

DRAFT

URBAN RIVER MANAGEMENT PLAN RAMNAGAR

 Kosi Barrage



RAMNAGAR MUNICIPAL COUNCIL
Uttarakhand

14th January, 2026

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EXECUTIVE SUMMARY

A river and a city have a symbiotic relationship. The river provides the "life" (resources, climate regulation, identity), and in return, the city acts as the "steward" (protecting the catchment, managing flow, and maintaining biodiversity). However, in recent times this relationship has devolved into parasitism, where the city extracts resources and dumps waste, slowly killing the host river. Urban River Management Plan (URMP) is a strategic framework designed to shift the urban-river dynamic from "exploitation" (parasitism) to "stewardship" (symbiosis).

The purpose of the Urban River Management Plan (URMP) Ramnagar is to develop a dedicated strategy for managing the Kosi River and its tributaries that flows through the city in an efficient and sustainable manner.

The purpose of this document (Urban River Management Plan, URMP of Ramnagar is to develop a dedicated strategy for managing the extent of Kosi River and its tributaries that flow through the city of Ramnagar in an efficient and sustainable manner. The document is based on the Strategic Framework for Managing Urban River Stretches developed by the National Institute of Urban Affairs (NIUA), in association with the National Mission for Clean Ganga (NMCG).

The URMP proposes **18 tangible and practical actions in addition to several recommendations for managing the river under a ten-point agenda** (or objectives) to ensure the "Nirmal" and "Aviral" nature of the rivers in the town. The level of detail for the interventions is restricted to the concept idea for general understanding. Detailed Project Reports (DPRs) will be prepared for each intervention based on the concept ideas proposed in the document. The URMP document is a living document, which will address issues related to river management on continuous basis.

Approach adopted for preparing the URMP for Ramnagar

At the start, a core Multistakeholder Working Group (MSWG) comprising eleven members from fifteen organizations, chaired by the Additional District Magistrate of Nainital district was set up to lead the development of the URMP for Ramnagar. The team from NIUA and NMCG helped facilitate the MSWG meeting.

This was followed by a rapid baseline assessment to understand river-related issues and challenges faced by the town and identify opportunities to enhance river-city interaction. The assessment was based on secondary data, published reports, and projects implemented / under implementation within the town. The baseline included information on planning provisions related to river, streams, drains etc; status of river pollution, groundwater status, encroachments in floodplain etc; and ongoing projects in the town on rivers, streams and drains.

A second MSWG meeting was held under the chairpersonship of Chief Development Officer (CDO), Bhimtal to seek input from different actors for the development of the URMP. On the basis of the rapid baseline assessment and discussions with MSWG members, 18 projects/interventions were identified that will be taken up in Ramnagar URMP.

Envisaged benefits of the URMP for Ramnagar Town

It is envisaged that implementing the URMP will yield several tangible and intangible benefits, as listed below.

1. It will improve climate resilience and environmental outlook of the town, making it more appealing to residents and visitors as well as help in providing ancillary benefits such as water pollution control, thriving biodiversity, flood mitigation, and improved groundwater recharge.
2. It will improve the connect between the residents and the river by creating avenues for recreation, social bonding, and leisure thereby improving the quality of life of the residents.
3. It will boost the town’s river-related economy and provide livelihood for multiple stakeholders.
4. The URMP will create a premise for shared governance with key stakeholders and citizens and enable them to take on a more active role in managing the town’s environmental assets and instilling a sense of ownership around actionable items.

Interventions proposed in URMP

The table on next page presents the key details of the 18 interventions that includes the agencies responsible for implementation, estimated costs, and the source of funding for each intervention.

Sl. No.	URMP Objective	Intervention	Responsible Agency	Estimated Cost (In rupees)	Potential Financing Sources
1	Regulation of Activities in Flood Plains	Intervention 1: Preparation of new master plan	Town & Country Planning, Govt. of Uttarakhand		Town & Country Planning, Govt. of Uttarakhand
2	To keep river free from pollution	Intervention 2: Zone 1A (Ward 1-3) Sewerage Redevelopment and Integration Plan	Pey Jal Nigam	43.16 Crore	Namami Gange
		Intervention 3: Construction of I & D Structure in Zone-1B (Ward 5 & 6)		6.5 Crore	Namami Gange
		Intervention 4: Controlled disposal of septage in the collection tank of 7 MLD STP	Lead: RMC Support: Jal Sansthan Dept	-	State Urban Development Department (SUDA), Swachh Bharat Mission (Urban) – FSM component, Convergence with AMRUT 2.0 or National River Conservation Plan (NRCP)
		Intervention 5: Preparation of Faecal and Septage	Lead: RMC Support: Jal Sansthan Dept	50 Lakhs	State Urban Development Department (SUDA), Swachh Bharat Mission (Urban) –

Sl. No.	URMP Objective	Intervention	Responsible Agency	Estimated Cost (In rupees)	Potential Financing Sources
		Management Plan			FSM component, Convergence with AMRUT 2.0 or National River Conservation Plan (NRCP)
3	To enhance riparian buffer along river bank	Intervention 6: Restoration of degraded riparian stretches	Forest Department & Irrigation department	53 lakhs	Ramnagar Forest Division
4	Reuse of treated waste water	Intervention 7: Enhance the reuse of treated wastewater in the city	Jal Nigam; Supporting Agencies: NMCG and Forest dept	3.32 Crore	State Urban Development Funds, and CSR funding
5	To develop eco-friendly riverfront projects	Intervention 8: Theme based development of existing Ramnagar riverfront parks	Forest Department & Irrigation department	5.7crore	CAMPA, State Tourism Grants, CSR
		Intervention 9: Infusion of additional activities at city park	Forest Department & Irrigation department	7.9 crore	CAMPA, State Tourism Grants, CSR
		Intervention 10: Riverfront promenade development joining the various riverfront parks	Forest Department & Irrigation department	3.8 crore	CAMPA, State Tourism Grants, CSR
6	To inculcate river-sensitive behaviour among citizens	Intervention 11: Interpretive Signage and QR-Coded Storytelling Boards	Waste Warriors, SHGs, RWAs, educational institutions, tourism Dept	12–15 lakh	SBM 2.0, CSR, community NGOs
		Intervention 12: Eco-Ritual Starter Kits at Balaji Mandir, Dhikuli & Tourist Resorts	RMC; Supporting Agencies: Temple committees,	6–8 lakh	Municipal sanitation budget, CSR (local businesses, flower vendors) and Temple trusts

Sl. No.	URMP Objective	Intervention	Responsible Agency	Estimated Cost (In rupees)	Potential Financing Sources
			SHGs, Waste warriors		
		Intervention 13: Digital River Engagement Platform (“Swachh Kosi”)	RMC; Supporting Agencies: Temple committees, SHGs, Waste warriors	3–4 lakh	Municipal IEC budget, CSR (telecom partners, hotels)
		Intervention 14: Annual Celebration of “Kosi Utsav”	RMC, Tourism Dept.; Supporting Agencies: Schools, RWAs, SHGs, NGOs, resorts	10–12 lakh	Municipal cultural budget, Tourism Dept., CSR (hotels, banks, safari operators),
10	To engage citizens in river management activities	Intervention 15: Ward-Level “Kosi Guardians” with Tourist Volunteers	RMC; Supporting Agencies: RWAs, SHGs, Waste Warriors	5–6 lakh	Municipal budget, CSR contributions.
		Intervention 16: Riverbank Adoption by Schools, RWAs & Resorts	RMC, Education Dept.; Supporting Agencies: Schools, RWAs, NSS/NCC units	8–10 lakh	Education Department, Municipal IEC Budget, CSR contributions from schools, coaching institutes and NGO.
		Intervention 17: Street Plays in Market, Temple & Tourist Zones	RMC; Supporting Agencies: RWAs, SHGs and NGOs	4–5 lakh	Municipal IEC Budget, CSR.
		Intervention 18: Citizen & Tourist Monitoring Dashboard	River Sabha Committees; Supporting Agencies: Waste Warriors, NSS/NCC units	2–3 lakh	Municipal IEC budget allocation under SBM(U) and CSR funds, Community contributions (RWAs)
	Total			Approx. 77 Crore	

1 INTRODUCTION

The National Institute of Urban Affairs (NIUA) and the National Mission for Clean Ganga (NMCG) have collaborated to promote river-sensitive urban development across cities in the Ganga basin and other Indian river basins. This collaboration aims to harness the role of the cities to rejuvenate and restore river health. As part of this initiative, two major support systems have been developed: Urban River Management Plan (URMP) Framework and Guidelines for creating River-Sensitive Master Plans.

The framework was prepared to help cities improve and sustain river stretches within their boundaries through holistic, ecosystem-based interventions. It underscores that healthy river are essential for urban livability and productivity and its vision is organized around three elements environmental, economic and social, supported by ten objectives. These objectives are translated into city-specific projects, each tied to funding sources and institutional mechanisms for effective implementation.



Figure 1-1: Ten Objectives of the URMP

A total of sixty URMPs are planned in two phases with 25 in Phase I and 35 in Phase II, including five cities in Uttarakhand in the first phase. Funded by the World Bank under Namami Gange Mission II, this initiative is expected to guide Urban Local Bodies (ULBs) in addressing challenges such as drying rivers, poor waste management, loss of green cover, floodplain encroachment, and industrial pollution through systematic, town-level planning. The three tiers of governance and monitoring committees at the center, state and town level is depicted in Figure 1-2.

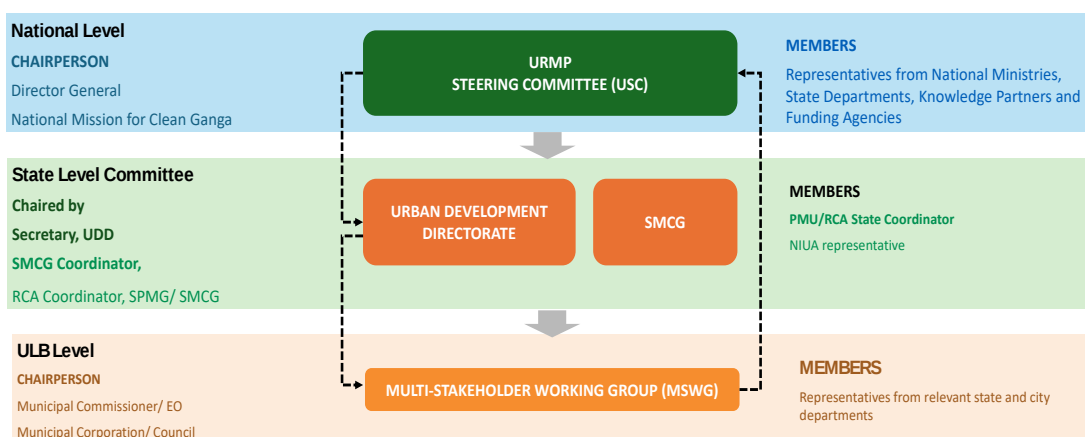


Figure 1-2: National, State & town Engagement for the URMP Preparation

1.1 Process for preparation of the URMP

The preparation of an URMP follows a systematic approach as per NIUA’s URMP Components and Guidance Note 2020 and strategic guidelines for making River Sensitive Master Plans 2021 to ensure effective river conservation, sustainable management and stakeholder collaboration. The process involves multiple stages, each contributing to a comprehensive and actionable plan as depicted below.

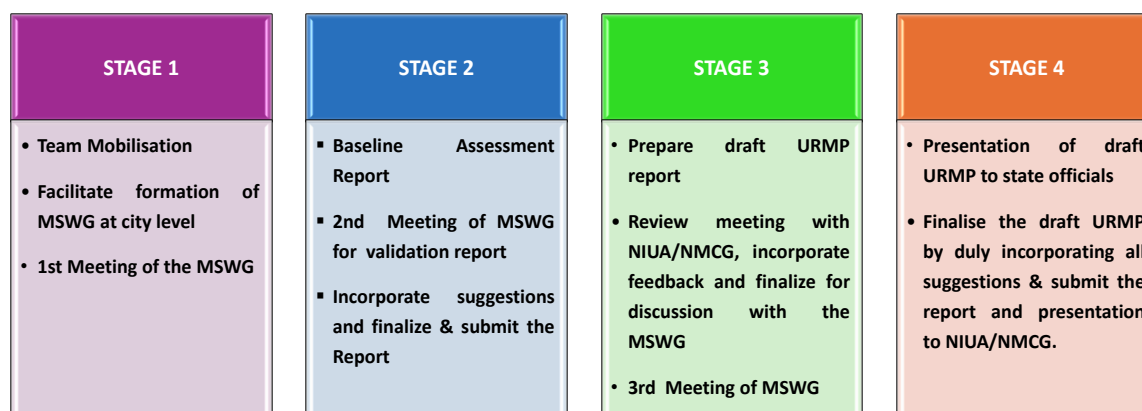


Figure 1-3: Process for preparation of URMP

In order to ensure that the plan is participatory and has involvement of concerned government agencies from the state to the town level, workshops and meetings have been carried out at all levels.

1.2 Status of work and contents of the present deliverable

Tasks one to three as listed in Figure 1-3, have been completed and findings are elaborated in the present deliverable of Draft URMP Report. The detailed content of the report includes the following:

- Key points discussed during URMP State level Steering Committee Meeting for Uttarakhand held on 6th February 2025 at Dehradun,
- Discussions during 1st Multistakeholder Working Group (MSWG) meeting at Nainital on 5th March 2025,
- Discussions during 2nd Multistakeholder Working Group (MSWG) meeting at Bhimtal on 8th October 2025,
- Analysis of the field visit, primary and secondary data available in the public domain and collected from various stakeholder departments post the MSWG meeting.

1.2.1 URMP State level Steering Committee

A State-level URMP Committee, chaired by the Secretary, Urban Development Department (UDD), Government of Uttarakhand has been constituted to oversee the URMP Process. The first State level Steering Committee meeting was held on 06 February 2025 in Dehradun, chaired by Director General, NMCG, with participation from Urban Development Department (UDD) Uttarakhand, State Mission for Clean Ganga (SMCG), Town and Country Planning Office (TCPO), Pey Jal Nigam, NIUA, World Bank, School of Planning and Architecture (SPA) and project consultants.

The meeting presented the guiding principles, objectives and work plan for preparing URMPs in five

cities of the state. Commissioners, Executive Officers and senior officials shared the current status, challenges and future plans for river management in their cities.



Image 1-1: Steering Committee Meeting for Uttarakhand on 6th February 2025

1.2.2 Multistakeholder Working Group

To guide the development of city URMP, a Multistakeholder Working Group (MSWG) was formed comprising of 15 representatives from Municipal Corporation, City Magistrate, Forest Department, Tourism Development Board, Uttarakhand Urban Sector Development Agency, Forest Development Corporation, Irrigation Department, Pay Jal Nigam, Jal Sansthan, TCPO, SMCg, Pollution Control Board, Hotel Association and NGO. Post the state level workshop, the first MSWG meeting was held on 5th March 2025 under the chairmanship of Additional District Magistrate of Nainital district, to notify the MSWG for the city and the nodal officer for the URMP (refer Image 1-2).



Image 1-2: Joint MSWG held on 5th March 2025 at Nainital

The second MSWG meeting for finalization of the baseline report was held on 8th October 2025 under the chairpersonship of Chief Development Officer (CDO), Bhimtal (refer Image 1-3).



Image 1-3: 2nd MSWG held on 8th October 2025 at Bhimtal

1.2.3 Draft URMP Report

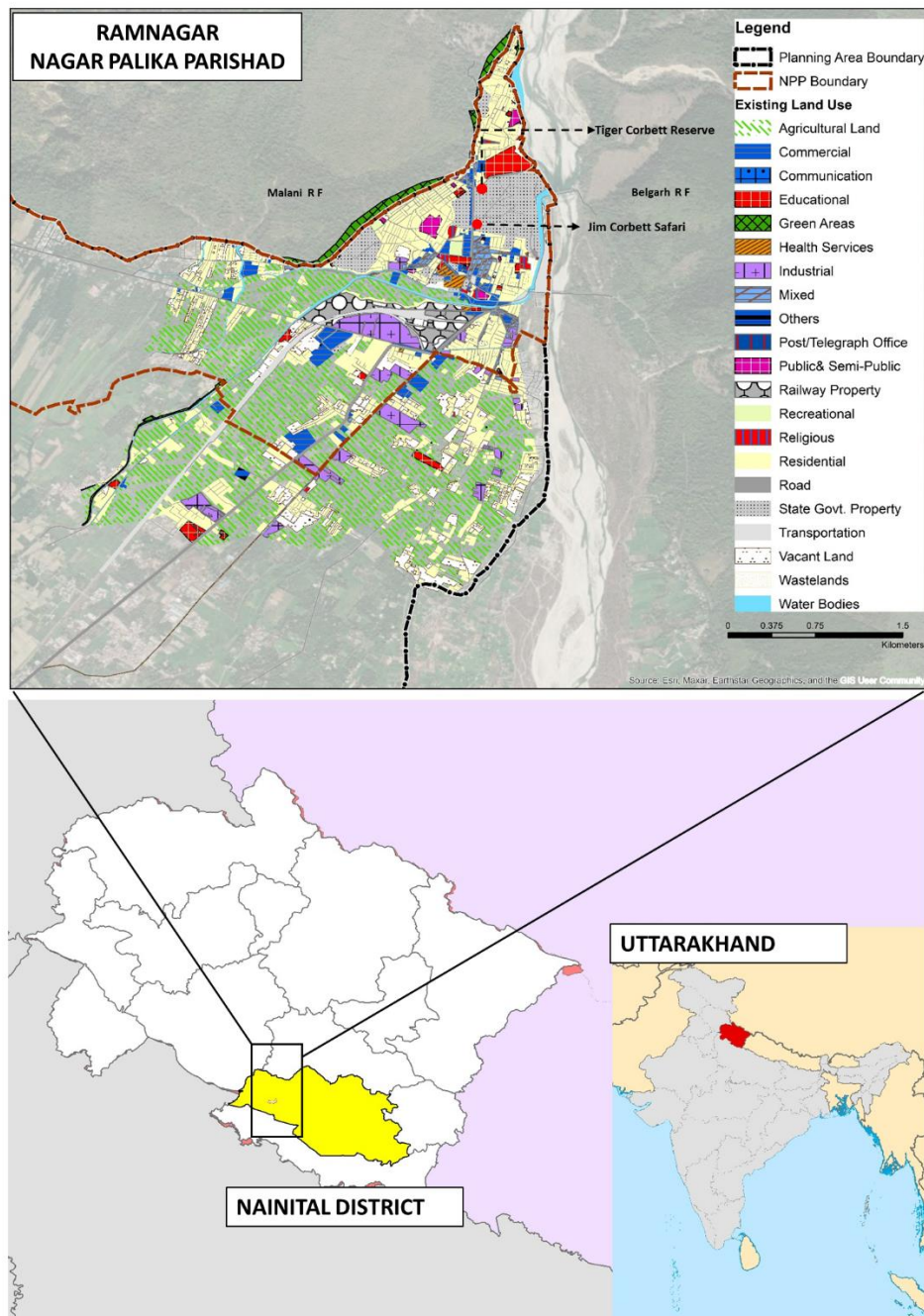
The Draft URMP report includes tangible interventions for river conservation and management for each of the ten URMP objectives. Multiple meetings and consultations with concerned agencies along with site visits were conducted to assess the ground situation and identify opportunities for future interventions (refer Image 1-4). Based on the gaps and prioritized issues identified in the Baseline Assessment Report, this document outlines interventions and recommended actions. Each intervention is elaborated in detail, including the project rationale, conceptual framework, key components, broad cost estimates and the designated implementing agency.



