					1		3
Bhubaneswar								1		1
Bilaspur			1			1				2
Coimbatore	8	1								9
Davanagere	2					1			1	4
Faridabad	5				1					6
Greater Warangal	7			2						9
Hubballi-Dharwad	3									3
Jabalpur	2					1				3
Jaipur	1									1
Kalyan-Dombivali	1									1
Kanpur		1								1
Karnal	2									2
Mangaluru	3									3
Muzaffarpur	3									3
Patna	1									1
Raipur	2			3						5
Rajkot	7									7
Sagar				1						1
Salem	4					2				6
Satna	1									1
Solapur	3									3
Srinagar	2							1		3
Thane	6									6
Tirunelveli	2									2
Tirupati	7	5						1		13
Tumakuru	2	1		2			1			6
Udaipur				1				1		2

Smart Cities	Area Development	Economic Development	Energy	Environment Including Pollution	Non-Motorised Transport and Walkability	Sewerage and Septage	Social Sectors Health and Education	Urban Transport	Water Supply	Total Projects
Ujjain				1	1	1				3
Vadodara		1								1
Vellore	1									1
Grand Total	84	9	4	10	2	7	2	5	1	124

Source: Compiled by SPA Delhi, 2024

Table 15: Sector Wise Beachfront Development Projects in Smart Cities

Smart Cities	**Area Development**	**Economic Development**	**Energy**	**Non-Motorised Transport and Walkability**	**Urban Transport**	**Total Projects**
Diu	1					1
Kochi				1		1
Panaji	1					1
Port Blair		1				1
Puducherry	6		1		1	8
Thoothukudi	1	1	1	1		4
Visakhapatnam	2					2
Grand Total	11	2	2	2	1	18

Source: Compiled by SPA Delhi, 2024

Riverfront Development Projects

The riverfront development project in Nashik, focusing on de-silting and infrastructure development along the Goda river, makes it a compelling case study for showcasing how urban revitalization can be integrated with environmental conservation efforts. The project's potential to transform the riverfront area into a vibrant public space while addressing concerns like water quality and flood mitigation offers valuable insights for other cities with similar challenges.

The Nashik Riverfront Development, particularly focusing on the Godavari River, is a significant initiative aimed at enhancing the urban landscape and promoting tourism in Nashik, Maharashtra.

Key Components of the Godavari Riverfront Development

1. Beautification and Infrastructure Upgrade:

The project encompasses beautification efforts along the Godavari River, including cobble stone paving, stone benches, cycle tracks, and tree plantations. It aims to create heritage walks and install features like a floating fountain and a jetty (Nashik Smart City 2024a; PM Gati Shakti and India Investment Grid 2023; Pawar 2022).

The overall goal is to improve water quality, increase green cover, and reduce flood risks, thus enhancing the river's ecological health and the urban environment (Nashik Smart City 2024a; CSIR-NEERI 2018; Dubey and Madan 2024).

2. Economic and Tourism Boost:

By promoting heritage and cultural tourism, the project seeks to boost the local economy. It is expected to highlight Nashik's significance on the spiritual and heritage map of India, especially in light of its status as a pilgrimage center (Nashik Smart City 2024a; PM Gati Shakti and India Investment Grid 2023).

3. Project Costs and Funding:

The beautification project is split into two major phases with estimated costs of INR 73.70 crore and INR 318 crore, funded primarily through the Smart City Fund. These investments are aimed at comprehensive upgrades to civil infrastructure around the river (Nashik Smart City 2024a; 2024b).

4. Current Status:

As of now, the beautification project is nearing completion, with significant progress reported in recent updates. This includes the enhancement of public spaces and facilities along the riverbank, which are essential for the expected increase in visitor traffic during religious festivals and events (Pawar 2022).

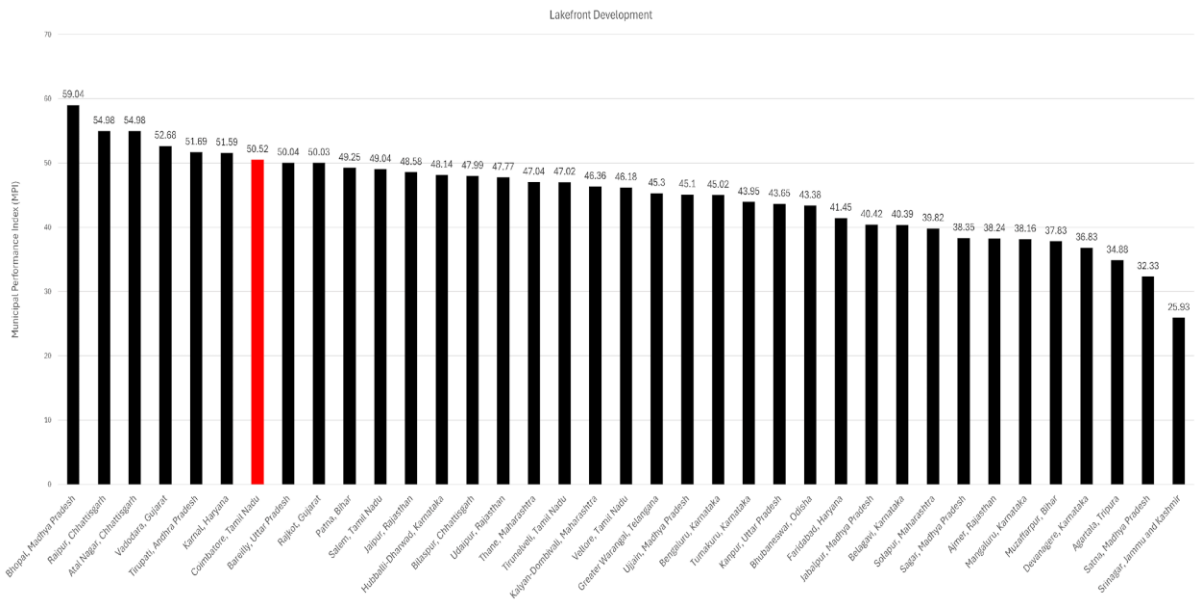
The Godavari Riverfront Development is a critical step in transforming Nashik into a more attractive urban space, fostering both local pride and economic growth through improved infrastructure and enhanced natural beauty.

Lakefront Development

The lakefront development project in Coimbatore, emphasizing lake restoration and rejuvenation, provides a valuable case study on how to leverage natural assets to enhance ecological health and recreational opportunities in urban areas. The project's potential to create attractive public spaces and promote eco-tourism can serve as a model for other cities seeking to balance urban development with environmental sustainability.

Coimbatore's Lakefront Development is a transformative initiative under the Smart Cities Mission aimed at rejuvenating seven historic lakes in the city. This project, which began in 2017, focuses on restoring the ecological balance of these lakes while creating vibrant recreational spaces for residents and visitors.

Figure 68: Municipal Performance Index (2020) Vs Cities with Lakefront Development Projects under SCM



Source: Compiled by SPA Delhi, 2024

Key Features of the Lakefront Development

1. Revitalization of Historic Lakes:

- The lakes involved in the project include Periyakulam, Krishnampathy, Selvampathy, Kumarasamy, Selvachinthamani, Valankulam, and Kurichikulam. These lakes, which date back to the Chola dynasty, were historically significant for irrigation and have been neglected over the years due to pollution and encroachment (Raj 2024; Special Correspondent 2020).

2. Investment and Progress:

- The total investment for the lake rejuvenation project is approximately ₹350 crore. As of now, about 92% of the work has been completed, with the remaining tasks expected to be finished by September 2024 (Financial Express Online 2023; Subhashini 2023).

3. Enhancements and Amenities:

- The Periyakulam Lake, the largest among them, has been particularly transformed with cycle tracks, amphitheaters for cultural events, and artworks. Other lakes have also been equipped with facilities for boating, jet skiing, and walking paths, promoting an active lifestyle among residents (Subhashini 2023; Financial Express Online 2023).

4. Environmental Impact:

- The project has significantly improved water quality through the installation of water treatment plants and has reclaimed approximately 28 acres of land for public use. Illegal encroachments have been removed, enhancing the ecological health of the lakes and attracting migratory birds (Subhashini 2023).

5. Community and Tourism Benefits:

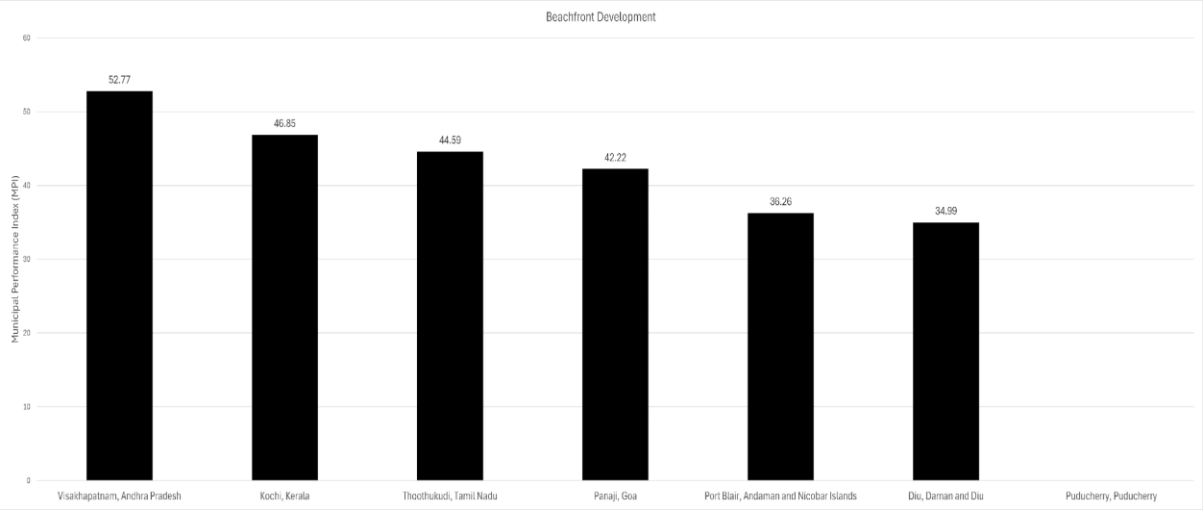
- The revitalized lakes have become popular spots for leisure activities such as jogging, yoga, and cycling, contributing to a healthier community. The initiative aims to boost tourism by encouraging visitors to explore Coimbatore beyond its transit role, enhancing the city's appeal as a destination (Financial Express Online 2023; Subhashini 2023).

While the lakefront development has made significant strides, challenges remain, including managing sewage contamination and maintaining the ecological integrity of the lakes. Addressing these issues will be crucial for the long-term success of the project and its goal of creating sustainable urban spaces in Coimbatore.

Beachfront Development

Despite the lack of complete quantitative data, Puducherry's focus on beachfront development through projects like the continuous beach promenade and dynamic LED lighting aligns well with its identity as a popular tourist destination. This strategic focus, coupled with the potential for economic growth through increased tourism, makes it a compelling case study for demonstrating how urban design and placemaking can contribute to a city's economic and social vibrancy. It also highlights the importance of considering both quantitative and qualitative factors when evaluating the potential impact of urban development projects.

Figure 69: Municipal Performance Index (2023) Vs Cities with Lakefront Development Projects under SCM



Source: Compiled by SPA Delhi, 2024

The Puducherry Beachfront Development is an ongoing initiative aimed at restoring and enhancing the coastal areas of Puducherry, addressing significant issues of erosion and environmental degradation while promoting tourism and recreation.

Key Aspects of the Beachfront Development

1. Erosion Challenges:

- Puducherry's coastline has been severely affected by erosion, with approximately 50% of the coastline experiencing erosion and several hotspots identified, including Auroville Beach and Pondy Marina Beach. The National Centre for Coastal Research (NCCR) has highlighted the vulnerability of these areas, prompting the need for urgent mitigation measures (B Nair 2023b).

2. Restoration Projects:

- The Beach Restoration Project, initiated in 2017, includes the construction of nearshore and offshore reefs designed to mitigate erosion and promote sand retention. This project involves significant beach nourishment efforts, utilizing approximately 450,000 cubic meters of sand dredged from local sources (Gov. of Puducherry, DST&E, and PCCC 2024; Thiagarajan 2021).