Image 1-4: Consultation and Site Visits held on 11th October 2025

2 CITY PROFILE

Ramnagar is a town located in Nainital district of Uttarakhand State. The town is situated on the western bank of Kosi River, at the foothills of Kumaon Himalayas. It serves as the gateway to the Jim Corbett National Park. The town is well connected with major cities via NH-309 such as Nainital (65 km), Delhi (202 km) and Dehradun (250 km), rail links under the North Eastern Railway zone and Pantnagar Airport (80 km).



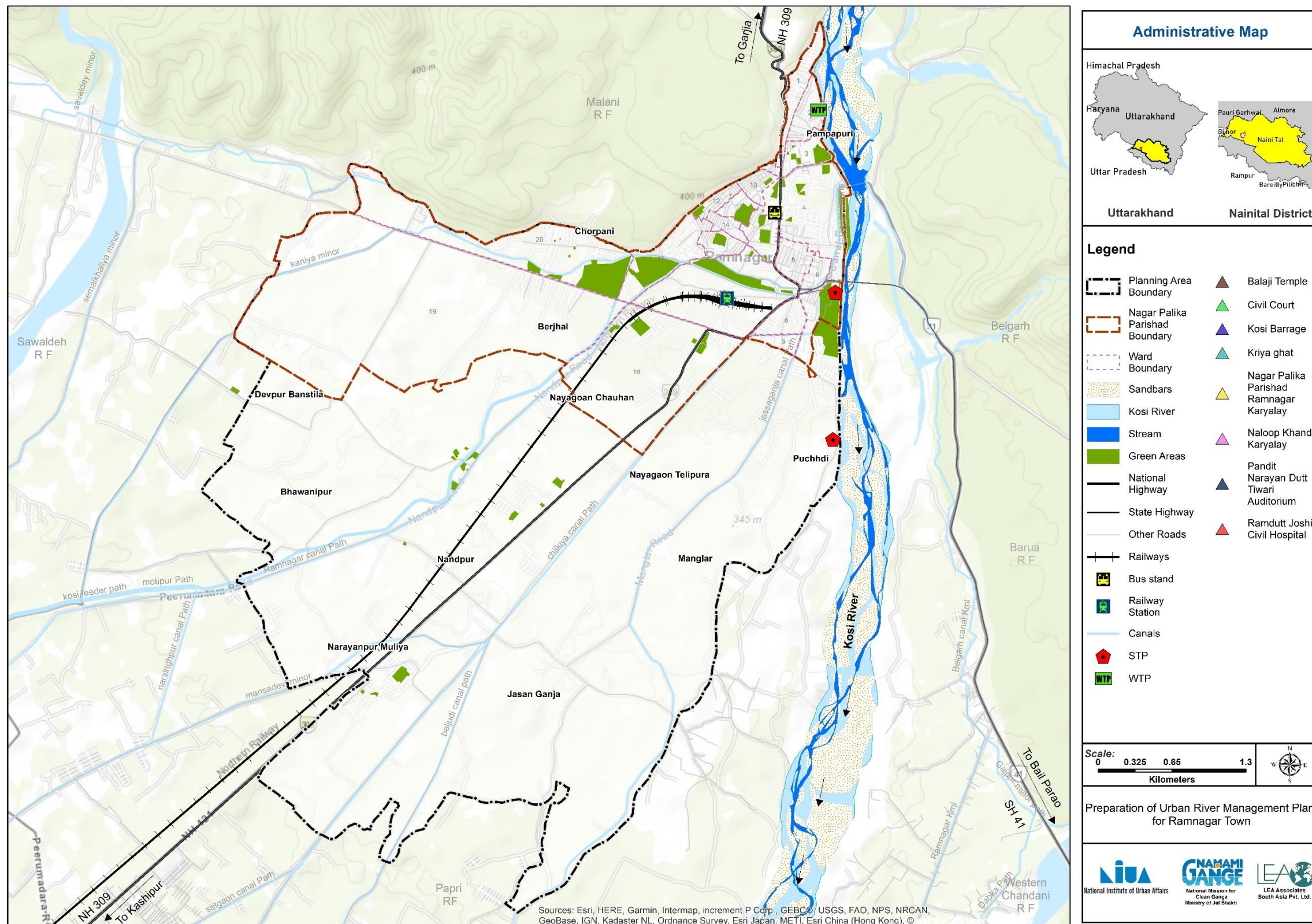
2.1 City administrative boundaries

As delineated in the Ramnagar Master Plan 2001, the Ramnagar planning area extends over 31.55 sq.km, including Ramnagar municipal area and 25 villages. The planning area is overseen by the Uttarakhand Housing and Urban Development Authority. This department operates under the Department of Housing, Government of Uttarakhand.

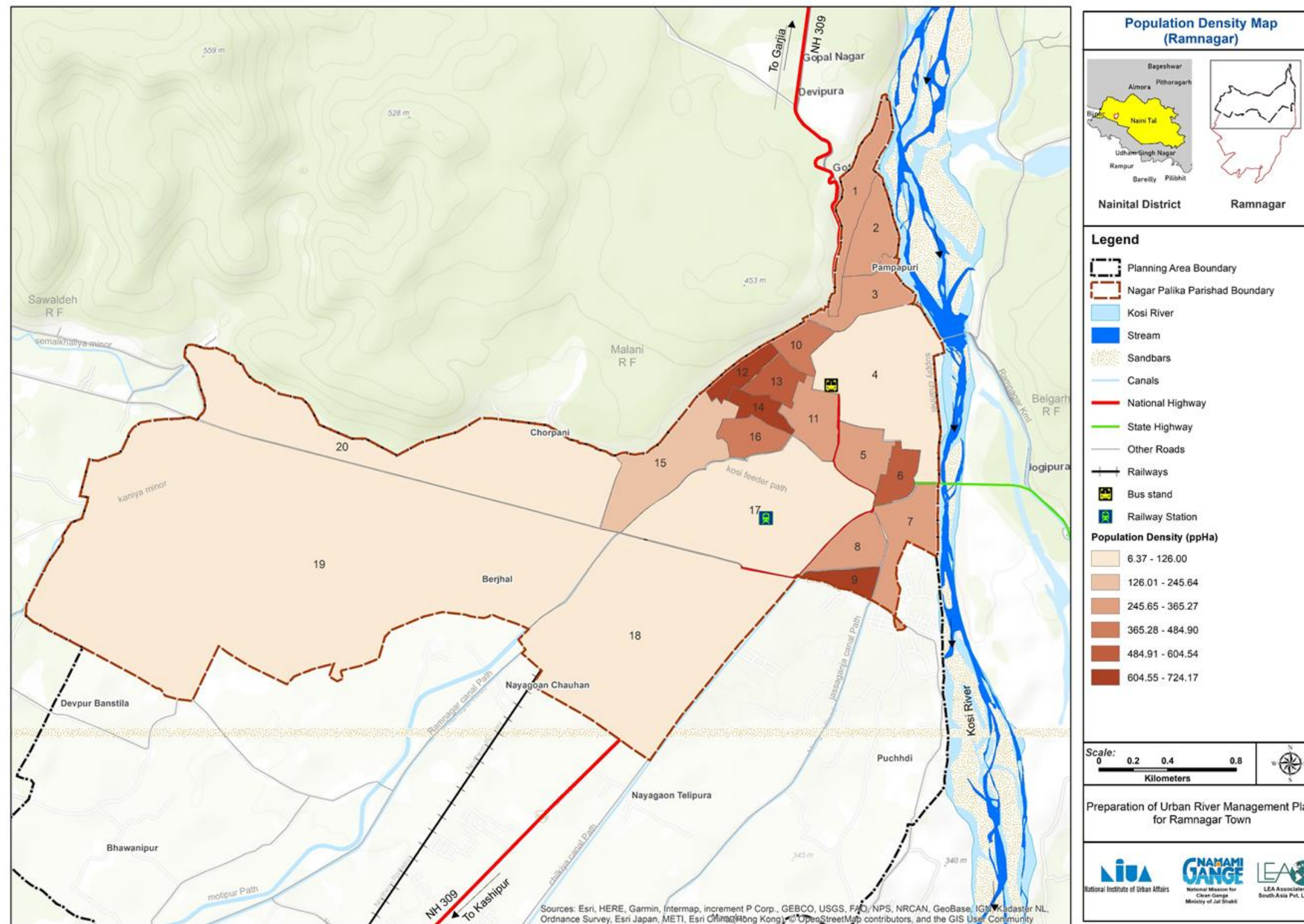
Ramnagar Municipal Council spreads over an area of 7.68 sq.km and is divided into 15 wards, after 2024 it increased to 20 wards. The Municipal Council is responsible for managing the town’s civic services and infrastructure, such as sanitation, water supply, road maintenance and public amenities.

2.2 Demography

The total population of the Ramnagar Municipal Council is 62,024 (Census 2011) and the population in the planning area is 77,405. Based on the current decadal growth trend, population for the year 2025 (base year) is estimated to be approximately 73,049 for the municipal area. The population of the town is expected to grow up to 1.08 lakhs in 2051. The urban expansion is restricted in west and northwest due to the presence of Jim Corbett National Park.



Map 2-2: Administrative Map of Ramnagar



Map 2-3: Population density map of Ramnagar

2.3 Physiography

Topography

Ramnagar is located in the piedmont region of the Kumaon Himalayas, near foothills of Shivalik range. The average elevation of Ramnagar ranges between 345 and 367 meters above sea level. It is characterized by fertile riverine plains shaped by the Kosi River, gently undulating slopes, and forested ridges.

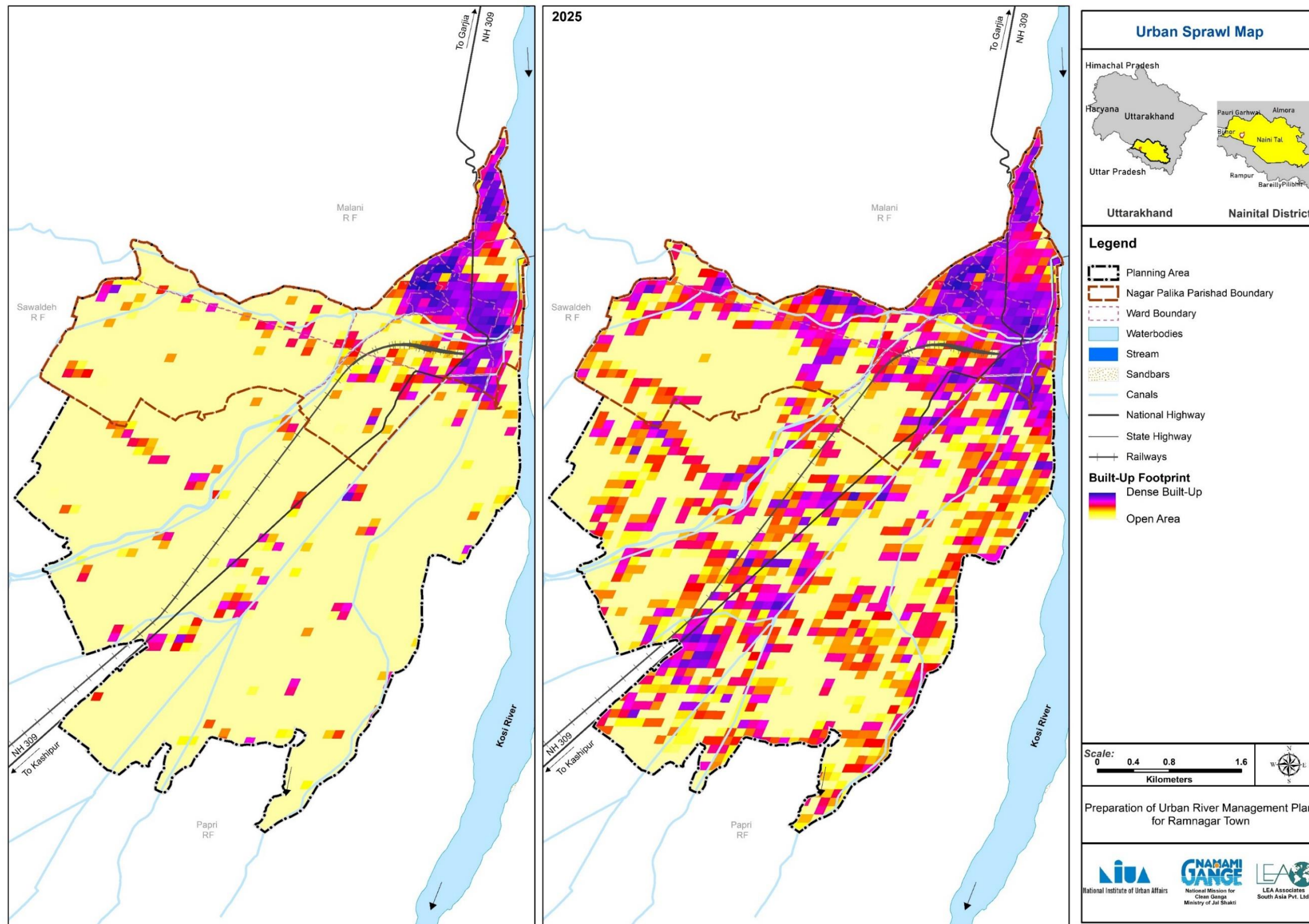
Geophysical Characteristic

Ramnagar lies across the Bhabhar and Terai zones of the Kumaon foothills, each with distinct geophysical traits. The northern sector falls within the Bhabhar belt, composed of porous alluvial deposits such as sand, gravel, and silt. These formations enable rapid infiltration and groundwater recharge, shaping seasonal stream flows. In contrast, the southern and southeastern areas lie within the Terai zone, characterized by deep, fertile clayey-loamy soils enriched with alluvium and organic matter. This spatial variation in soil quality directly influences land use and settlement patterns. The town is classified under Seismic Zone IV (BIS), denoting high earthquake risk and necessitating resilient planning and construction practices.

2.4 Urban Sprawl

Ramnagar is undergoing rapid urbanization characterized by the conversion of peri-urban open spaces into high-density built-up zones. Growth follows a classic ribbon development pattern, catalyzed by NH 309 and railway infrastructure, with significant expansion extending eastward toward the Kosi River and southward toward Kashipur. The intensification of the urban core and sprawl toward sensitive forest reserves like Garjia and Malani highlight a critical need for integrated urban-river management to balance infrastructure demands with ecological preservation.

The horizon period of the Ramnagar Master Plan expired in 2001, and presently, the town lacks an active planning framework. Notably, the expired Master Plan did not include any zoning regulations or provisions for flood plains. The absence of updated land-use controls has allowed sprawl to proceed without safeguards for ecological zones or resilience against flooding, reinforcing the urgency for a renewed, integrated plan that aligns growth with environmental sustainability.



Map 2-4: Urban Sprawl of Ramnagar town

2.5 Historical and cultural profile

Ramnagar was founded in 1850 by Sir Henry Ramsay, the British Commissioner of Kumaon, as a planned settlement to support administrative and forestry functions in the Terai region. Its strategic position along the Kosi River and at the Himalayan foothills made it central to colonial forest management and hill access. The establishment of Hailey National Park in 1936, later renamed Jim Corbett National Park in 1957, further reinforced Ramnagar’s role as a gateway to conservation and eco-tourism. Colonial-era investments in irrigation, forestry offices, and road connectivity laid the foundation for agriculture and timber trade, while post-independence growth consolidated its status as an administrative and commercial hub under a Municipal Council.

Culturally, Ramnagar reflects a blend of Kumaoni traditions and tourism-driven modern influences. Its identity is closely tied to the Kosi River and Jim Corbett National Park. Local festivals such as Harela, Ghughutia, and Makar Sankranti are celebrated with strong community participation, while folk theatre forms like Ramleela and Nautanki, along with places of worship including Balaji Mandir and Hanuman Mandir, remain integral to its cultural fabric.

2.6 Tourism profile

As the primary gateway to Jim Corbett Tiger Reserve, Ramnagar serves as a critical transit hub, with all the visitors to the park, passing through the town. Thus, the tourist footfall in Ramnagar is closely tied with the tourists visiting the Reserve. The tourism sector is highly seasonal (November to June), with an annual footfall of approximately 3.5 lakhs and a peak daily capacity of around 1,600 visitors¹. Recent initiatives such as the Uttarakhand Tourism Entrepreneur Promotion Scheme (2024) is expected to boost eco-tourism and schemes such as Skill India Mission and Pradhan Mantri Kaushal Vikas Yojana (PMKVY) under Ministry of Skill Development & Entrepreneurship (MSDE) strengthens vocational training and skill development.