3. Funding and Implementation:

- The Puducherry government has sought ₹310 crore from the National Disaster Management Authority (NDMA) for further coastal protection measures. This funding aims to implement a mix of grey (hard structures like seawalls) and green (natural solutions like mangrove restoration) strategies to enhance resilience against coastal disasters (B Nair 2023a).

4. Community and Ecological Benefits:

- The beachfront development not only aims to protect the coastline but also to create recreational spaces for the community, enhancing the aesthetic and functional value of the beach areas. The project is expected to improve local biodiversity and provide spaces for cultural and community activities, making the beaches more accessible and enjoyable for residents and visitors alike (Inflibnet 2021).

5. Ongoing Challenges:

- Despite restoration efforts, the beachfront continues to face challenges from ongoing erosion. The effectiveness of the constructed reefs and nourishment strategies will be closely monitored to ensure that they meet the intended goals of stabilizing the coastline and restoring the natural beach environment (The New Indian Express 2024; Thiagarajan 2021).

These cities, each with their unique focus and potential, offer valuable insights into different approaches to urban development and revitalization leveraging their natural assets.

9.2 Hazards associated with SCM Projects

Riverfront Projects

City	State	Hazards	Source	Link
Amravati, Andhra Pradesh	*Andhra Pradesh*	*Floods, droughts, heatwaves*	*Andhra Pradesh State Disaster Management Authority (APSDMA) publications.*	*https://apsdma.ap.gov.in/files/2db5b886392dd1528f2c46bfc3a2902b.pdf*
Itanagar, Arunachal Pradesh	*Arunachal Pradesh*	*Floods, landslides, earthquakes*	*Arunachal Pradesh State Disaster Management Authority (APSDA) reports.*	*https://sdma-arunachal.in/wp-content/uploads/2020/08/SDMP-2019.pdf*
Pasighat, Arunachal Pradesh	*Arunachal Pradesh*	*Floods, landslides, earthquakes*	*Arunachal Pradesh State Disaster Management Authority (APSDA) reports.*	*https://sdma-arunachal.in/wp-content/uploads/2020/08/SDMP-2019.pdf*
Patna, Bihar	*Bihar*	*Floods, droughts*	*Bihar State Disaster Management Authority (BSDMA) publications.*	*http://bsdma.org/images/global/SDMP.pdf*
Bilaspur, Chhattisgarh	*Chhattisgarh*	*Floods, droughts*	*Chhattisgarh State Disaster Management Authority (CSDMA) reports.*	*http://sdma.cg.gov.in/index.html*
Panaji, Goa	*Goa*	*Floods, landslides, cyclones*	*Goa State Disaster Management Authority (GSDMA) reports.*	*https://sdma.goa.gov.in/sites/default/files/2024-07/State%20Disaster%20Management%20Plan%202024.pdf*
Ahmedabad, Gujarat	*Gujarat*	*Floods, droughts, heatwaves*	*Gujarat State Disaster Management Authority (GSDMA) reports.*	*http://gsdma.org/uploads/Assets/sdmp/gsdmpvolume-1final09142021055622047.pdf*
Dahod, Gujarat	*Gujarat*	*Floods, droughts, heatwaves*	*Gujarat State Disaster Management Authority (GSDMA) reports.*	*http://gsdma.org/uploads/Assets/sdmp/gsdmpvolume-1final09142021055622047.pdf*

City	State	Hazards	Source	Link
Jammu, Jammu and Kashmir	Jammu and Kashmir	Floods, landslides, earthquakes, avalanches	Jammu and Kashmir State Disaster Management Authority (JKSDMA) publications.	https://jksdma.jk.gov.in/pdfs/site/jksdmaplan.pdf
Srinagar, Jammu and Kashmir	Jammu and Kashmir	Floods, landslides, earthquakes, avalanches	Jammu and Kashmir State Disaster Management Authority (JKSDMA) reports	https://jksdma.jk.gov.in/pdfs/site/jksdmaplan.pdf
Devanagere, Karnataka	Karnataka	Floods, droughts	Karnataka State Disaster Management Authority (KSDMA) publications.	https://webapps.bbmpgov.in/dm-apply/Images/final-english-ksdmp-2019-20.pdf
Mangaluru, Karnataka	Karnataka	Floods, landslides, cyclones	Karnataka State Disaster Management Authority (KSDMA) publications.	https://webapps.bbmpgov.in/dm-apply/Images/final-english-ksdmp-2019-20.pdf
Shivamogga, Karnataka	Karnataka	Floods, landslides	Karnataka State Disaster Management Authority (KSDMA) publications.	https://webapps.bbmpgov.in/dm-apply/Images/final-english-ksdmp-2019-20.pdf
Indore, Madhya Pradesh	Madhya Pradesh	Floods, droughts	Madhya Pradesh State Disaster Management Authority (MPSDMA) reports.	https://www.mpsdma.mp.gov.in/uploads/media/MP-SDMP-2307141.pdf
Nashik, Maharashtra	Maharashtra	Floods, droughts	Maharashtra State Disaster Management Authority (MSDMA) publications.	https://www.maharashtra.gov.in/Site/Upload/PDF/SDMP.pdf
Kalyan, Maharashtra	Maharashtra	Floods, cyclones	Maharashtra State Disaster Management Authority (MSDMA) publications.	https://www.maharashtra.gov.in/Site/Upload/PDF/SDMP.pdf
Imphal, Manipur	Manipur	Floods, landslides, earthquakes	Manipur State Disaster Management Authority (MSDMA) publications.	https://manipur.gov.in/wp-content/uploads/2020/03/ie-dm-plan.pdf