2.7 Socio – economic profile of the town

Ramnagar possesses a local economy shaped by agriculture, tourism and small businesses. The agro-climatic conditions of the town support horticulture, notably litchi and mango cultivation. Its proximity to Jim Corbett National Park enables opportunities in eco-tourism, which in turn sustains modest service activities such as small hotels, eateries, tour operators, and handicraft sellers.

- a. **Economic activities along the river:** There are two shops and one restaurant near Kosi Barrage, serving visitors to this riverside spot.
- b. **River based religious events:** No significant river-based religious events are observed in Ramnagar. While Kosi river flows through the town, its role remains primarily ecological and recreational rather than ritualistic.
- c. **IEC and social engagement:** The Municipal Council conducts regular Information, Education, and Communication (IEC) activities to promote civic responsibility and river-sensitive behaviour. Weekly sessions on solid waste management are supplemented by campaigns on septage and liquid waste, with 4–5 activities held monthly and up to 14 during special drives. These include

¹ Source: Corbett Tiger Reserve (CTR) Office, 2025

cleanliness campaigns, workshops, school visits, and community meetings, engaging anywhere from 50 participants in small events to over 1,000 in large drives. Waste Warriors Society, in partnership with the Forest Department, has implemented waste management initiatives near the Kosi River at Dhikuli and Girjiya Mandir.

2.8 Institutional Mechanism

The list of existing agencies responsible for planning, development and service delivery within the planning area are presented in Table 2-1.

Table 2-1: Role and responsibility of key government agencies for Ramnagar Town

Sl. No.	Department	Key role and responsibilities	Nodal Officer	Applicable for URMP Objectives
A. Local Level Agencies				
1	Municipal Council Ramnagar	- Town governance and civic administration - Urban services and infrastructure – solid waste management, maintenance of road & drainage, management of water supply & sewerage - Environment and public welfare activities - Development and planning - Public interface and emergency services	Executive Officer	Objective 2, objective 4, objective 5 and objective 9
2	City Magistrate Ramnagar	Maintaining law and order, coordinating civic operations, and ensuring regulatory compliance across the twin cities.	City Magistrate	
3	Local NGO/ Civil Society Member	- Educate local communities on river health, waste management, and conservation practices. - Organize awareness drives, clean-up campaigns, Nukkad Natak, school sessions, and public meetings. - Promote citizen participation in river protection initiatives. - Lead or support riverbank clean-ups, plantation drives, wetland restoration, and lake rejuvenation activities. - Promote volunteerism in events like River Festival, Ganga Swachhta Pakhwada, etc.	Representative	Objective 10
4	Hotel Association	- Represent the hospitality industry and collaborate with government departments such as Tourism, Urban Development, Pollution Control, etc. - Provide input on state tourism policies, environmental regulations, pricing norms, and sustainable tourism practices.	Presiding Officer	Objective 10
B. Regional/State level				
5	Forest Department	- Protect wildlife habitat in nearby forest areas comprising Ramnagar Forest, Tarai Central Forest, and buffer zones of Corbett Tiger Reserve. - Conserve water catchment areas, especially the Kosi River (vital for the region's water supply).	Divisional Forest Officer, Terai central, Terai west	Objective 4, Objective 9

Sl. No.	Department	Key role and responsibilities	Nodal Officer	Applicable for URMP Objectives
			and Ramnagar	
6	Uttarakhand Tourism Development Board	- Formulate state tourism policies and long-term development strategies - Develop eco-tourism zones and nature trails with Forest Department coordination - Monitor environmental and social impact of tourism projects - Implement safety protocols and eco-friendly practices	Tourism Development Officer, Nainital	Objective 8
7	Uttarakhand Urban Sector Development Agency	- Plan and execute projects related to water supply, sewerage, sanitation, solid waste management, and drainage systems. - Prepare city development plans (CDPs), master plans, and detailed project reports (DPRs) - Monitor progress and ensure timely execution of projects using digital tools and MIS systems - Mobilize and manage funds from multilateral agencies (e.g., ADB, World Bank) and government grants - Provide technical and managerial support to Urban Local Bodies (ULBs).	Project Manager	Objective 1
8	Uttarakhand Forest Development Corporation	- Supervise extraction of minor minerals (like sand, gravel, boulders) from forest riverbeds such as: Gaula, Kosi, Sharda, Dabka, and others - Prevent illegal mining and support state revenue generation through transparent auctions and lease operations - Collection and sale of medicinal herbs, resin, honey, bamboo, etc. - Implement CAMPA and other greening projects across the state.	Divisional Land Management (DLM)	Objective 4, Objective 9
9	State Mission for Clean Ganga, Uttarakhand	- Execute centrally funded projects for sewage treatment, river rejuvenation, drainage management, and ghat development - Ensure timely completion of STPs (Sewage Treatment Plants), I&D (Interception & Diversion) works, and faecal sludge management projects - Oversee construction and beautification of ghats, crematoria, and riverfront amenities to enhance religious and tourism experiences while maintaining sanitation. - Run awareness campaigns, school programs, and public outreach to encourage citizen participation in river conservation.	M&E Officer	Objective 2, objective7 and objective 9

Sl. No.	Department	Key role and responsibilities	Nodal Officer	Applicable for URMP Objectives
10	Uttarakhand Irrigation Department	- Construct and maintain embankments, spurs, check dams, and anti-erosion works along rivers - Develop watershed projects to conserve soil and water in hilly terrain. - Plan, design, and construct canals, dams, barrages, lift irrigation schemes, and tube wells to support agriculture - Identify and mark the maximum flood level recorded or estimated during a major flood.	Executive Engineer	Objective 1
11	Uttarakhand Pey Jal Nigam	- Plan, design and construct drinking water supply, - Implement rural water schemes such as Jal Jivan Mission, - Install chlorination units, UV treatment, or filtration systems in contamination-prone zones, - Prepare Detailed Project Reports (DPRs) and execute works for sewer networks, sewage treatment plants (STPs), and drainage systems in coordination with Urban Development Department or Smart City Projects.	Executive Engineer	Objective 2
12	Uttarakhand Jal Sansthan	Responsible for day-to-day operation and maintenance of urban and rural water supply systems.	Executive Engineer	Objective 2
13	Uttarakhand PWD	Plan, construct, and maintain state highways, district roads, rural roads, and bridges.	Executive Engineer	
14	Town and Country Planning Department	- Prepare Master Plans, Zonal Development Plans, and Land Use Maps for cities, towns, and notified areas, - Prevent unauthorized constructions and encroachments, - Conduct public consultations, hearings, and surveys before finalizing plans.	Executive Engineer	Objective 1
15	Uttarakhand Pollution Control Board	- Enforce key environmental acts including: Water (Prevention & Control of Pollution) Act, 1974, Air (Prevention & Control of Pollution) Act, 1981, Environment Protection Act, 1986, Plastic Waste Management Rules, 2016, Biomedical Waste Rules, E-Waste Rules, Solid Waste Rules, etc. - Regularly monitor water quality of the rivers, - Actively support the Namami Gange program through monitoring and enforcement, - Ensure no untreated sewage or industrial waste is discharged into rivers, - Conduct regular inspections of industrial units, hotels, stone crushers, mining sites, etc.	Regional Officer	Objective 2

2.9 Conclusion

Ramnagar’s profile underscores its pivotal role as a tourism gateway, cultural hub, and ecological buffer. The town’s projected population growth and spatial constraints demand compact and resilient planning. Its economic base, anchored in agriculture and seasonal tourism offers opportunities for diversification through eco-tourism, skill development, and small-enterprise support.

3 ECOLOGICAL PROFILE OF THE TOWN

3.1 River ecosystem

The Kosi River originates from the southern slopes of the Kumaon Himalayas and enters the Terai-Bhabar zone near Ramnagar, shifting from a fast-flowing mountain stream to a meandering river in the plains. Though not glacial, it remains perennial, fed by tributaries across Nainital district and carries heavy water and sediment loads during the monsoon. Its morphology is highly dynamic, with mid-channel bars, sandbanks, and braided channels that change seasonally, while loose alluvial banks make it prone to erosion and lateral shifting. These processes create risks for nearby settlements and farmland, prompting the construction of embankments and flood control structures. Ecologically, the river corridor supports riparian vegetation, native fish and migratory birds. It also delivers vital ecosystem services, including irrigation through canals from the Kosi Barrage and groundwater recharge.

The cross-section of the Kosi river and the adjoining town area reveals a dynamic interface between natural and urban systems. The river flows through a wide channel with features like mid-channel bars and riparian vegetation. Kosi River near Ward 1 (refer Image 3-1) presents a broad river corridor characterized by settlements with embankment and a central channel. A distinct zone of deposition, comprising accumulated sand and sediments, is observed along the banks and gradually merges into the main river channel. Kosi River near barrage (Refer Image 3-2) reveals a wider river corridor. This stretch is characterized by two distinct sand bars separated by a prominent mid-channel.

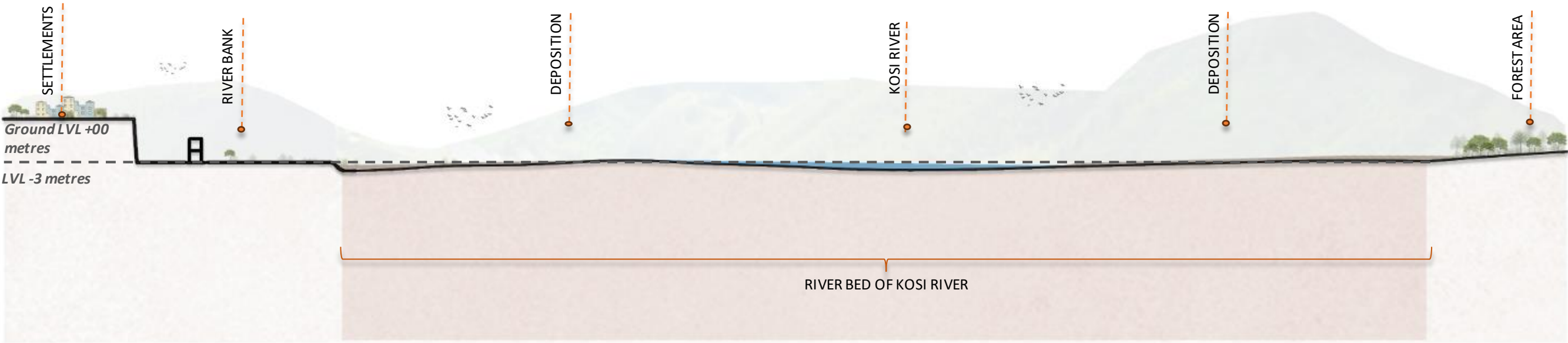
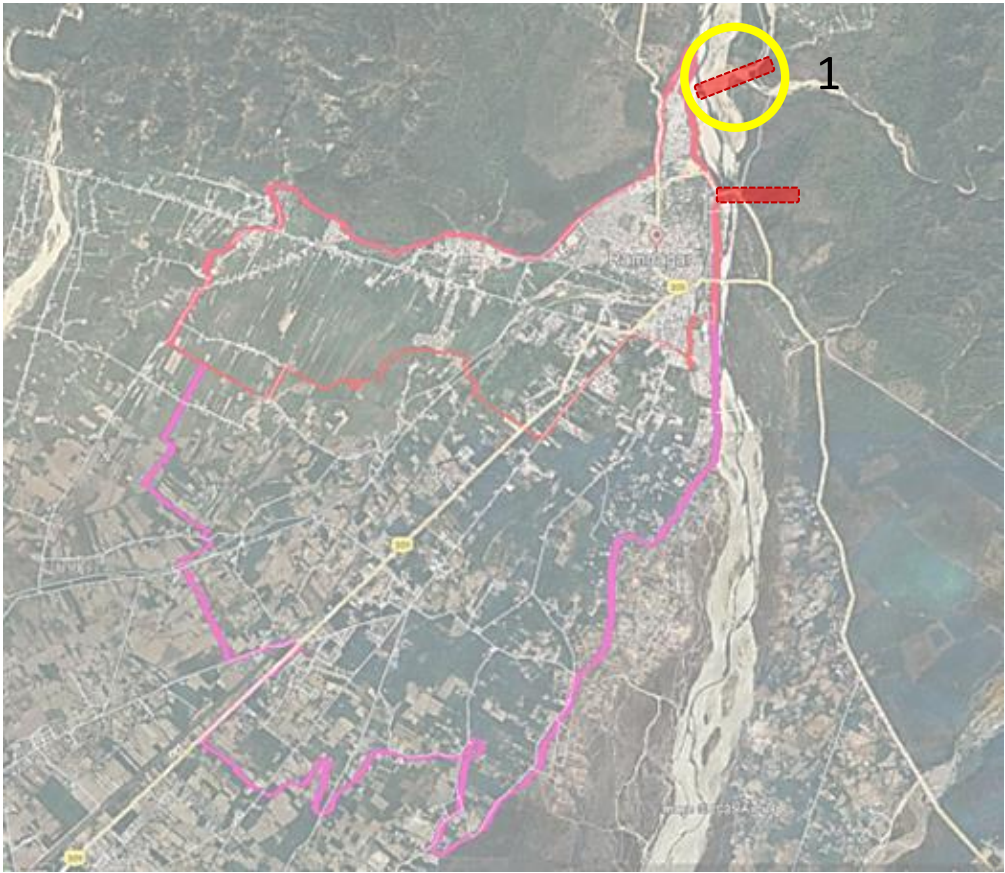


Image 3-1: Cross Section of Kosi River Near Ward 1

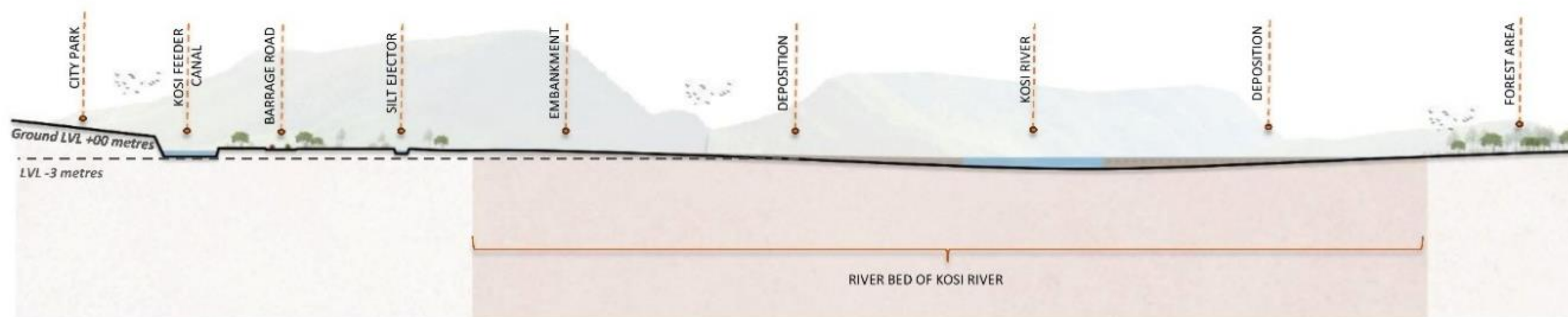


Image 3-2: Cross Section of Kosi River near Kosi Barrage

3.2 Blue-Green resources in the town

3.2.1 Blue Resources:

Apart from the Kosi River, no other significant water bodies have been identified within the planning area of Ramnagar. Kosi River remains the sole prominent water feature, playing a crucial role in the town's ecology, economy and water management. The Kosi barrage diverts the river water to the Kosi Feeder Canal, used for irrigation and water management.

3.2.2 Green Resources:

1. **Forest:** Ramnagar forest division falls on the western bank of kosi river. It is dominated by Sal (*Shorea robusta*) forests, along with a rich mix of native species such as Haldu (*Adina cordifolia*), Sheesham (*Dalbergia sissoo*), Khair (*Acacia catechu*), Semal (*Bombax ceiba*), Banj oak (*Quercus leucotrichophora*), and fruit-bearing trees like Amla (*Phyllanthus emblica*) and Jamun (*Syzygium cumini*).

Nagar Van located within the forest division is a recreational park developed by forest division. It lies on the western bank of Kosi river along the Kosi Barrage Road. It is spread over an area of approximately 17 hectares. This urban green retreat for recreation and wellness features lawns, bamboo huts, walking trails, open-air gym with a focus on native green species.

2. **Wildlife:** The Ramnagar Forest Division is renowned for its rich and diverse wildlife, primarily due to its proximity to Jim Corbett Tiger Reserve. The wildlife in the forest is Royal Bengal Tiger, leopards, Asian elephants, sloth bears, and wild boars. Other commonly spotted animals include sambar deer, chital (spotted deer), barking deer, goral, and langurs. The division also supports an impressive avifauna, with over 650 bird species recorded, such as great hornbills, crested serpent eagles, kingfishers and various species of woodpeckers and other migratory birds. Reptilian fauna such as monitor lizards, python, and cobras are also present in significant numbers.
3. **Urban green belt/ parks:** The town has less than 1% green area as against a required minimum of 12% as per Urban and Regional Development Plans Formulation and Implementation (URDPFI) guidelines. There are a total of 3 parks within the town which is spread over 5,000 square meter and is managed by the municipal council.
4. **Agriculture:** Total agricultural area in Ramnagar Planning Area is 60%, the region supports cultivation of cereals, sugarcane, mustard, seasonal vegetables such as tomato, brinjal and cauliflower forming the backbone of local farming. The area is also known for horticulture, particularly mangoes, litchis, guavas and citrus orchards, which are marketed across Uttarakhand and neighboring states.



Image 3-3: Agriculture area near ward 19



Image 3-4: Amrit Vatika along the Kosi
River

3.2.3 Riparian Buffer

The western bank of Kosi river is characterized by dense vegetation and forms part of the Ramnagar Forest Division. This area lies outside the defined municipal and planning boundaries and has therefore not been included in the present study. In contrast, although 64% of the eastern bank (along the total 4.3 km stretch of the Kosi River) maintains a riparian buffer, it contains significantly fewer dense green patches compared to the western bank refer Map 3-1.

Further detailing the limited green cover observed on the eastern bank, Table 3-1 provides an inventory of the discontinuous riparian buffer stretches that currently existing along the Kosi river. The vegetative buffer is dominated by native grasses, shrubs and aquatic vegetation. Most of the land along the eastern bank of Kosi river is under the ownership of the Irrigation department and forest department.