City	State	Hazards	Source	Link
Ajmer, Rajasthan	*Rajasthan*	*Droughts, heatwaves*	*Rajasthan State Disaster Management Authority (RSDMA) reports.*	*https://dmrelief.rajasthan.gov.in/documents/sdmp-eng.pdf*
Udaipur, Rajasthan	*Rajasthan*	*Floods, droughts*	*Rajasthan State Disaster Management Authority (RSDMA) reports.*	*https://dmrelief.rajasthan.gov.in/documents/sdmp-eng.pdf*
Madurai, Tamil Nadu	*Tamil Nadu*	*Floods, droughts, cyclones*	*Tamil Nadu State Disaster Management Authority (TNSDMA) reports.*	*https://www.thehindu.com/news/resources/66656729-Disaster-Management-Plan-Book.pdf*
Salem, Tamil Nadu	*Tamil Nadu*	*Floods, droughts*	*Tamil Nadu State Disaster Management Authority (TNSDMA) reports.*	*https://www.thehindu.com/news/resources/66656729-Disaster-Management-Plan-Book.pdf*
Tiruchirappalli, Tamil Nadu	*Tamil Nadu*	*Floods, cyclones*	*Tamil Nadu State Disaster Management Authority (TNSDMA) reports.*	*https://www.thehindu.com/news/resources/66656729-Disaster-Management-Plan-Book.pdf*
Tirunelveli, Tamil Nadu	*Tamil Nadu*	*Floods, cyclones*	*Tamil Nadu State Disaster Management Authority (TNSDMA) reports.*	*https://www.thehindu.com/news/resources/66656729-Disaster-Management-Plan-Book.pdf*
Tiruppur, Tamil Nadu	*Tamil Nadu*	*Floods, droughts*	*Tamil Nadu State Disaster Management Authority (TNSDMA) reports.*	*https://www.thehindu.com/news/resources/66656729-Disaster-Management-Plan-Book.pdf*

City	State	Hazards	Source	Link
Prayagraj, Uttar Pradesh	*Uttar Pradesh*	*Floods, droughts, heatwaves*	*Uttar Pradesh State Disaster Management Authority (UPSDA) reports.*	*https://upsdma.up.nic.in/2023/SDMP-POLICY.pdf*
Saharanpur, Uttar Pradesh	*Uttar Pradesh*	*Floods, droughts*	*Uttar Pradesh State Disaster Management Authority (UPSDA) reports.*	*https://upsdma.up.nic.in/2023/SDMP-POLICY.pdf*
Varanasi, Uttar Pradesh	*Uttar Pradesh*	*Floods*	*Uttar Pradesh State Disaster Management Authority (UPSDA) reports.*	*https://upsdma.up.nic.in/2023/SDMP-POLICY.pdf*

Lakefront Projects

City	State	Hazards	Source	Link
Tirupati, Andhra Pradesh	*Andhra Pradesh*	*Floods, cyclones*	*Andhra Pradesh State Disaster Management Authority (APSDMA) publications.*	*https://apsdma.ap.gov.in/files/2db5b886392dd1528f2c46bfc3a2902b.pdf*
Muzaffarpur, Bihar	*Bihar*	*Floods, droughts*	*Bihar State Disaster Management Authority (BSDMA) publications.*	*http://bsdma.org/images/global/SDMP.pdf*
Patna, Bihar	*Bihar*	*Floods, droughts*	*Bihar State Disaster Management Authority (BSDMA) reports.*	*http://bsdma.org/images/global/SDMP.pdf*
Atal Nagar, Chhattisgarh	*Chhattisgarh*	*Floods, droughts*	*Chhattisgarh State Disaster Management Authority (CSDMA) reports.*	*http://sdma.cg.gov.in/SDMP%20English.pdf*
Bilaspur, Chhattisgarh	*Chhattisgarh*	*Floods, droughts*	*Chhattisgarh State Disaster Management Authority (CSDMA) reports.*	*http://sdma.cg.gov.in/SDMP%20English.pdf*

City	State	Hazards	Source	Link
Raipur, Chhattisgarh	Chhattisgarh	Floods, droughts	Chhattisgarh State Disaster Management Authority (CSDMA) publications.	http://sdma.cg.gov.in/SDMP%20English.pdf
Rajkot, Gujarat	Gujarat	Floods, droughts, heatwaves	Gujarat State Disaster Management Authority (GSDMA) reports.	http://gsdma.org/uploads/Assets/sdmp/gsdmpvolume-1final09142021055622047.pdf
Vadodara, Gujarat	Gujarat	Floods, droughts, heatwaves	Gujarat State Disaster Management Authority (GSDMA) reports.	http://gsdma.org/uploads/Assets/ddmp/vadodaraddmp2017-18part-207122017032923531.pdf
Faridabad, Haryana	Haryana	Floods, droughts, heatwaves	Haryana State Disaster Management Authority (HSDMA) reports.	https://cdn.s3waas.gov.in/s305049e90fa4f5039a8cadc6acbb4b2cc/uploads/2018/05/2018051750-1.pdf
Karnal, Haryana	Haryana	Floods, droughts, heatwaves	Haryana State Disaster Management Authority (HSDMA) reports.	https://karnal.gov.in/document-category/disaster-management-plan/
Srinagar, Jammu and Kashmir	Jammu and Kashmir	Floods, landslides, earthquakes, avalanches	Jammu and Kashmir State Disaster Management Authority (JKSDMA) reports.	https://jksdma.jk.gov.in/pdfs/site/jksdmaplan.pdf
Belagavi, Karnataka	Karnataka	Floods, droughts	Karnataka State Disaster Management Authority (KSDMA) reports.	https://webapps.bbmpgov.in/dm-apply/Images/final-english-ksdmp-2019-20.pdf
Bengaluru, Karnataka	Karnataka	Floods, droughts	Bengaluru Urban District Disaster Management Plan.	https://webapps.bbmpgov.in/dm-apply/Images/final-english-ksdmp-2019-20.pdf
Devanagere, Karnataka	Karnataka	Floods, droughts	Karnataka State Disaster Management Authority (KSDMA) reports.	https://webapps.bbmpgov.in/dm-apply/Images/final-english-ksdmp-2019-20.pdf

City	State	Hazards	Source	Link
Hubballi-Dharwad, Karnataka	Karnataka	Floods, droughts	Karnataka State Disaster Management Authority (KSDMA) publications.	https://webapps.bbmpgov.in/dm-apply/Images/final-english-ksdmp-2019-20.pdf
Mangaluru, Karnataka	Karnataka	Floods, landslides, cyclones	Karnataka State Disaster Management Authority (KSDMA) reports.	https://webapps.bbmpgov.in/dm-apply/Images/final-english-ksdmp-2019-20.pdf
Tumakuru, Karnataka	Karnataka	Floods, droughts	Karnataka State Disaster Management Authority (KSDMA) reports.	https://webapps.bbmpgov.in/dm-apply/Images/final-english-ksdmp-2019-20.pdf
Bhopal, Madhya Pradesh	Madhya Pradesh	Floods, droughts	Madhya Pradesh State Disaster Management Authority (MPSDMA) reports.	https://www.mpsdma.mp.gov.in/uploads/media/MP-SDMP-2307141.pdf
Jabalpur, Madhya Pradesh	Madhya Pradesh	Floods, droughts	Madhya Pradesh State Disaster Management Authority (MPSDMA) reports.	https://www.mpsdma.mp.gov.in/uploads/media/MP-SDMP-2307141.pdf
Sagar, Madhya Pradesh	Madhya Pradesh	Floods, droughts	Madhya Pradesh State Disaster Management Authority (MPSDMA) publications.	https://www.mpsdma.mp.gov.in/uploads/media/MP-SDMP-2307141.pdf
Satna, Madhya Pradesh	Madhya Pradesh	Floods, droughts	Madhya Pradesh State Disaster Management Authority (MPSDMA) publications.	https://www.mpsdma.mp.gov.in/uploads/media/MP-SDMP-2307141.pdf
Ujjain, Madhya Pradesh	Madhya Pradesh	Floods, droughts	Madhya Pradesh State Disaster Management Authority (MPSDMA) publications.	https://www.mpsdma.mp.gov.in/uploads/media/MP-SDMP-2307141.pdf
Kalyan-Dombivali, Maharashtra	Maharashtra	Floods, landslides, cyclones	Maharashtra State Disaster Management Authority (MSDMA) reports.	https://www.maharashtra.gov.in/Site/Upload/PDF/SDMP.pdf

City	State	Hazards	Source	Link
Solapur, Maharashtra	*Maharashtra*	*Floods, droughts*	*Maharashtra State Disaster Management Authority (MSDMA) reports.*	*https://www.maharashtra.gov.in/Site/Upload/PDF/SDMP.pdf*
Thane, Maharashtra	*Maharashtra*	*Floods, landslides, cyclones*	*Maharashtra State Disaster Management Authority (MSDMA) publications.*	*https://www.maharashtra.gov.in/Site/Upload/PDF/SDMP.pdf*
Bhubaneswar, Odisha	*Odisha*	*Floods, cyclones*	*Odisha State Disaster Management Authority (OSDMA) reports.*	*https://www.bmc.gov.in/download-docs*
Ajmer, Rajasthan	*Rajasthan*	*Droughts, heatwaves*	*Rajasthan State Disaster Management Authority (RSDMA) publications.*	*https://dmrelief.rajasthan.gov.in/documents/sdmp-eng.pdf*
Jaipur, Rajasthan	*Rajasthan*	*Droughts, heatwaves*	*Rajasthan State Disaster Management Authority (RSDMA) publications.*	*https://dmrelief.rajasthan.gov.in/documents/sdmp-eng.pdf*
Udaipur, Rajasthan	*Rajasthan*	*Floods, droughts*	*Rajasthan State Disaster Management Authority (RSDMA) reports.*	*https://dmrelief.rajasthan.gov.in/documents/sdmp-eng.pdf*
Coimbatore, Tamil Nadu	*Tamil Nadu*	*Floods, cyclones*	*Tamil Nadu State Disaster Management Authority (TNSDMA) publications.*	*https://www.thehindu.com/news/resources/66656729-Disaster-Management-Plan-Book.pdf*
Salem, Tamil Nadu	*Tamil Nadu*	*Floods, droughts*	*Tamil Nadu State Disaster Management Authority (TNSDMA) reports.*	*https://www.thehindu.com/news/resources/66656729-Disaster-Management-Plan-Book.pdf*
Tirunelveli, Tamil Nadu	*Tamil Nadu*	*Floods, cyclones*	*Tamil Nadu State Disaster Management Authority (TNSDMA) reports.*	*https://www.thehindu.com/news/resources/66656729-Disaster-Management-Plan-Book.pdf*

City	State	Hazards	Source	Link
Vellore, Tamil Nadu	*Tamil Nadu*	*Floods, cyclones*	*Tamil Nadu State Disaster Management Authority (TNSDMA) reports.*	*https://www.thehindu.com/news/resources/66656729-Disaster-Management-Plan-Book.pdf*
Greater Warangal, Telangana	*Telangana*	*Floods, droughts*	*Telangana State Disaster Management Authority (TSDMA) reports.*	*https://warangal.telangana.gov.in/disaster-management/*
Agartala, Tripura	*Tripura*	*Floods, landslides*	*Tripura State Disaster Management Authority (TSDMA) reports.*	*https://cdn.s3waas.gov.in/s39fe8593a8a330607d76796b35c64c600/uploads/2024/07/2024071893.pdf*
Bareilly, Uttar Pradesh	*Uttar Pradesh*	*Floods, droughts, heatwaves*	*Uttar Pradesh State Disaster Management Authority (UPSDA) publications.*	*https://upsdma.up.nic.in/2023/SDMP-POLICY.pdf*
Kanpur, Uttar Pradesh	*Uttar Pradesh*	*Floods, droughts, heatwaves*	*Uttar Pradesh State Disaster Management Authority (UPSDA) reports.*	*https://upsdma.up.nic.in/2023/SDMP-POLICY.pdf*

Beachfront Projects

City	State	Hazards	Source
Andaman and Nicobar Islands	*Tsunami/Cyclone*	*Indian Meteorological Department (IMD) reports on seismic activity and tsunamis.*	*https://ddm.and.nic.in/Files/Disaster_Mgmt_Plan_2016_New.pdf*
Andhra Pradesh	*Tsunami/Cyclone/Floods*	*Andhra Pradesh State Disaster Management Authority (APSDMA) publications on cyclones and drought.*	*https://apsdma.ap.gov.in/files/2db5b886392dd1528f2c46bfc3a2902b.pdf*
Daman and Diu	*Cyclone/ Flood/ Earthquake*	*National Disaster Management Authority (NDMA) reports on coastal hazards.*	*https://daman.nic.in/ddfesnew/documents/Disaster-Management-Action-Plan.pdf*