Table 3-1: Existing Riparian Buffer along the Eastern Bank of Kosi River

Stretch Nos.	Location	Length of Existing Riparian Buffer (in Km)	Width ranges from riverbank (in Meters)
1	Along ward 1	0.67	10 -22
2	Along ward 2	0.11	5 -10
3	Along ward 3-4	0.48	10- 30
4	Along ward 5	0.74	10- 80
5	Along Puchhdi	0.73	10 -12
	Total (approx.)	2.7	

Source: Consultant's analysis from site observation & satellite imagery

3.2.4 Biodiversity

Along Kosi River, the riparian buffer has two distinct vegetative storeys i.e., canopy layer and shrubs layer. The canopy layer of medium to tall native trees such as Sal (*Shorea robusta*), Khair (*Acacia catechu*), and Semal (*Bombax ceiba*), forming the first storey. The shrubs layer (second storey) comprises of shrubs, grasses and saplings such as Lantana, Clerodendrum and *Saccharum* species is observed, providing ground cover and supporting biodiversity. Near the Kosi Barrage and residential settlements, the vegetative buffer is often reduced to a single layer of sparse shrubs or invasive species, with limited canopy cover. Sal is the predominant plant species found in the region, which is followed by Khair Sissoo, used to provide as grazing grounds for the animals in the forest area around Ramnagar refer Image 3-5.



Image 3-5: Native species along the Kosi River

The Corbett Tiger Reserve hosts a remarkable diversity of fauna due to its rich habitats. The summary of various faunal classes along with the number of species found in the forest division is as under in Table 3-2.

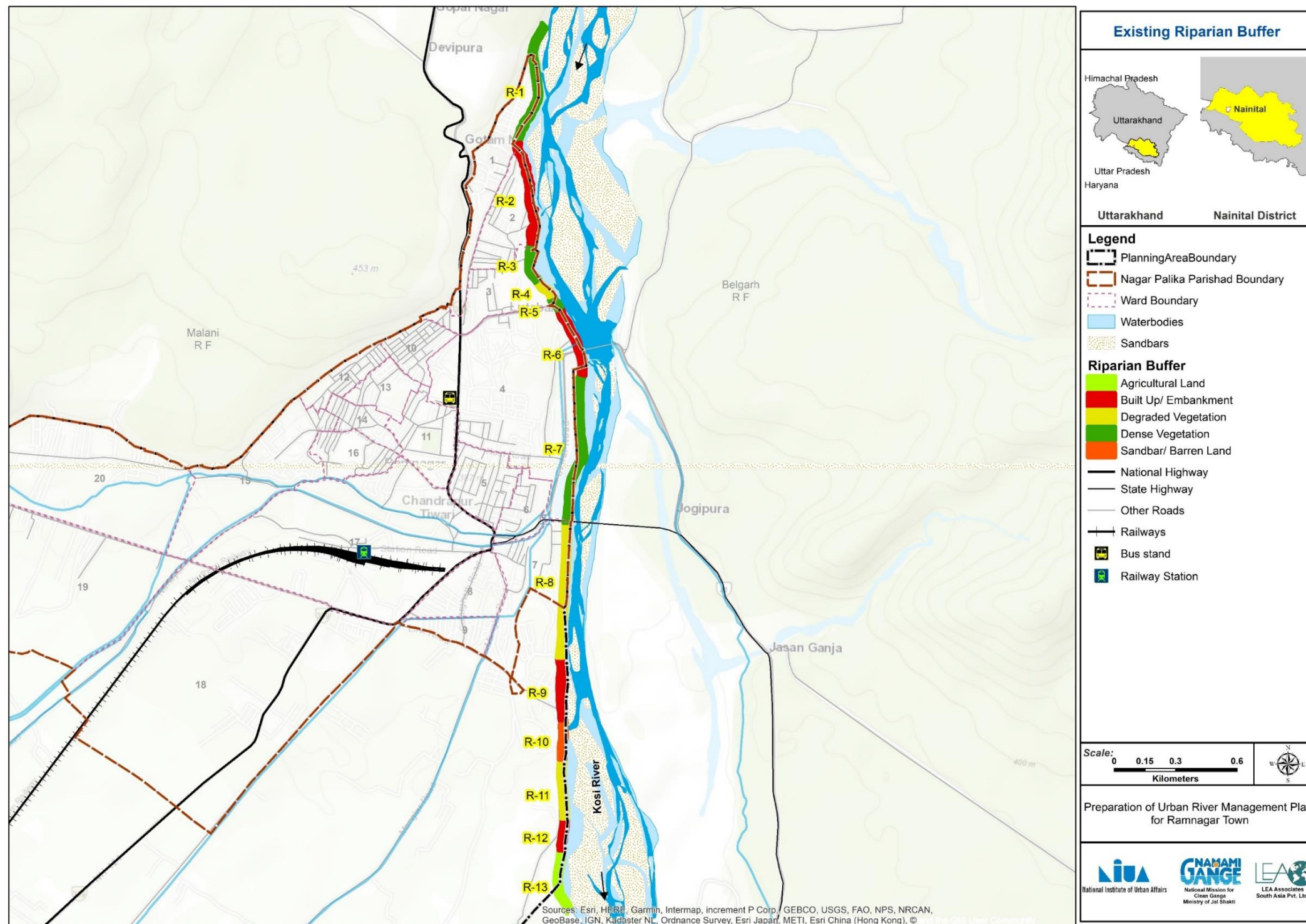
Table 3-2: Types of Fauna Species Available in Region

Faunal Class	Number of Species
Mammalia	49
Aves	685
Reptilia	39
Amphibia	10
Pisces	36
Nematoda	10
Chilopoda (Scolopendromorpha)	11
Isoptera (Termites)	21
Hemiptera (Bugs)	19
Odonata (Dragon & Damselflies)	37
Orthoptera	34
Ephemeroptera (Mayflies)	6
Dermaptera (Earwigs)	10
Coleoptera (Beetles)	10
Lepidoptera (Butterflies)	36
Total	1013

Source: Corbett Tiger Reserve (CTR)



Image 3-6: Types of flora species along the Kosi River

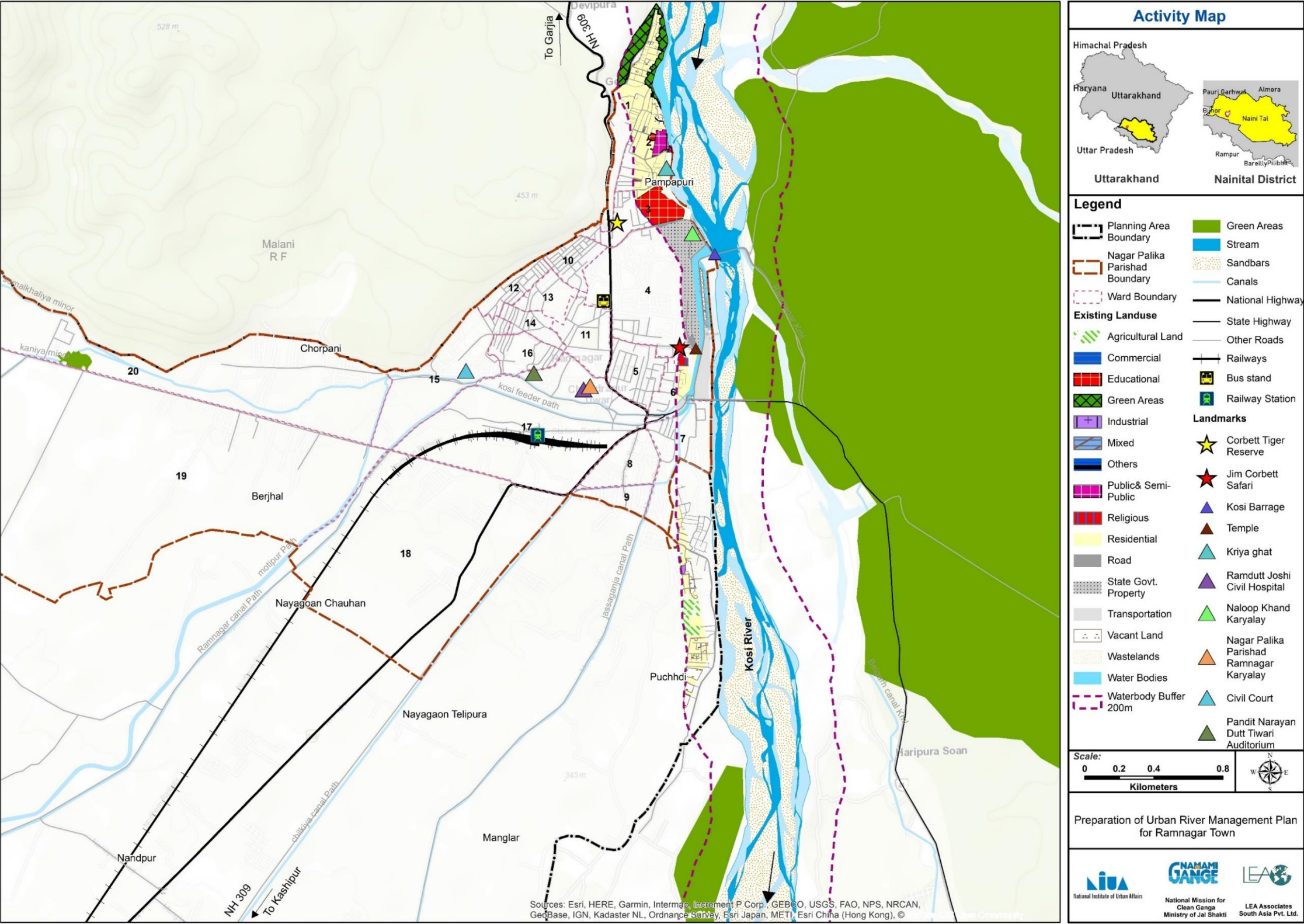


Map 3-1: Riparian stretch along Kosi River

3.3 Activity mapping along the river

Two activities observed along the Kosi river (refer Map 3-2), which are as following

1. **Kosi Barrage** – It is a key river city interaction point, It is a popular public space that attracts around 100 visitors daily. It features an existing park, making it a recreational hub for families.
2. **Recreational Spot** - A key feature along the Kosi River is the recreational area upstream of the Kosi Barrage. This site serves as a riverfront destination where visitors engage in activities such as walking and birdwatching.



Map 3-2: Activity mapping along the Kosi River

3.4 Flooding

The Kosi River is highly susceptible to fluvial flooding particularly during intense monsoon surges. The floodplain zone assessment for the Kosi River has been conducted in compliance with NGT directives and the Uttarakhand Flood Plain Zoning Act, 2012. The Irrigation Department has completed the delineation of the Red Line (100-year return period) and Blue Line (25-year return period) for the town. However, the official notification of these zones is currently pending. The flood lines marked by Irrigation Department is shown in the Image 3-7 below:

- **Developments within Blue Line:** No structural developments were observed along the entire river stretch. The area currently consists primarily of natural vegetation and engineered bank protection measures.



Image 3-7: Showcasing 25-year floodplain boundaries as shared by Irrigation Department

- **Developments within Red Line:** Image 3-8 indicates the presence of settlements in the southern part of the planning area. Additionally, stretches of vegetation and residential clusters is observed along ward no 2.

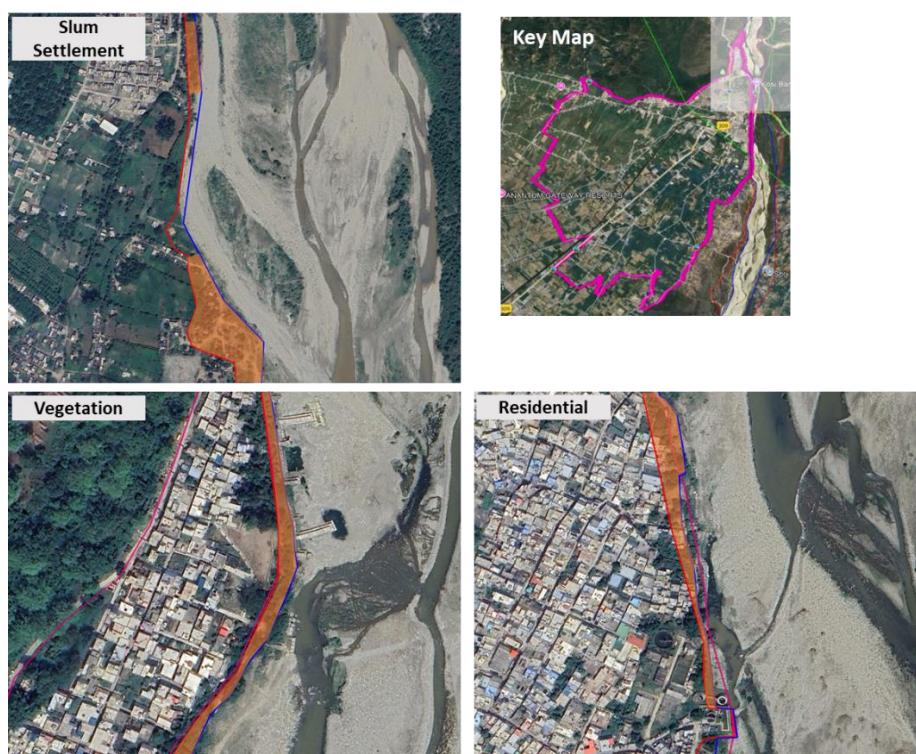


Image 3-8: Showcasing 25-year and 100- year floodplain boundaries as shared by Irrigation Department

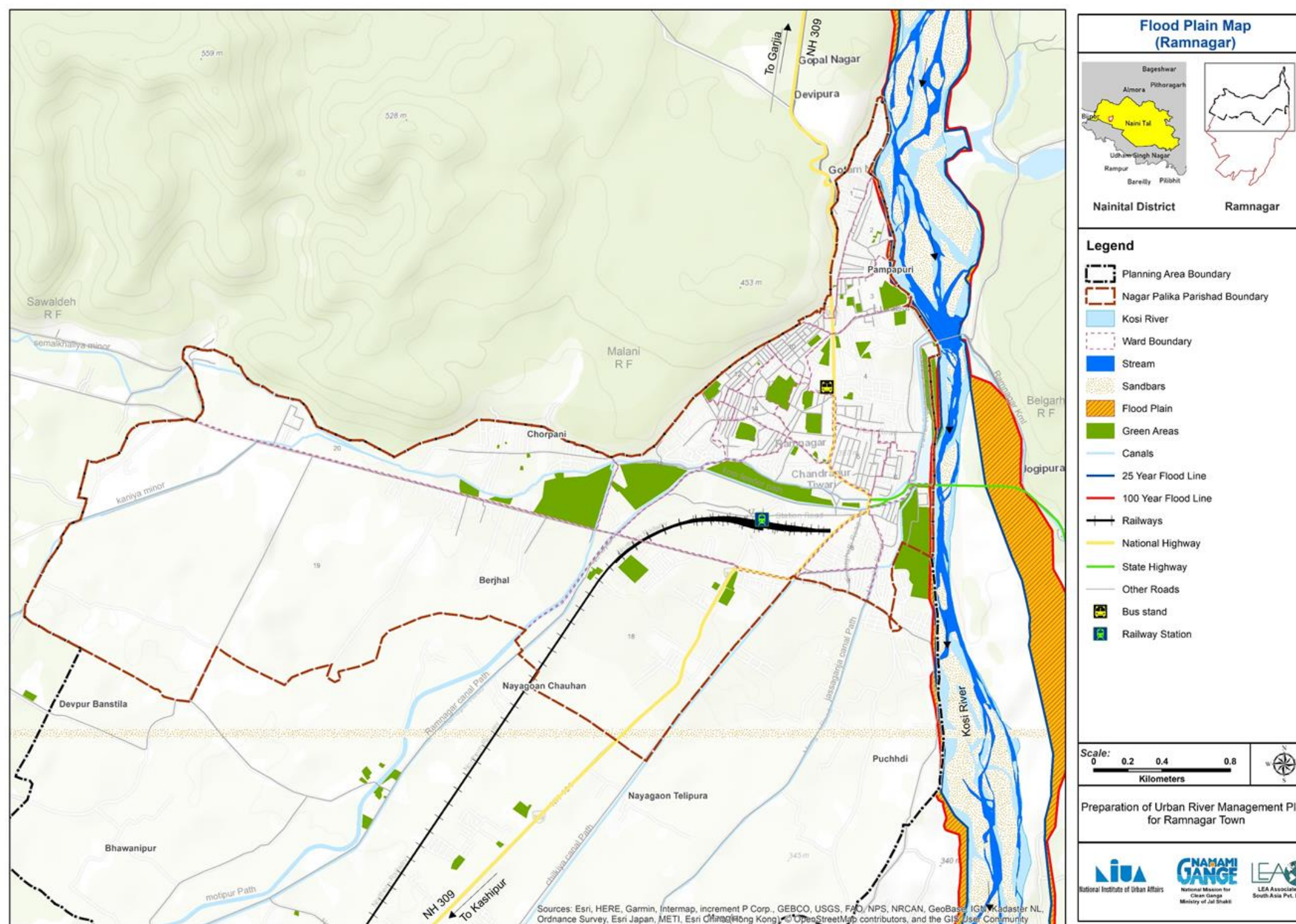
As per Stakeholder consultation, the low-lying stretches of Wards 1 and 2 along the river are susceptible to flooding during monsoon season. These concerned areas are presented in Map 3-4.



Image 3-9: Kosi River Flooding Near Ward 1



Image 3-10: Concrete Wall Near Ward 1



Map 3-3: Map of 25 year and 100-year Flood lines



Map 3-4: Areas of concerns within the flood plain

3.5 Existing/ upcoming/ proposed projects

The Irrigation Department has undertaken the placing of concrete blocks and gabion walls to stabilize the riverbanks and prevent further degradation.

3.6 Institutional mechanism

The Forest Department oversees ecological planning, plantation and conservation activities while the Municipal Corporation handles public amenities, maintenance, and urban integration. This urban green retreat for recreation and wellness features lawns, bamboo huts, walking trails, open-air gym with a focus on native green species.