Goa	*Flood, Cyclonic Storms, Earthquake Landslide, Mining hazards and Sea Erosion*	*Goa State Disaster Management Authority (GSDMA) reports on coastal erosion and flooding.*	*https://sdma.goa.gov.in/sites/default/files/2024-07/State%20Disaster%20Management%20Plan%202024.pdf*
Kerala	*floods*	*Kerala State Disaster Management Authority (KSDMA) publications on floods and landslides.*	*https://sdma.kerala.gov.in/wp-content/uploads/2018/11/Kerala%20State%20Disaster%20Management%20Plan%202016.pdf*
Puducherry	*Cyclone, Flood / Heavy Rainfall, Tsunami, Fire, Industrial & Chemical hazards.*	*Puducherry Disaster Management Plan by the government.*	*https://cdn.s3waas.gov.in/s3b4288d9c0ec0a1841b3b3728321e7088/uploads/2023/11/2023112829.pdf*
Tamil Nadu	*Floods,cyclone,Sea erosion*	*Tamil Nadu State Disaster Management Authority (TNSDMA) reports on floods and cyclones.*	*https://www.thehindu.com/news/resources/66656729-Disaster-Management-Plan-Book.pdf*

9.3 Stakeholders Survey/Interview

NMSCDCL

1. Mr. Krishna Kumar Jha, Dy. General Manger (civil)
2. Mr. Sadek Shaikh, Dy. General Manager (finance)
3. Mr. Rajaram Hire, Project Manager Civil
4. Mr. Durgesh Ozarkar, Project Manager Civil

Puducherry Smart City Development Limited

1. 1.Mr. Jayant Kumar Ray, IAS, Chief Executive Officer
2. Mr. P. Rudra Goud, Jt. Chief Executive Officer
3. Mr. R. Ravichandran, Chief Technical Officer (Civil)
4. Mr. S. Thulasingam, General Manager (Projects)
5. Mr. J. Somasundaram, Manager (Technical)
6. Ms. V. Chitra, Manager (Technical)
7. Mr. R. Murali, Chief Technical Officer (Electrical)
8. Mr. P. Subbarayal, Manager (Electrical)

Coimbatore Smart City Limited and Coimbatore City Municipal Corporation

1. Mr. Anbalagan, Chief Engineer, Coimbatore City Municipal Corporation
2. Mr. Baskar, General Manager, Coimbatore Smart City Limited
3. Mr. Nagarajan, Deputy Manager, Coimbatore City Municipal Corporation

9.4 User Survey Questionnaire

General Information

- Name (Optional)
- Age
- Sex
- User Category (Select one):
    - Tourist (Domestic/International)
    - Local Resident (Length of residency in the city: _____ years)
    - Business Owner (Type of Business: _____)
    - Livelihood Dependent (e.g., fisherman, vendor) (Nature of Livelihood: _____)
    - Religious User (Religious Affiliation: _____)
    - Other (Please specify)

Frequency of Visits & Activities

- How often do you visit the waterfront development?
    - Daily
    - Weekly
    - Monthly
    - Less Often (If less often, how frequently: _____ times per year)
- What activities do you typically do at the waterfront? (Select all that apply)
    - Walking
    - Jogging
    - Biking
    - Picnics
    - Boating (Please specify type: Kayak/Paddleboard/Motorboat etc.)
    - Fishing (Recreational/Commercial)
    - Shopping
    - Dining (Type of Cuisine: _____)
    - Attending Events (Type of Events: Concerts/Festivals/Markets etc.)
    - Sightseeing (Specify landmarks/areas of interest)
    - Religious Activities (Specify)
    - Others (Please Specify): _____

Accessibility & Amenities

- How easy is it to get to the waterfront development using public transportation? (Very Easy/Somewhat Easy/Difficult/Not Available)
- Is there ample parking available for visitors? (Yes/No)
- If yes, is the parking fee reasonable? (Yes/No)
- How accessible is the waterfront development for people with disabilities (ramps, accessible restrooms)? (Very Accessible/Somewhat Accessible/Not Accessible)
- Are there clean and well-maintained public restrooms available? (Yes/No)
- Are there designated areas for picnicking and barbecuing? (Yes/No)
- Are there changing rooms and showers available for water-based activities? (Yes/No)
- Is there a designated area for pet owners to walk their dogs? (Yes/No)

Economic Impact

1. Business Owner

- How has the waterfront development project impacted your business (increased sales, foot traffic, etc.)? (Positively/Negatively/No Impact)
- Please elaborate on your response: _____

2. Livelihood Dependent

- If applicable, have you been able to secure permits or licenses to operate within the waterfront area (e.g., fishing licenses)? (Yes/No)
- If no, what challenges have you faced in obtaining these permits? _____

3. Local Resident

- Do you believe the development project has created new job opportunities in the area? (Yes/No)
- If yes, in what sectors are these jobs concentrated (tourism, hospitality, retail, etc.)? _____

4. Tourist

- How much money do you typically spend during your visits to the waterfront development (e.g., on food, souvenirs, activities)? (Less than $25/$25-$50/$50-$100/More than $100)

Aesthetics & Design

- How would you rate the overall aesthetic appeal of the waterfront development? (Very Attractive/Somewhat Attractive/Neutral/Somewhat Unattractive/Very Unattractive)
- Are there any design elements you find particularly appealing or unappealing? (Yes/No)
- If yes, please describe them and explain why: _____
- Does the waterfront development feel integrated with the surrounding environment, or does it appear out of place? (Integrated/Out of Place)

Safety & Security

- Do you feel safe and secure using the waterfront development, day and night? (Daytime/Nighttime/Both)
- Have you witnessed any incidents of crime or antisocial behavior at the waterfront? (Yes/No)
- If yes, please describe the incident(s): _____
- Is there a visible presence of security personnel at the waterfront? (Yes/No)

Environmental Sustainability

- How would you rate the overall cleanliness of the waterfront area (water and land)? (Very Clean/Somewhat Clean/Somewhat Dirty/Very Dirty)

- Have you noticed any efforts to reduce pollution and promote environmental sustainability in the development project? (Yes/No)
- If yes, please describe the specific practices you observed (e.g., recycling bins, energy-efficient lighting, use of sustainable materials): _____
- How concerned are you about the potential environmental impact of the development project on the water quality, wildlife habitat, and surrounding ecosystem? (Very Concerned/Somewhat Concerned/Neutral/Not Concerned)
- Are there sufficient green spaces and trees incorporated into the waterfront development to mitigate the urban heat island effect and provide shade? (Yes/No)
- If no, how could the project be improved in this aspect? (Optional): _____