Table 3-3: Roles and responsibilities of government agencies in ecological management for Ramnagar town

Departments	Role
Irrigation Department	Lead agency for river bank protection, embankment construction and flood mitigation
Municipal Corporation	Responsible for land regulation, solid waste management and informal settlement control along the river banks
Forest Department	Custodian of forested riparian zones and biodiversity conservation

4 PHYSICAL INFRASTRUCTURE

4.1 Water supply

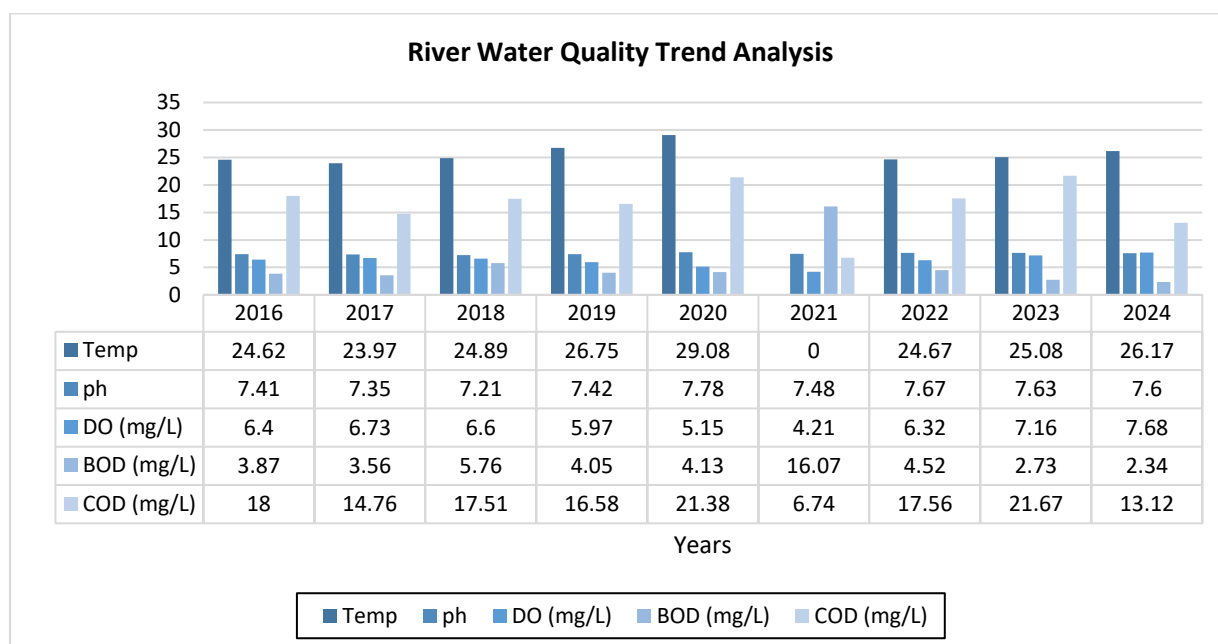
As mentioned in section 3.2.1 above, Ramnagar’s water supply system is sustained through a combination of surface water (from Kosi River) and groundwater extracted through 23 tube wells for domestic use. Together, these sources form the town’s core water infrastructure. The water from kosi river is diverted through the Kosi barrage to the Kosi Feeder Canal, which is used for irrigation and water management. Its presence supports various activities, including sand mining, irrigation, and limited recreational use, making it a vital natural resource for the town.

4.1.1 Water Demand and Supply

At present, approximately 80% of the town’s supply is met through surface water, while 20% is derived from groundwater. The total water extracted from both surface water and ground water is 20.89 MLD. The surface water is extracted from the Kosi Barrage to WTP with a capacity of 11 MLD. During peak season, additional requirement of 5 MLD is met by an infiltration well located approximately 12 km upstream at Bangajhala. For the ward number 19 and 20, the water is extracted from 4 tube wells located with 4.89 MLD of extraction within these wards. In addition, there are 23 tube wells in the planning area. There are no ground water recharge points identified by the department.

4.1.2 Water Quality

Over the past decade, results indicate that Dissolved Oxygen (DO) and Biochemical Oxygen Demand (BOD) levels remain within CPCB standards. The river is classified under Category B, denoting suitability for outdoor bathing. The river water quality taken at pampapuri is presented in Figure 4-1 below.



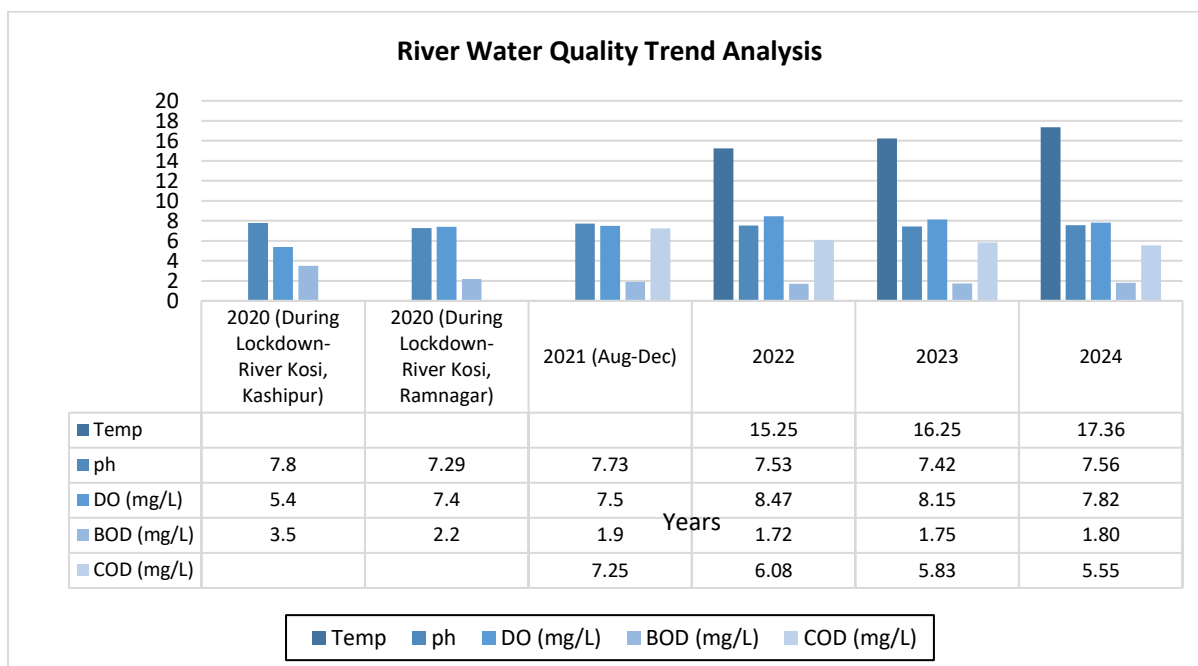


Figure 4-1 : River water Quality as per State Pollution control board for Kosi River

4.1.3 Groundwater

Groundwater serves as a critical buffer bridging gaps in surface water supply. Ground water is extracted through 27 tube wells of which 4 are located within the town and 23 are located across the 4 villages in the planning area. The total water extracted from these tube wells is 28.14 MLD of which 4.89 MLD is extracted from the tube wells in the town. These tube wells are located in Ward 19 and 20 because they are too far away to be connected to the main water supply network.

There are no underground or overhead Reservoirs for storing water extracted from these tube wells and there are no groundwater Recharge points being operated or maintained by the department.

As per the Dynamic Ground Water Resources Report, 2023 of Central Ground Water Board (CGWB), Ramnagar falls within the safe category of ground water extraction. The Uttarakhand map showing the various categorization is presented in below Image 4-1 and Image 4-2. The likely reasons for Ramnagar being in the "safe" category are as follows:

- High natural recharge capacity due to town's location in the tarai-bhabar zone allowing rapid infiltration of rainfall and surface water in aquifer recharge.
- Irrigation canals from the Kosi Barrage reduce dependence on groundwater for agriculture, keeping ground water extraction levels lower.

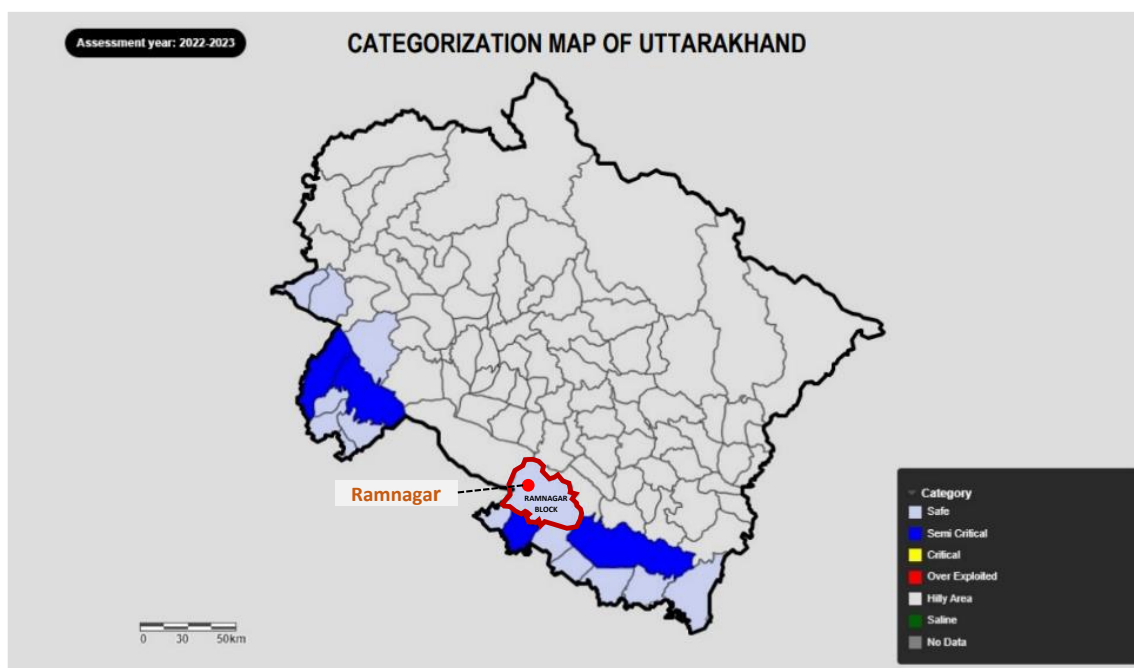


Image 4-1: Dynamic Ground Water Resources, 2023 Uttarakhand, CGWB

There is potential for recharge of ground water due to the presence of local/ discontinued aquifers, as is evident from the hydrogeological map indicating the aquifers in the region.

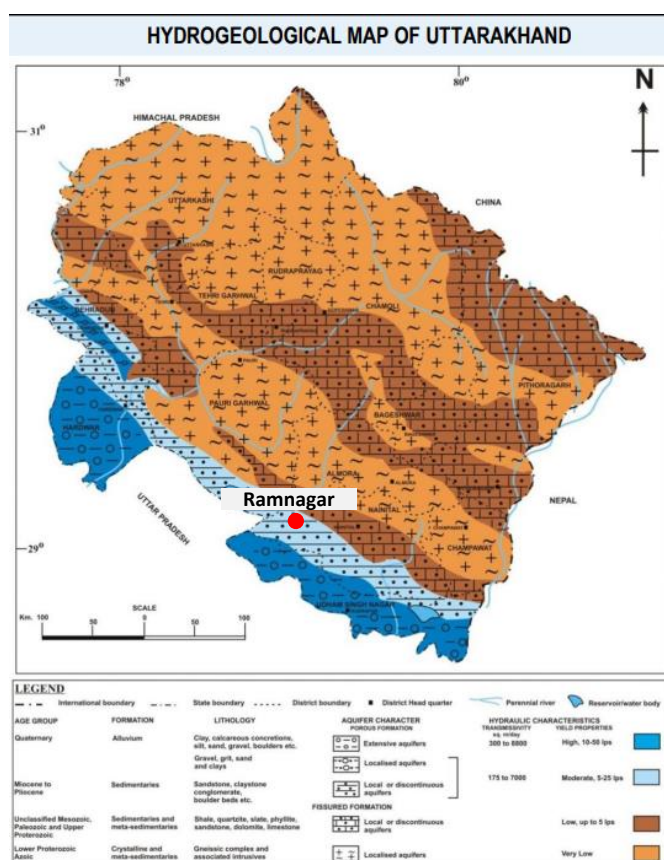


Image 4-2: Dynamic Ground Water Resources, 2023 Uttarakhand, CGWB

4.1.4 Institutional Mechanism

Department	Role
Uttarakhand Pay Jal Nigam	Authority in charge of project design, planning, and implementation of water supply projects
Uttarakhand Jal Sansthan	Operation and maintenance of the projects upon their transfer from Pay Jal Nigam for water supply projects

4.2 Sewerage system

4.2.1 Sewage Generation and Coverage

Currently, town has no sewerage network and sewage disposal relies entirely on septic tank. The total faecal sludge generated in the town is estimated at 11 KLD per day.

As per Ramnagar Municipal Council, there are a presently 7 toilets in the town, comprising 3 public toilets and 4 community toilets, all of which are connected to septic tanks.

4.2.2 Existing Sewerage infrastructure

At present there are two Sewerage Treatment Plants (STPs) in Transport Nagar and Puchdi with a combined capacity of 8.5 MLD based on secondary treatment and one SPS with a capacity of 5.11 MLD. These STPs are only treating the domestic used water of the town. The treated water is directly discharged into the river. The STPs, its inflow & outflow and the outfall location are listed in Table 4-1.

Table 4-1: Inflow and outflow of STPs

Sl. No.	Name of STP	Technology	STP Capacity (in MLD)	Inflow (in MLD)	Outflow (in MLD)	Outfall Location	Distance of Outfall from STPs (In Km)
1	STP at Transport Nagar, Ramnagar	SBR	7.0	3.5	3.5	Kosi River	0.08
2	STP at Puchdi, Ramnagar	SBR	1.5	0.90	0.90	Kosi River	3.15
	Total		8.5	4.40	4.40		3.60

Source: Pey Jal Nigam Department, Ramnagar, 2025



Image 4-3: 7 MLD and 1.5 MLD STP in Ramnagar

Currently, there is no faecal sludge treatment plant in the town. The desludging is carried by Private Sanitary & Sewer Operator (PSSO) vehicles operated by private operators and registered in Municipal Council. A co-treatment plant is located in Rurdpur at distance of 73 km from Ramnagar. Due to the

distance, the sludge is transported and dumped into agriculture and horticulture land in the planning area by the operators on request of the farmers. The average desludging frequency of septic tanks is 3 -5 years.

4.2.3 Institutional Mechanism

Department	Role
Uttarakhand Pay Jal Nigam	Authority in charge of project design, planning, and implementation of sewerage projects
Uttarakhand Jal Sansthan	Operation and maintenance of the projects upon their transfer from Pay Jal Nigam for sewerage projects

4.3 Storm water management/ Drains

The drains carry the domestic used water of town to the STPs. The town is divided by a ridgeline. On the eastward side, which cover 1- 7 ward there are total 11 drains out of which 5 are major drains and 6 are minor drains. On the westward side, which cover 8 – 20 wards the drains merge with the irrigation canal and eventually discharge into the Swaladeh Nadi which is 7 Km from the town as shown in Image 4-4.

Cleaning mechanism

Out of the 5 major drains, 4 drains [i.e., Fooltal Nallah, transport Nagar Nallah, Kriya Gath Nallah (Teda Road Nallah & Baldiya Parao Nallah) and Pumpapuri Nallah] are connected to Transport Nagar STP and one drain (i.e., Gular Ghati Nallah) is connected to the Puchdi STP. The 6 minor drains are directly falling into the kosi river but the volume of used water these drains carries is very low as it is not impacting the quality of kosi river (refer Image 4-4) and (refer Map 4-1).



Image 4-4: Minor drains outflow into kosi river



Image 4-5: Transport Nagar Nallah



Image 4-6: Minor Drains directly fall into kosi river

Institutional Mechanism

Department	Role
Uttarakhand Pay Jal Nigam	Authority in charge of project design, planning, and implementation of sewerage projects

4.4 Solid waste management

Residential Waste

Ramnagar town generates 13.6 metric tonnes per day (TPD) of solid waste which includes 50% dry waste and 50% wet waste. There is 100% door-to-door waste collection. Waste collected from Households & community bins or from the roadside kerbs via Auto-tippers by private contractor "Nivaran seva samiti" for Rs 10/HH taken initially. The waste is collected via 4 Auto tipper, 2 tipper trucks & 1 tractor trolley in total 10 trips and transferred to the current trenching ground where it is dumped without any processing.

Waste Processing Facilities

The waste undergoes segregation into recyclable and non-recyclable categories. Recyclable waste is transported to the Haldwani recycling plant for processing. And the non-recyclable waste is disposed at the trenching ground located near the Puchddi area. Additionally, biomedical waste managed transported to Rudrapur, by Global Environment Solutions for its decomposition and treatment which is in compliance with the health and safety standards of biomedical Waste. A Material Recovery Facility (MRF) is located within the Municipal Council for the segregation and handling of E-waste.



Image 4-7: MRF Center at Municipal Council



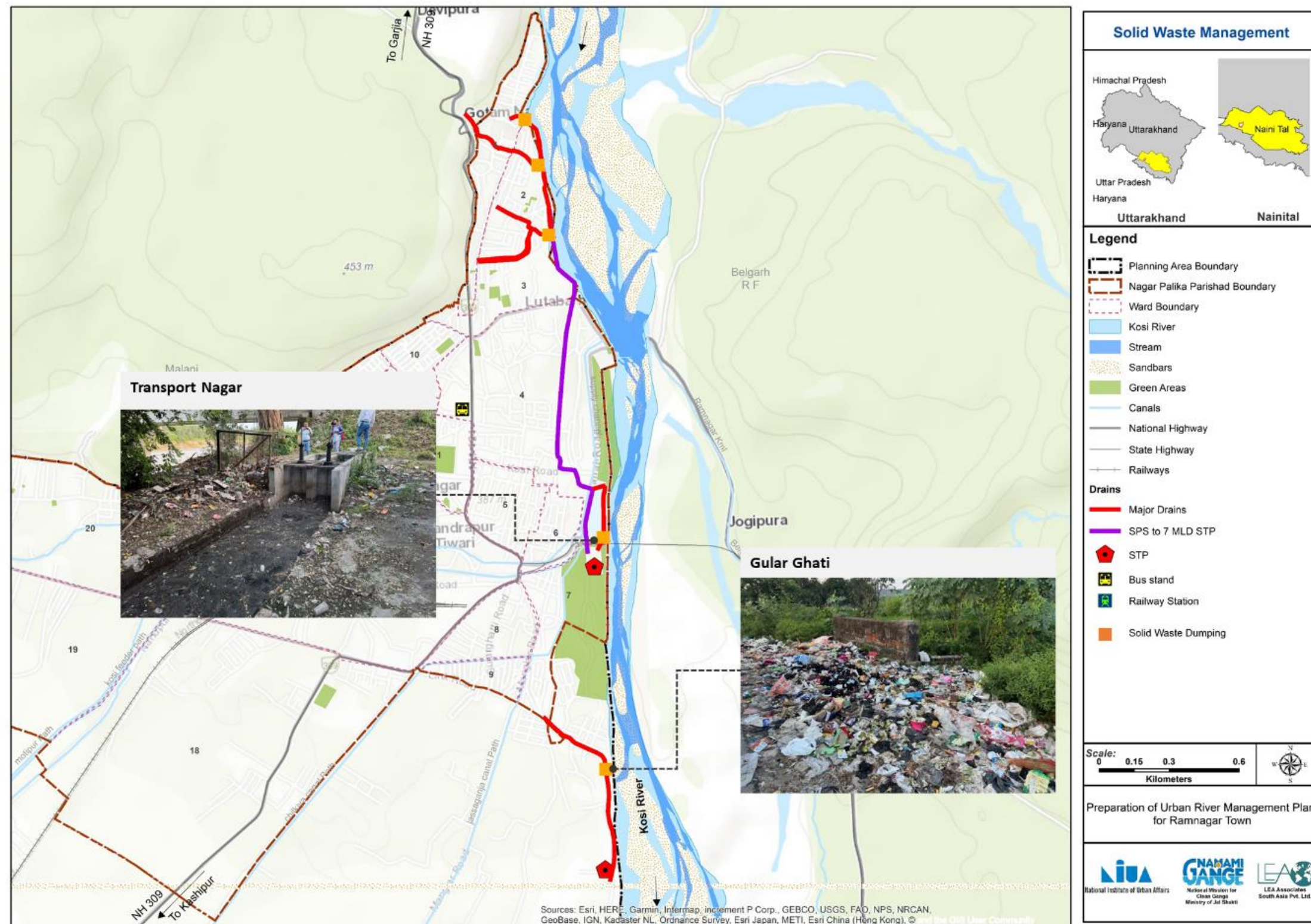
Image 4-8: Location of Solid Waste dumping area along the Kosi River

Institutional Mechanism

Solid Waste Management in Ramnagar town is being carried out by Municipal Council and handling components of door-to-door waste collection and processing through agencies hired on contracts. The source of funding of the town for waste management, is received from SBM 2.0.



Map 4-1: Physical Infrastructure Map



Map 4-2: Solid Waste Hotspot Map

5 SWOC ANALYSIS AND URM INDEXING OF THE TOWN

5.1 SWOC Analysis

Based on the baseline assessment of Ramnagar town, various issues and gaps have been identified. Based on this, a SWOC analysis has been done and presented below:

	STRENGTHS • 25 & 100-years flood lines are delineated. • Two sewage treatment plants (STPs) with a combined capacity of 8.5 MLD intercept all major drains, and bar screens prevent solid waste from entering the system. • The STPs currently operate at 52% capacity, allowing for additional used water treatment without immediate expansion. • River water quality remains within permissible limits for bathing. • The Kosi Barrage functions as a recreational hub, supporting small hospitality businesses and attracting visitors. • Municipal outreach programs, including rallies, ward meetings, college sensitization, and youth-focused events, foster long-term stewardship of the river.
	WEAKNESS • Absence of a recent master plan and lack of floodplain provisions in master plan 2001, limits strategic flood risk and land use regulation • The 5,25 & 100-years flood lines are not notified. • town lacks a sewer network and rely on septic tanks • Economic activities linked to the river remain underdeveloped, with no enterprise zones, handicraft hubs, or cultural circuits. • no formal guidelines for allocating treated used water to maintain ecological flows • Riparian buffers are fragmented, with no active restoration projects or continuous stretches towards the town. • Kosi River is prone to erosion due to high velocity and channel migration. • No centralized digital platform or earmarked funds to ensure continuity of river-related initiatives • Community involvement in river planning, promotion, and benefit-sharing is minimal, and cultural events connecting citizens to the river are absent.
	OPPORTUNITIES • A new master plan integrating floodplain zoning and ecological flow targets can strengthen long-term resilience. • The eastern bank of the Kosi River and areas near Balaji Temple can be developed into eco-friendly riverfronts with nature trails, ghats, and cultural spaces. • Treated used water can be repurposed for agriculture, vehicle washing, park maintenance, and industrial processes, freeing freshwater for ecological flows. • Formal river-linked markets, handicraft hubs, and cultural circuits can expand livelihoods and boost local economies. • Strategic planning around the Kosi Barrage and downstream stretches can transform underutilized zones into vibrant public spaces.

	CHALLENGES • Rising groundwater extraction and irregular rainfall patterns may compromise aquifer stability and recharge rates. • Monsoon floods and high river velocity pose risks to flood resilience and vegetation buffers. • Riverfront projects may face delays due to multiple statutory and forest clearances. • Absence of dedicated budgets, long-term outreach and IEC programs may lose momentum. • Problem of silting / High turbidity in rainy season.
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5.2 URM Indexing of the Town

The URMP framework provides a clear indexing/ scoring mechanism to monitor progress of project implementation recommended under URMP vis-à-vis its objectives. The implementation of the URMP is monitored through 10 indicators, one for each objective of the URMP framework. The URM_{index} is measured on a scale of one to five, and is useful to paint a snapshot of the situation, which can be used to monitor the implementation of the URMP, and develop overall strategies and policies for enhancement.

In order to understand the present status of water resources in the town, an assessment has been made using the URM_{index}. With a score of 2.3, Ramnagar is at elementary level of urban river management. This score shall improve upon implementation of proposed interventions against each objective. The Figure 5-1 below shows the current status of the town against each of the objectives of urban river management.

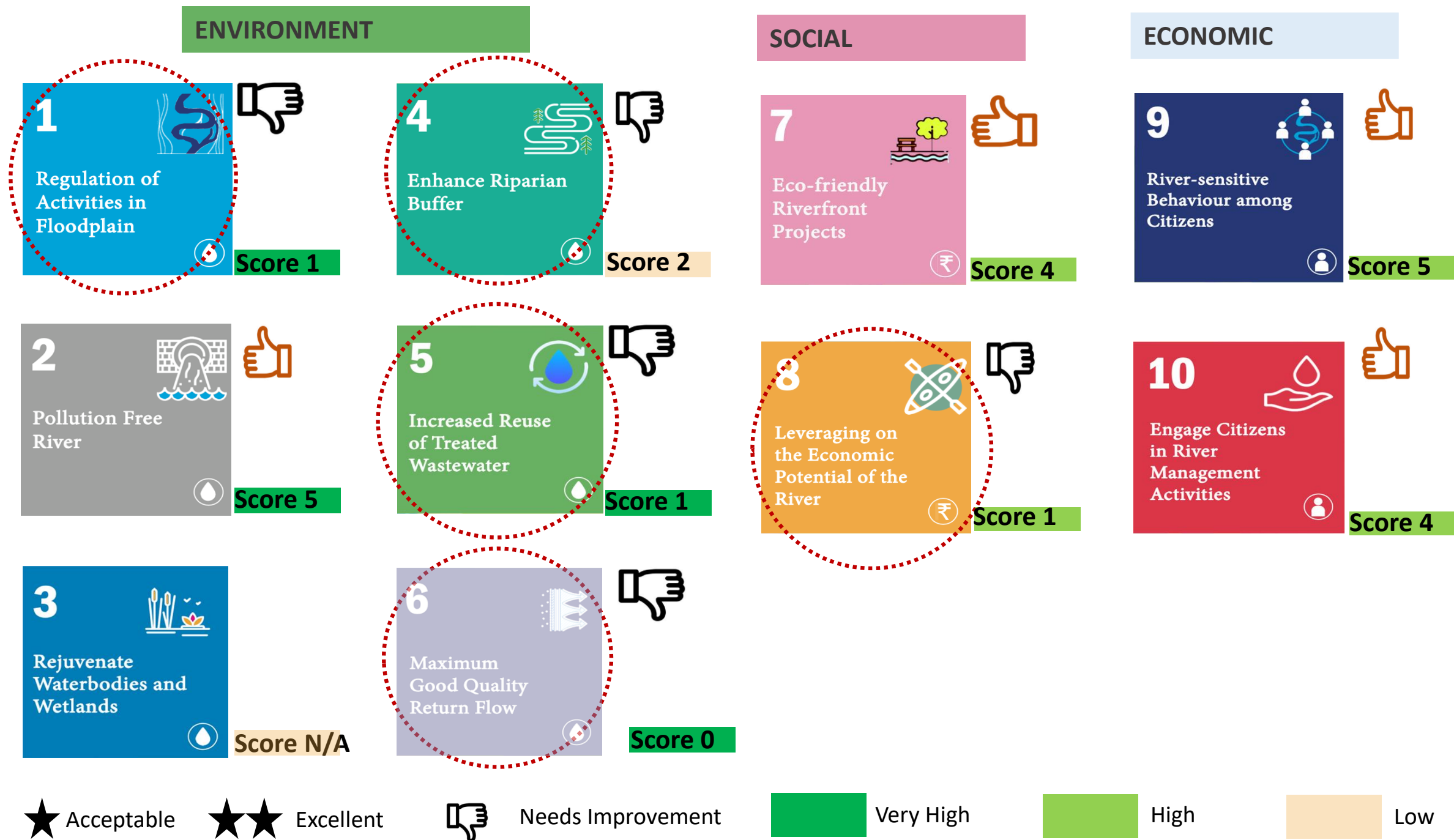


Figure 5-1: Prioritization Matrix

6 URMP VISION FOR THE TOWN

URMP Vision for Ramnagar

"To reconnect Ramnagar with the Kosi River by ensuring a clean, continuous flow, celebrating its sacred identity at Garjiya, and creating vibrant, flood-resilient riverfronts for the community while safeguarding the Corbett ecological buffer."

Proposed Homogeneous Stretches & Interventions

Stretch A: Civic Recreation & Infrastructure Zone (Northern Municipal limit to Kosi Barrage)

- **Character:** Barrage precinct dominated by the Kosi Barrage infrastructure, irrigation canals, and the existing Pump House. It is the highest ground in the municipal limit.
- **Interventions:**
 - Riverfront Park Upgrade: Enhancing the existing small park near the barrage into a formal Bio-Diversity Park that educates visitors on the river's ecology while providing leisure space.
 - Safety Zoning: Installing "Soft Barriers" (landscape hedges/railings) to prevent accidental falls near the sluice gates while allowing visual access to the water.

Stretch B: Active Cultural & Social Interface Zone (Kosi Barrage to Kosi Bridge)

- **Character:** The most critical stretch where the dense settlement of Ramnagar (Pampapuri, Bharatpuri) meets the river. Currently characterized by backyard dumping and informal access.
- **Interventions:**
 - Linear Promenade: Construction of a 1.5 km eco-friendly walkway (using permeable pavers) along the high bank, connecting the Barrage Park to the Bridge.
 - Chhath/Ganesh Ghat: developing a dedicated Community Ghat with steps for ritual bathing (Chhath Puja) to localize religious activities and prevent debris from entering the main flow.
 - Nallah Interception: Decentralized used water treatment (DEWATS) at the mouths of the Pampapuri drains before they empty into the Kosi.

Stretch C: Ecological Resilience & Buffer Zone (Kosi Bridge to Municipal Southern limit)

- **Character:** The riverbed widens here. The bank is less defined, and the area is prone to bank erosion during high floods. It borders semi-urban areas and agricultural patches.
- **Interventions:**
 - Flood Plain Zoning: Strict demarcation of the Blue Line (1-in-25-year flood) to prohibit permanent concrete structures.
 - Green Buffer/Sponge Zone: Planting deep-rooted native riparian species (Bamboo, Vetiver) to stabilize the banks against erosion without using concrete retaining walls.

- Solid Waste Trap: Installation of floating trash barriers (trash booms) at the end of this stretch to catch any floating debris before the river leaves the town limits.

Details of the two stretches are presented in the following table and Image 6-1).

Stretch A (Up Stream):		
Location	:	Kosi Barrage Precinct & Park
Theme	:	Civic Recreation & Infrastructure
Description	:	A formal gateway transforming the barrage area into a regulated public recreation zone with controlled water access.
Stretch B (Mid-Stream):		
Location	:	Barrage to Kosi Road Bridge
Theme	:	Active Cultural & Social Interface
Description	:	The primary "City Riverfront" ensuring continuous public access, ghats for rituals, and intercepting urban drains (Nallahs) like those from Pampapuri.
Stretch C (Down Stream):		
Location	:	Kosi Bridge to Southern Limit
Theme	:	Ecological Resilience & Buffer Zone
Description	:	A "Green Sponge" zone focused on flood retention, preventing soil erosion, and managing the transition from town to agriculture.

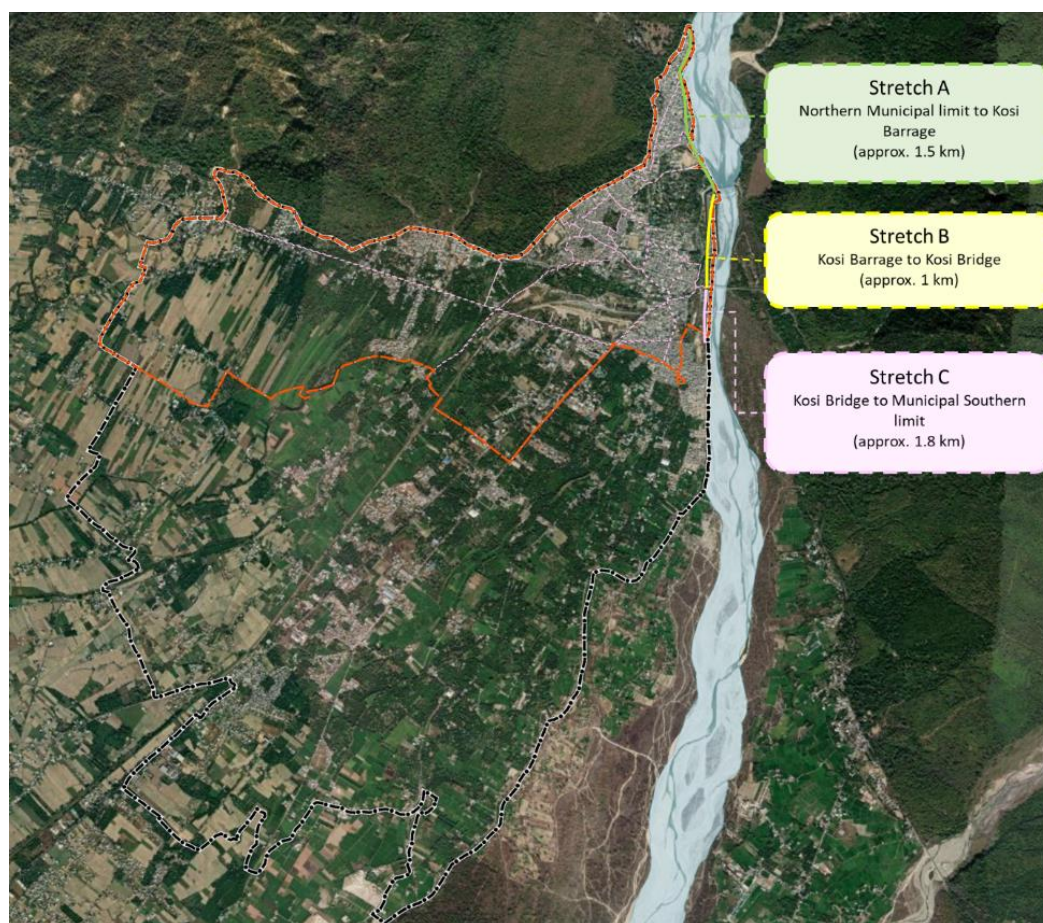


Image 6-1: Spatial Division of the Kosi Riverfront – Ecological Resilience Gateway Urban Interface

7 PROPOSED INTERVENTIONS

7.1 Objective 1 Interventions to ensure effective regulation of activities in Floodplain

Interventions under Objective 1 are designed to strengthen the Ramnagar Master Plan by embedding flood resilience, ecological restoration and sustainable water management into core planning framework of the town. Measures such as validated flood lines, encroachment free flood plains, river and stream buffer conservation, naturalized bank protection, ground water recharge will enhance resilience, reduce disaster risks, safeguard communities, and protect critical infrastructure. Aligned with national floodplain zoning and climate adaptation guidelines, these planning interventions will ensure balanced urban growth with long term sustainability.

7.1.1 Intervention 1: Preparation of a New Master Plan for Ramnagar

The existing Master Plan for Ramnagar has surpassed its intended horizon period (2001) and requires immediate revision. It is mandated that the preparation of the new Master Plan ensure the inclusion of a comprehensive section on the long-term conservation and management of Kosi river and drains.

The following recommendations shall also be incorporated in the new Master Plan.

Table 7-1: Proposed Interventions for Flood and Water Management in Ramnagar new Master Plan.