Cultural Integration & Community

1. Religious User

- Does the design of the waterfront development respect and accommodate the cultural and religious practices associated with the waterfront? (Yes/No)
- If no, please elaborate on how it could be improved: _____

2. All Users

- Do you feel a sense of community at the waterfront development, or does it feel impersonal and isolating? (Strong Sense of Community/Somewhat Sense of Community/Neutral/Not Sense of Community)
- Are there opportunities for public events, festivals, or cultural programs at the waterfront that celebrate the local heritage and diversity? (Yes/No)
- If yes, would you like to see more of these events? (Yes/No)

Future Development & Management

- What additional amenities or facilities would you like to see incorporated into the waterfront development in the future? (Open ended)
- How can the management of the waterfront development be improved to better serve the needs of the community and visitors? (Open ended)
- Would you be interested in participating in future planning or advisory boards related to the waterfront development? (Yes/No)
- If yes, please provide your contact information (Optional): _____

Additional Comments

- Please use this space to share any additional thoughts, suggestions, or concerns you may have regarding the waterfront development project.

9.5 Waterfront Development Observation Survey Questionnaire

Locational Information

- Date:
- Time:
- Location: Please mark the specific location on the provided map.

Environmental

1. Vulnerability
   - Does the surrounding area appear at risk of flooding from rising sea levels?
     - Yes
     - No
   - If yes, explain why you think this area is vulnerable: [Text box]
2. Sea Level Rise Features
   - Does the development project incorporate any features to address sea level rise (e.g., levees, elevated structures, bunds)?
     - Yes
     - No
3. Storm Surges
   - Have you noticed any visible signs of past storm surge damage (e.g., debris lines, damaged structures)?
     - Yes
     - No
4. Microclimate
   - How would you describe the wind patterns today?
     - Calm
     - Breezy
     - Windy
   - Compared to other areas you know, does the waterfront seem windier or calmer?
     - Windier
     - Calmer
     - Similar
5. Pollutant Levels (Dust)
   - How noticeable is dust in the air?
     - Very noticeable
     - Somewhat noticeable
     - Not noticeable
   - Are there any visible sources of dust (e.g., construction activities, unpaved roads)?
     - Yes
     - No
6. Pollutant Levels (Noise):
   - How would you describe the noise level at the waterfront?
     - Very quiet
     - Quiet
     - Somewhat noisy
     - Noisy
     - Very noisy

- What are the main sources of noise you hear (e.g., traffic, construction, recreation)? [Text box]

7. Land Use Change

Compared to how this area was used before the development project, how has the land use changed? (e.g., industrial to recreational, vacant to residential)? What are the current surrounding landuses? [Text box]

8. Water Quality:

- How clear is the water?
    - Very clear
    - Clear
    - Slightly cloudy
    - Cloudy
    - Very cloudy
- Have you noticed any visible pollutants in the water (e.g., garbage, oil slicks)?
    - Yes
    - No
- If yes, please specify the type and location of the pollutants: [Text box]

9. Riparian Buffer:

- Is there a natural vegetated area along the bank of the river (riparian buffer)?
    - Yes
    - No
- If yes, how wide is the buffer zone (estimate in meters)? [Number]
- Does the buffer appear healthy (lush vegetation) or degraded (sparse vegetation)?
    - Healthy (lush vegetation)
    - Degraded (sparse vegetation)

10. Habitat:

- Have you observed any wildlife (birds, fish, etc.) in or around the water?
    - Yes
    - No
- If yes, please list the types of wildlife you observed: [Text box]
- Do you think that the project has led to modification of species habitat that can have a negative impact? (e.g., Fragmentation, destruction, etc.) [Yes/No]
- Do you think that the project has led to modification of specie habitat that can have a positive impact? (e.g., Greening, improved water availability, more animals/birds using the WFD area?) [Yes/No]

11. Additional Observations (Environmental):

- Have you noticed any other environmental concerns related to the waterfront development project?
    - Yes
    - No
- If yes, please describe your observations: [Text box]

Social

1. Accessibility

- Is the waterfront development easily accessible for people with disabilities (ramps, accessible restrooms)?
    - Yes
    - No
- How easy is it for pedestrians to access the waterfront?

    - Very easy
    - Somewhat easy
    - Difficult
- How easy is it for cyclists to access the waterfront?
    - Very easy
    - Somewhat easy
    - Difficult

2. Safety

- Do you feel safe and secure using the waterfront development?
    - Very safe
    - Somewhat safe
    - Not safe
- Are there any areas that seem particularly unsafe?
    - Yes
    - No
- If yes, please describe the location and safety concerns:

3. Recreational Opportunities:

- What types of recreational activities are available at the waterfront? (Select all that apply)
    - Walking
    - Biking
    - Boating
    - Fishing
    - Other (please specify): [Text box]
- Does the variety of activities seem adequate for different user groups?
    - Yes
    - No
- Are there designated areas for different activities (e.g., swimming areas, dog parks)?
    - Yes
    - No

4. Inclusivity

- Does the waterfront development seem welcoming to people of all ages, backgrounds, and abilities?
    - Yes
    - No
- Are there any aspects of the development that could be exclusionary?
    - Yes
    - No
- If yes, please describe your observations: [Text box]

5. Community Involvement:

- Were there opportunities for the community to provide input during the development process?
    - Yes
    - No
- Do you see evidence of ongoing community involvement in the use and management of the waterfront?
    - Yes

- No

6. Impact on Livelihoods:

- Has the development project created new job opportunities in the area (e.g., restaurants, shops, tourism)?
  - Yes
  - No
- If yes, are these jobs accessible to a variety of skill levels?
  - Yes
  - No

7. Aesthetic Quality

- How would you describe the overall aesthetic quality of the waterfront development?
  - Very attractive
  - Somewhat attractive
  - Neutral
  - Somewhat unattractive
  - Very unattractive
- Are there any design elements that you find particularly appealing or unappealing?
  - Yes
  - No
- If yes, please describe them: [Text box]

8. Social Cohesion:

- Does the waterfront development seem to be a place where people gather and socialize?
  - Yes
  - No
- Are there any design features that encourage social interaction?
  - Yes
  - No
- If yes, please describe them: [Text box]

Economic

1. Investments

- Are there any visible signs of new investments in the area (e.g., new construction, renovations)?
  - Yes
  - No

2. Tourism

- Does the waterfront development seem to be attracting tourists?
  - Yes
  - No
- If yes, what types of tourist activities do you observe? (Select all that apply)
  - Sightseeing
  - Dining
  - Recreation (e.g., boating, fishing)
  - Other (please specify): [Text box]

3. River Economy:

- Does the development project incorporate any elements that support the river economy (e.g., fishing, boating)?