S.no.	Aspects	Recommendation	Rationale/Justification
1.	River Context & Basin Integration	Include basin-level diagnostics: catchment, tributaries, historical course, flood history, hydrology, and cultural significance of Kosi River.	Aligns with MoHUA River Centric Guidelines (2021) which mandate contextual understanding of river systems for spatial planning.
2.	River Zone Delineation & Land Use	Designate a “River Conservation Zone” (RCZ) covering active channel, floodplain, riparian buffers, and wetlands. Integrate 25-year and 100-year flood lines from Irrigation Dept. into land use zoning.	Required under Flood Plain Zoning Guidelines (MoJS, 2025) and Uttarakhand Urban Planning norms for hazard mitigation and ecological protection.
3.	Riparian Buffers & Setbacks	Notify and enforce buffer zones: 30 m from riverbank, 10 m from streams, 5 m from Nallah. Restrict permanent structures and allow only eco-compatible uses.	Mandated in Uttarakhand Building Bye-laws (2025 Amendment); buffers prevent erosion, protect biodiversity and reduce flood risk.
4.	Drainage & Water Body Integration	Map and protect natural drains, canals, tanks, and wetlands. Treat them as separate land use zones with buffer provisions.	Ensures hydrological connectivity and flood resilience; supported by MoHUA guidelines and State Water Conservation Strategy (IIT Roorkee, 2025).

S.no.	Aspects	Recommendation	Rationale/Justification
5.	Pollution Abatement & Water Quality	Ensure 100% sewerage coverage and STP capacity. Prohibit untreated discharge into river or drains. Identify solid waste hotspots and stormwater litter zones.	Required under National River Conservation Plan (NRCP) and State Water Strategy (2025); protects aquatic ecosystems and public health.
6.	Groundwater Management	Map aquifers and recharge zones. Regulate borewell extraction near river. Prohibit recharge from polluted open areas.	IIT Roorkee’s Water Conservation Strategies for Uttarakhand (2025) mandate aquifer protection and recharge safeguards.
7.	Flood Plain Zoning & Permissible Uses	Adopt FPZ categories (high, moderate, low risk zones) with permitted, restricted, and prohibited activities. Prohibit basements and permanent structures in high-risk zones.	Based on MoJS Technical Guidelines on Flood Plain Zoning (2025); reduces exposure and supports climate resilience.
8.	Rainwater Harvesting & Urban Recharge	Mandatory RWH for plots ≥ 300 sq m and all public buildings/open spaces. Integrate bio-swales, recharge trenches, and rain gardens in parks and streets.	Mandated in Water Conservation Strategies for Uttarakhand (2025); enhances water security and reduces runoff.
9.	Riverfront Development & Public Access	Plan low-impact riverfront access: eco-trails, ghats, meditation decks, interpretive signage. Avoid concrete hardscapes in buffer zones.	Encouraged under MoHUA River Planning Guidelines; balances public access with ecological integrity.
10.	Vulnerability Assessment & Risk Reduction	Identify flood-prone zones, erosion hotspots, and landslide risks. Avoid critical infrastructure in high-risk areas.	Required under Flood Plain Zoning Guidelines (2025) and State Disaster Risk Reduction Framework.
11.	Institutional Framework & Enforcement	Establish a River Corridor Management Committee (RCMC) with Development Authority, ULB, Irrigation, Forest, Jal Sansthan, and PCB. Define roles, SOPs, and reporting.	Ensures coordinated governance; supported by MoHUA and Jal Shakti directives for river zone enforcement.
12.	Monitoring & Evaluation	Set up GIS-based monitoring stations. Track encroachments, water quality, biodiversity, and buffer compliance. Publish public dashboards.	Enables adaptive management and transparency; mandated under MoHUA River Planning Guidelines and State Water Strategy.

7.1.2 Recommendation 2: Mitigation strategies for bank protection and scouring

Over the past 25 years, kosi river has widened significantly, increasing from 78 meters in 1999 to 170 meters in 2024 resulting in repeated flooding and erosion. This widening has particularly impacted developments near ward 1 and 2.

In response, the Irrigation Department has constructed mass concrete stepped retaining walls along the municipal stretch to protect the river banks.



Image 7-1: Sliding and overturning of concrete blocks due to scouring

In Ramnagar, high-velocity river flows during monsoon season induce severe scouring at the toe of the embankment. This undermining destabilizes the protective structure, leading to sliding and overturning of the concrete blocks, as illustrated in Image 7-1.

The high-velocity flows of the Kosi River, debris loads and high seismicity (Seismic Zone 4) of the region may require choice of Soft/Flexible Engineering (Gabions & Geotextiles) proposals over Hard Engineering (Concrete/Masonry Walls) for the following reasons:

- **Handling hydrostatic pressure:** Concrete is impermeable and vulnerable to hydrostatic pressure when water level in the river drops after flooding, as water trapped in the soil behind the wall cannot escape quickly. This may lead to concrete wall collapse (toppling or sliding). Gabions on the other hand are highly permeable and less susceptible to build up of hydrostatic pressure.
- **Flexibility and settlement:** Concrete structures are rigid and settling of soil beneath them due to scouring leads to cracks and breaks, thereby compromising the entire structural integrity. Gabion structures are flexible the wire crates or geotextile bags "bend" or settle into the new shape without breaking in such a situation. Thus, they continue to provide protection even after significant deformation.
- **Energy dissipation vs. acceleration:** Smooth concrete surfaces accelerate river flow which leads to severe scouring at the "toe" (bottom) of the wall and transferring the flood risk downstream to the next vulnerable area. In contrast, the rough surface of stone-filled gabions acts as a brake and creates friction that dissipates the energy of water and reduces the erosive power of river.
- **Ecological impact:** Concrete structures create a "dead edge" since no plants can grow on it. Further, it severs the link between the river and the land. Gabion structures allow for "green" engineering as over time, silt fills the voids between the stones, allowing vegetation to grow through the structure. This eventually binds the structure even tighter to the earth and restores the natural habitat.

Cost and Maintenance: Concrete structures have high initial carbon footprint due to high cement content and are difficult to repair. However, if a gabion wire breaks it can be patched or a new crate can be wired on the top. Their use of locally available river stones also reduces transportation costs significantly.

Proposed Intervention:

It is proposed that bank protection measures along municipal area can be undertaken with gabion structures along with gabion aprons at the toe for scour protection. Details of the proposed gabion structure is presented in Image 7-2 and the technical specifications are presented in Annexure 1.



Image 7-2: Gabion bank protection measures proposed for the riparian stretch along western bank

7.2 Objective 2 Interventions to keep the river free from pollution

Interventions under Objective 2 comprise measures to keep the Kosi River and the Nallahs flowing into the river free from liquid and solid waste pollution. Major source of liquid waste pollution in Ramnagar is from raw sewage disposed of into the drains from houses. Similarly, disposal of municipal solid waste into drains is a major cause of solid waste pollution.

7.2.1 Intervention 2: Zone 1A (Ward 1-3) Sewerage Redevelopment and Integration Plan

As mentioned in section 4.2 town has been divided into 3 zones and zone 1 is further divided into zone 1A and zone 1B. PeyJal Nigam has prepared the design and cost estimate for the provision of sewer lines in Sewerage Zones 1A and 1B, which encompass Wards No. 1 to 6. The proposed system will convey sewage from these areas to the existing 7 MLD Sewage Treatment Plant (STP) via 5.11 MLD.

Proposed Intervention:

Currently, most of the used water generated in Wards No. 1 to 3 is conveyed through roadside drains and diverted to the 7 MLD Sewage Treatment Plant (STP) via 4 Interception and Diversion (I&D) structures. Of these four structures, the I&D at Pampapuri drain has been rendered redundant due to river protection works (refer Image 7-3). Additionally, the sewer line connecting Pampapuri I&D to Foltal I&D, which lies along the riverbed, has been damaged as a result of high flooding in the Kosi River (refer Image 7-3 and Image 7-4).



Image 7-3: Redundant of I&D at Pampapuri



Image 7-4: Damaged sewer line between Pampapuri to Fooltal I&D

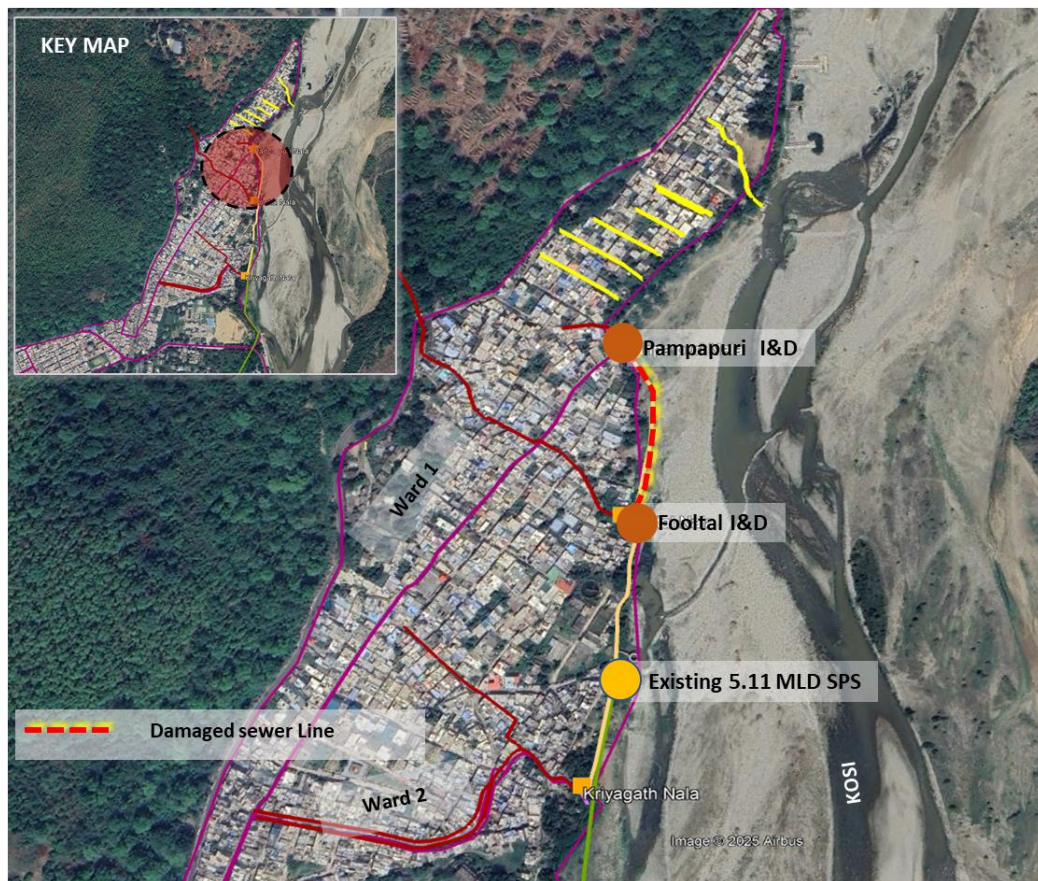


Image 7-5: Existing Trunk line In Zone 1A near ward 2

Due to a significant elevation change exceeding 10 meters across Wards 1, 2, and 3, a trunk sewer line is proposed for installation behind the bank protection. This placement is intended to safeguard the infrastructure and ensure optimal performance (refer Image 7-5).

The proposed system will function as follows:

- **Collection:** The trunk line will collect used water from Wards 1 and 2, integrating flow from 6 minor drains.

- **Conveyance:** This used water will be channeled to the Fooltal Interception and Diversion (I&D) unit.
- **Disposal:** From the I&D unit, the effluent will be directed flow to the existing Sewage Pumping Station (SPS) and subsequently pumped to the 7 MLD Sewage Treatment Plant (STP) for treatment.

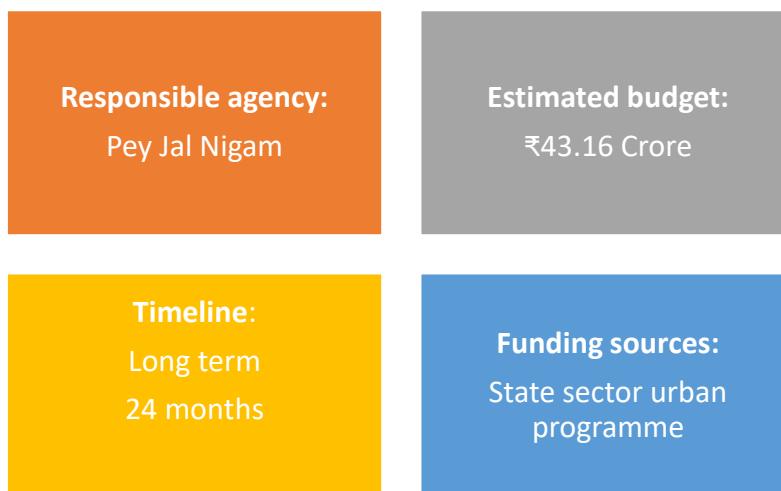
In Image 7-6 yellow lines represent the untapped minor drains in Ward 1A, which will be integrated into the proposed sewerage network. This trunk line should be incorporated into the town's proposed sewer plan by Peyjal Nigam.



Image 7-6: Proposed Sewer line In Zone 1A

Implementation Framework:

The expected budget for the interventions, along with the sources of funding are presented below. The actual costs will vary when DPRs or detailed activities are developed.



7.2.2 Intervention 3: Construction of I & D Structure in Zone-1B (Ward 5 & 6)

In Zone 1B, used water currently flows through roadside drains and discharges into the irrigation canal. While Pey Jal Nigam has proposed a long-term sewerage plan for this zone, Interception and Diversion (I&D) measures can be implemented in the interim to divert used water away from the canal.

Proposed Intervention:

In the absence of a dedicated sewer system that prevents the sewage from reaching the STP, it is proposed to construct a 4 Interception and Diversion (I&D) structure of 2 MLD on road side of Kasera lane, Jawala lane, Nai lane and bambagher lane. (Refer Figure 7-1)

The proposed I&D structure may be constructed outside the NH 309 right-of-way, requiring a land area of approximately 15x15 m. The outlet of the I&D structure shall be connected to IPS through sewer line and then pump through rising mains to 7 MLD STP. The flow arrangement is presented in Figure 7-1 and the conceptual arrangement of the I&D components is presented in Image 7-7.

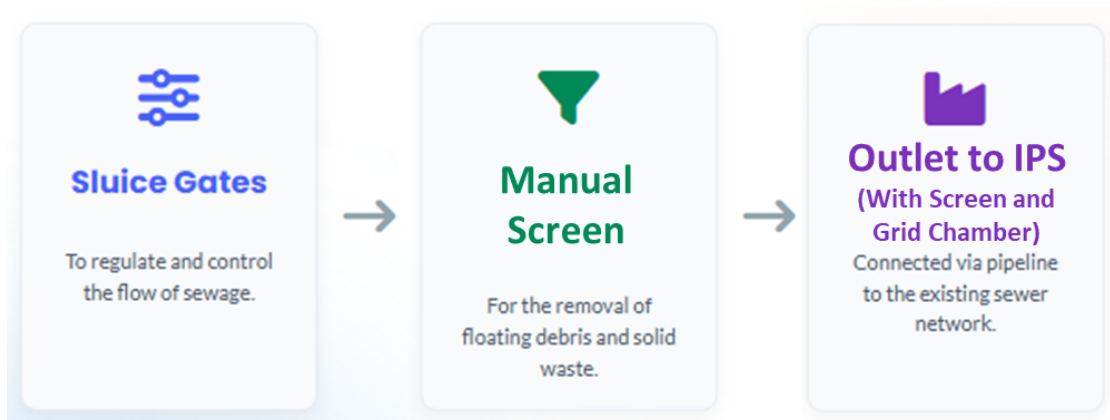


Figure 7-1: Flow arrangement of proposed I & D Structure



Image 7-7: Proposed Plan for Zone 1B

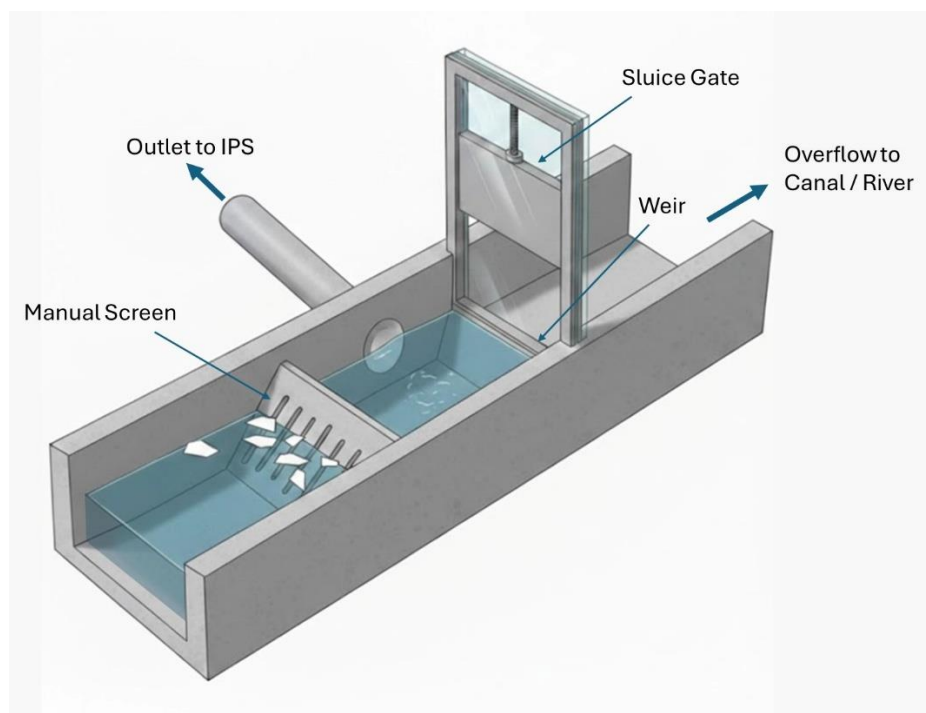


Figure 7-2: Proposed I & D Structure

Implementation Framework:

Responsible agency:
Peyjal Nigam

Estimated budget:
₹6.5 Crore

Timeline:
Short term
9-12 months

Funding sources:
Namami Gange

7.2.3 Intervention 4: Controlled disposal of septage in the collection tank of 7 MLD STP

At present, faecal sludge collected from septic tanks by desludging vehicles is directly discharged into a privately managed disposal site. The details of faecal sludge and its mechanisms have already been elaborated in Section 4.2.1, the current practice demonstrates a clear deviation from proper disposal standards. Instead of following regulated and safe mechanisms, the sludge is being disposed of in an uncontrolled manner, which poses risks to both environmental quality and public health.