- Yes
- No

- If yes, please describe them: [Text box]

Infrastructure

1. Transportation

- Is there adequate public transportation to serve the number of visitors to the waterfront?
  - Yes
  - No

2. Water Supply

- Is there a reliable source of clean water for the development project?
  - Yes
  - No

3. Sanitation

- Can you observe improper sewage management?
  - Yes
  - No

4. Waste Management

- Do you see littering?
  - Yes
  - No

5. Electrical Grid Capacity

- Is there sufficient electrical capacity to meet the needs of the development project?
  - Yes
  - No

6. Telecommunication

- Is there good cell phone and internet reception at the waterfront?
  - Yes
  - No

7. Drainage

- Does the development project have a well-functioning drainage system to prevent flooding?
  - Yes
  - No

8. Floodplain Management

- Are there any visible measures in place to manage potential flooding (e.g., levees, flood walls)?
  - Yes
  - No
- If yes, do these measures appear to be well-maintained?
  - Yes
  - No

Sustainability

1. Wastewater Reuse

- Are there any systems in place to reuse wastewater for irrigation or other purposes?
  - Yes
  - No

2. Return Flow
    - Is there a healthy flow of water between the river and the surrounding area?
        - Yes
        - No

3. Eco-friendly Riverfront Development
    - Are there any elements of the development project that appear to be designed with ecological sustainability in mind?
        - Yes
        - No
        - If yes, please describe them: [Text box]

4. Riparian Buffer Coverage (%)
    - Estimate the percentage of the shoreline with a natural vegetated buffer zone (enter a number between 0 and 100): [Number]

5. Return Flow Achieved (%) (If applicable)

Estimate the percentage of planned return flow that is being achieved (enter a number between 0 and 100): [Number]

Technology

1. Integration of Smart Technologies:
    - Are there any smart technologies being used to monitor water quality, manage waste, or improve energy efficiency?
        - Yes
        - No
        - If yes, please describe the types of technologies you observed: [Text box]

2. Innovative Construction Materials
    - Were any innovative or sustainable construction materials used in the development project?
        - Yes
        - No
        - If yes, please describe them: [Text box]

3. Digital Signage
    - Are there digital signs present at the waterfront development for information or public engagement?
        - Yes
        - No
    - If yes, do they seem informative and user-friendly?
        - Yes
        - No

9.6 Lakefront Development User Experience Survey Questionnaire

General Information

- Name (Optional)
- Age
- Sex
    - Male
    - Female
    - Others
- Occupation
    - Student
    - Self Employed
    - Salaried
    - Unemployed
    - Retired
    - Homemaker
- Monthly Household Income
    - Less than Rs.10,000
    - Rs. 10,000 - Rs.50,000
    - Rs. 50,000 - 1lakh
    - More than 1 lakh
- Local Resident (Length of residency in the city in years)
- Which Lake do you like visiting the most
    - Periyakulam
    - Valankulam
    - Chinnakulam
    - Krishnampathy
    - Selvachintamani
    - Selvampathy
    - Kumaraswamy
    - Narsampathy
    - Singanallur
    - Kurichikulam
    - Other:
- You usually visit
    - Alone
    - with Friends
    - with family
    - Other:

Frequency of visits & Activity

- Purpose of visit
    - Religious
    - Leisure

    - Work
    - Other:
- Reason for visiting the selected lake:
    - Near home
    - Water sport
    - Peace and Quiet
    - Birdwatching
    - Good walking and jogging track
    - Availability of parking
    - Other:
- How often do you visit the Lake?
    - Daily
    - Weekly
    - Monthly
    - Less often
    - Other:
- What activities do you typically do at the lakefront?
    - Walking
    - Jogging
    - Cycling
    - Picnics
    - Boating
    - Fishing
    - Shopping
    - Sightseeing place of interest
    - Birdwatching
    - Dining
    - Attending events
    - Other:

Accessibility & Amenities

- Mode of Transport used by you to reach the lake
    - Walk
    - Cycle
    - Bike
    - Private Car
    - Taxi
    - Bus
    - Other:
- Is there ample parking available for visitors?
    - Yes
    - No
    - Other:
- How much money do you typically spend during your visits to the Lakefront development?

Aesthetics & Design

- How would you rate the overall aesthetic appeal of the lakefront development?
    - Very Attractive
    - Moderately Attractive
    - Unattractive
- Are there any design elements you find particularly appealing or unappealing? If yes, please describe them and explain why?
    - Yes
    - No
    - Other:

Safety & Security

- Do you feel safe and secure using the lakefront development? If no, mention time of the day? (In others)
    - Yes
    - No
    - Other:
- Have you witnessed any incidents of crime or antisocial behaviour at the lakefront?
    - Yes
    - No

Environmental Sustainability

- How would you rate the overall cleanliness of the lakefront area (water and land)?
    - Very Clean
    - Moderately clean
    - Dirty
    - Very Dirty
- Do you feel the present development would have negative impact on the birds and animals in the area?
    - Yes
    - No
- Are there sufficient green spaces and trees incorporated into the lakefront development to provide shade?
    - Yes
    - No

Cultural Integration & Community

- Do you feel a sense of community at the lakefront development, or does it feel impersonal and isolating?
    - Strong Sense of Community
    - Somewhat Sense of Community/
    - No Sense of Community
- If yes, would you like to see more of these events?
    - Yes
    - No

Future Development & management

- How would you rate the change in the lakefront after 2022. Reason of rating
    - Much better
    - Better
    - Same
    - Worse
    - Other:
- What additional amenities or facilities would you like to see incorporated into the waterfront development in the future?
- Additional Comments