Image 7-8: Desludging vehicles queued up for discharging faecal sludge in private site

Proposed Intervention:

In light of the recommendation of construction of a 32 KLD Co-treatment Plant, mentioned above, it is expected to take approximately one year to construct. Therefore, an interim septage management measure is required. During this period, it is proposed that the septage shall be discharged directly into the collection tank of the existing 7 MLD STP in a controlled and regulated manner. This practice should be maintained until the 32 KLD Co-treatment Facility is commissioned.

A technical assessment was conducted to confirm the viability of this interim measure by evaluating the STP's unutilized capacity. The analysis compared the designed parameters, current influent loads and the highly concentrated septage characteristics to determine maximum permissible daily input as mentioned below in Table 7-2.

Table 7-2: The design and current load at 7 MLD STP with septage parameters

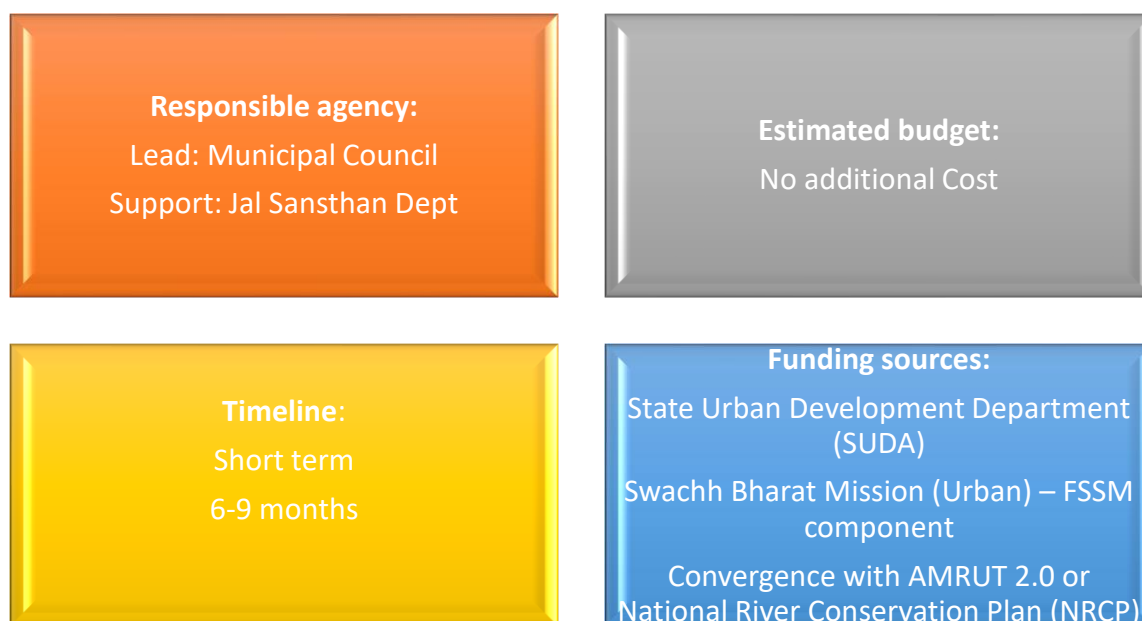
Parameter	Designed Value	Influent Value	Septage
Flow	7 MLD	3.5 MLD	-
BOD	230	87 mg/l	3420 mg/l
COD	450	184 mg/l	9040 mg/l
TSS	400	123 mg/l	35236 mg/l

Source: Consultants' Estimates

Based on the preliminary capacity calculations (refer Annexure 2), the 7 MLD STP can safely accommodate a controlled volume of septage. The following steps constitute the operational protocol. This controlled temporary disposal is crucial for effective interim septage management.

- Capacity Constraint:** Approximately 8 truckloads of septage can be discharged daily in the collection tank of 7 MLD STP with Total Suspended Solids (TSS) as the constraining parameter.
- Regulated Discharge:** Discharge should be introduced at a rate of one truckload every 2-3 hours to mitigate hydraulic shock and ensure adequate mixing within the collection tank.
- Performance Monitoring:** The plant operators must rigorously monitor the STP's performance (e.g., effluent quality, aeration basin oxygen levels, TSS etc.) to validate the assumptions and determine the optimum and safe daily tanker limit for sustained operations.

Implementation Framework



7.2.4 Intervention 5: Preparation of Faecal and Septage Management Plan

Ramnagar is currently facing challenges from unplanned urbanization, with the town's sanitation primarily dependent on septic tanks. However, municipal initiatives are now underway to expand the formal sewerage network.

Many of these containment systems are poorly designed and inadequately maintained, posing serious risks of groundwater contamination and environmental pollution. Furthermore, desludging of septic

tanks is demand based and the town does not have scheduled desludging. The desludging vehicles of the town are owned by private operators and are not registered under the municipal council. This scenario creates a broken sanitation value chain that leads to severe environmental, health, and administrative consequences. Specific gaps identified during field visits and stakeholder consultations are as follows.

1. **Containment:** Town depend on septic tanks due to lack of sewer lines. Many tanks are not watertight and lack baffles, with **no municipal registry** of tank size or desludging history.
2. **Storage:** No mechanism exists to measure sludge volume or effluent quality, and **manual access points** pose safety risks.
3. **Transport:** The town has around **2–3 private desludging vehicles** (3,000–5,000 L). However, trucks discharge into **manholes** without controlled inlets and **GPS/digital tracking** is absent. Trucks also serve **Rudrapur**, raising risks of unmonitored dumping.
4. **Treatment:** **Currently** no separate faecal sludge treatment facility is available in the town.
5. **Reuse:** Currently 0% of faecal sludge is reused, with no composting, fertilizer production, or market linkages established.

Proposed Intervention

To bridge the identified gaps in containment, storage, transport, treatment, and reuse, the town must adopt a structured Faecal Sludge and Septage Management (FSSM) Plan. The plan should be anchored in clear municipal bylaws, licensing of service providers and ring-fenced O&M funding, ensuring accountability and sustainability is aligned with the Faecal Sludge and Septage Management in Urban Areas of India – Standard Operating Procedures (SOPs). The interventions below combine the baseline findings with SOP-mandated best practices to ensure technical compliance, environmental safety, and institutional accountability. The details are as under:

1. Safe Containment

- Retrofit septic tanks to **watertight standards** with baffles, venting, and inspection ports.
- Ensure tanks are accessible for periodic desludging and designed to prevent leakage into drains or groundwater.
- Mandate a **household registry** capturing tank size, desludging history and effluent pathway.

Best practices: Tiruchirappalli (Tamil Nadu) has successfully implemented watertight septic tank retrofits and household registries under its citywide FSSM program.

City Application: Require immediate retrofitting and a centralized geo-tagged database of all onsite containment systems.

2. Scheduled and Regulated Desludging

- Establish bylaws mandating desludging cycles: **3–5 years**
- Use licensed service providers operating GPS-equipped desludging vehicles to minimize illegal dumping

Best practices: Navi Mumbai (Maharashtra) has implemented a regulated desludging schedule with licensed operators and municipal monitoring.

City Application: Current practice is reactive desludging, with trucks discharging into private site in planning area. A regulated schedule will ensure safe handling of faecal **sludge generated**.

3. Transport and Tracking

- Deploy a **digital tracking system** (GPS + mobile app) for all desludging vehicles with trip logs integrated into municipal dashboards.
- Require geo-tagged proof of discharge at designated treatment points.

Best practices: *Bhubaneswar (Odisha)* has adopted GPS-based tracking of desludging vehicles, ensuring transparency and accountability.

City Application: Trucks currently discharge into private site. GPS-based tracking will prevent illegal dumping into drains and open lands.

4. Treatment Infrastructure

- Establish decentralized FSTPs at strategic locations to intercept untreated sludge before it enters drains and rivers. These units will reduce transport distances, minimize illegal dumping, and provide localized treatment capacity.
- Integrate faecal sludge into existing sewage treatment plants through co-treatment, with controlled inlet dosing to prevent shock loading and maintain stable performance. This approach optimizes resource use and reduces capital expenditure by leveraging existing infrastructure.

5. Reuse and Resource Recovery

- Convert treated sludge as compost, with compliance to **Fertilizer Control Order (FCO)** standards.
- Establish MoUs with horticulture, forestry and municipal parks for offtake.

Best Practices: *Indore (Madhya Pradesh)* has pioneered reuse of treated sludge as compost for municipal parks and agriculture.

City Application: The entire sludge is discharged untreated. Without reuse, the town loses potential recovery of 15–20 tons/month of compostable material.

6. Operation & Maintenance (O&M)

- Ensure **continuous funding** through ring-fenced municipal budgets dedicated to FSSM operations.
- Engage **trained staff** with quarterly refresher courses on SOPs, PPE use, and emergency response.
- Establish **service contracts** with private operators for plant operation, desludging and transport, tied to performance indicators.
- Institute **preventive maintenance schedules** for pumps, screens, drying beds, and mobile FSTPs, with independent audits.

Best Practices: *Warangal (Telangana)* has successfully ring-fenced O&M budgets and contracted trained operators for its FSTPs, ensuring >95% uptime.

City Application: Ramnagar currently lacks dedicated O&M funding and trained staff for faecal sludge treatment. To sustain proposed 32 KLD co-treatment at the 7 MLD STP, the town must adopt ring-fenced budgets, operator training, and service contracts to ensure long-term viability.

7. Policy, Regulation & Institutional Framework

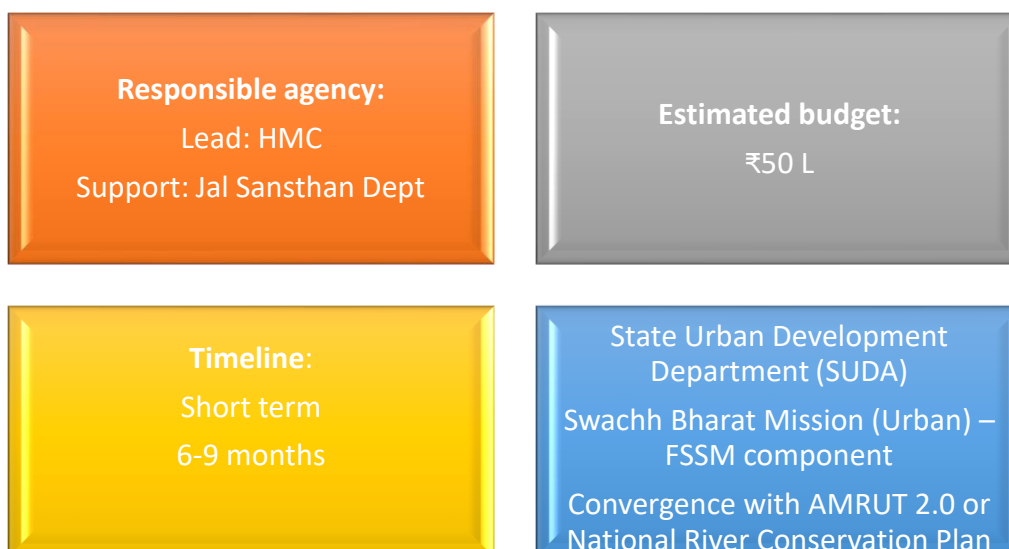
- Draft and notify **clear municipal bylaws** regulating desludging frequencies, service standards, licensing, and fines for illegal disposal.
- Establish a dedicated **FSSM Cell** within the municipality to coordinate containment, desludging, transport, treatment, and reuse.
- Launch **citizen dashboards** for service requests, compliance monitoring, and grievance redressal.

Best Practices: *Devanahalli (Karnataka)* has adopted municipal bylaws for desludging cycles and established a dedicated sanitation cell, ensuring compliance and transparency.

City Application: Ramnagar currently operates without enforceable bylaws, leading to informal desludging and uncontrolled disposal into manholes and drains. Adoption of bylaws regulating 3–5-year desludging cycles, licensing of the private desludging vehicles and penalties for illegal dumping will institutionalize accountability and align with national SOPs.

Draft Scope of Work for Faecal Sludge and Septage Management (FSSM) is presented in Annexure 3.

Implementation Framework



7.2.5 Recommendation 1: Regular cleaning and maintenance of existing I&D structures

Before the commissioning of the sewerage network, the project area will continue to rely on the existing I&D infrastructure for greywater management. Site assessments indicate that these structures are not maintained according to the required schedule of desilting and debris removal. This leads to frequent overflow of grey water from the I&D structures directly into the Kosi River. One such instance has been observed at the Kriya Ghat I&D, as shown in Image 7-9. To prevent environmental contamination until the permanent sewerage system is operational, strict adherence to a scheduled maintenance protocol is essential. In addition, constructing an access path along the Kosi River would

enable weekly cleaning of all I&D units.



Image 7-9: Silting in the Kriya Ghat I&D Structure and overflow of grey water directly in the Kosi river

7.2.6 Recommendation 2: Early Implementation of sewer network in Zone 3 (Ward 10-16)

In sewer zone 3 i.e., Karanpur area, (refer Image 7-10) roadside drains currently discharge into the irrigation canal. Due to the absence of a centralized sewerage network, these areas remain unserved, necessitating a primary reliance on onsite septic tank systems for wastewater management. Due to the absence of road access on the opposite bank prior to the drain's confluence with the canal, implementing a river interceptor is considered unfeasible (refer Image 7-11). Pey Jal Nigam has proposed a sewer network for Zone 3 that will connect to the new Sewage Treatment Plant (STP). It is recommended that this project needs to be prioritized.



Image 7-10: Drain merges with irrigation canal

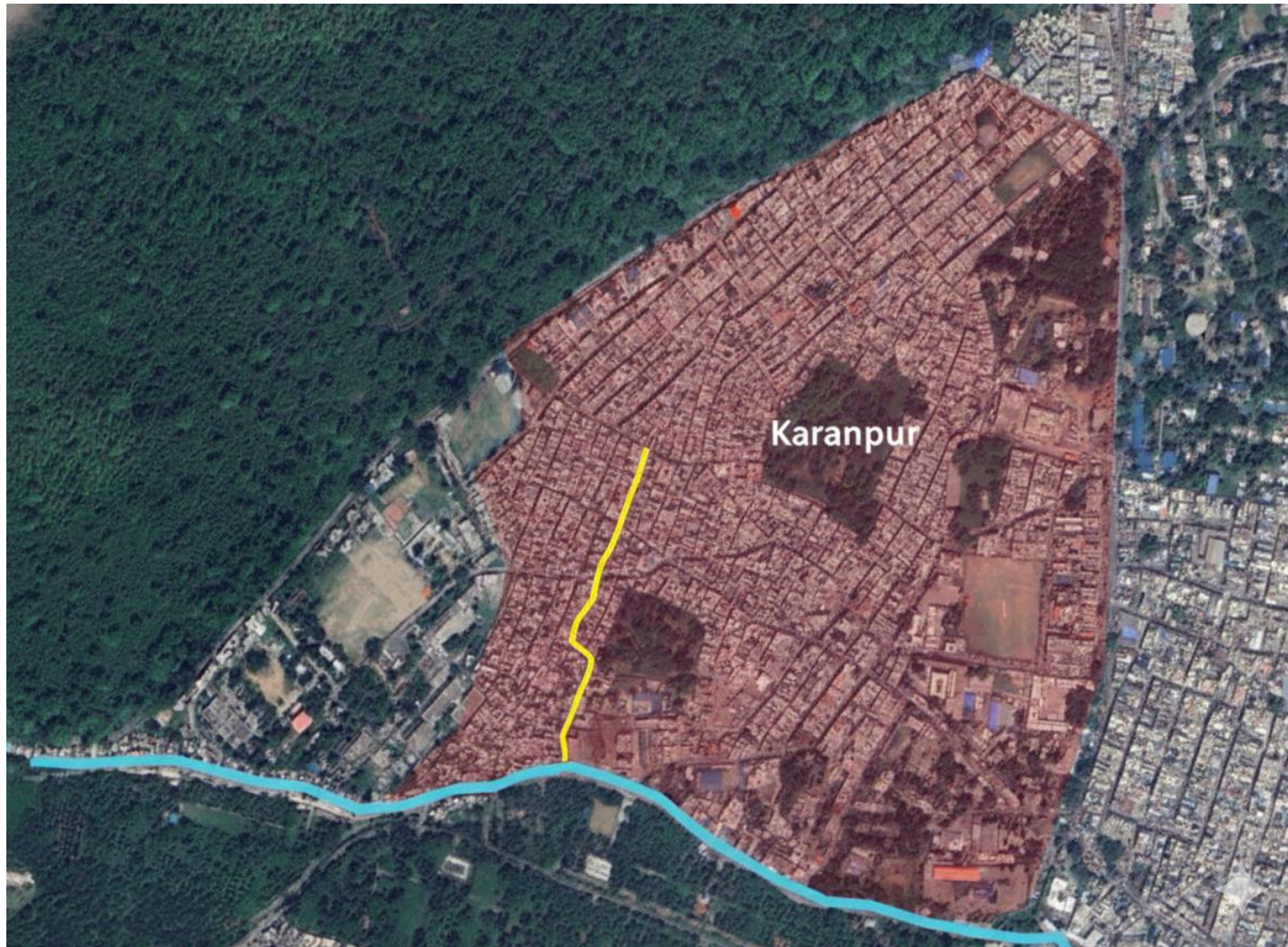


Image 7-11: Area of concern

7.3 Objective 4 Interventions to enhance riparian buffer along river bank

Riparian stretches comprising vegetated strips alongside rivers and natural drains are essential "living infrastructure" in cities because they perform critical services that cannot be provided by concrete edges. These include:

- **Flood Control:** Riparian stretches absorb excess rainwater and slow down runoff, preventing downstream flooding.
- **Water Purification:** The soil and roots filter out toxic urban pollutants and sediments before they reach the river.
- **Climate Regulation:** They cool the surrounding area thereby combating "Urban Heat Island" effect.
- **Biodiversity and Recreation:** They serve as the primary corridors for wildlife movement and provide valuable green space for human mental health and recreation.

The riparian stretch on eastern bank of Kosi River was analyzed and differentiated between degraded and healthy stretches. Interventions have been proposed for restoration of degraded stretches whereas conservation and preservation recommendations have been proposed for the relatively healthy stretches in the following paragraphs.



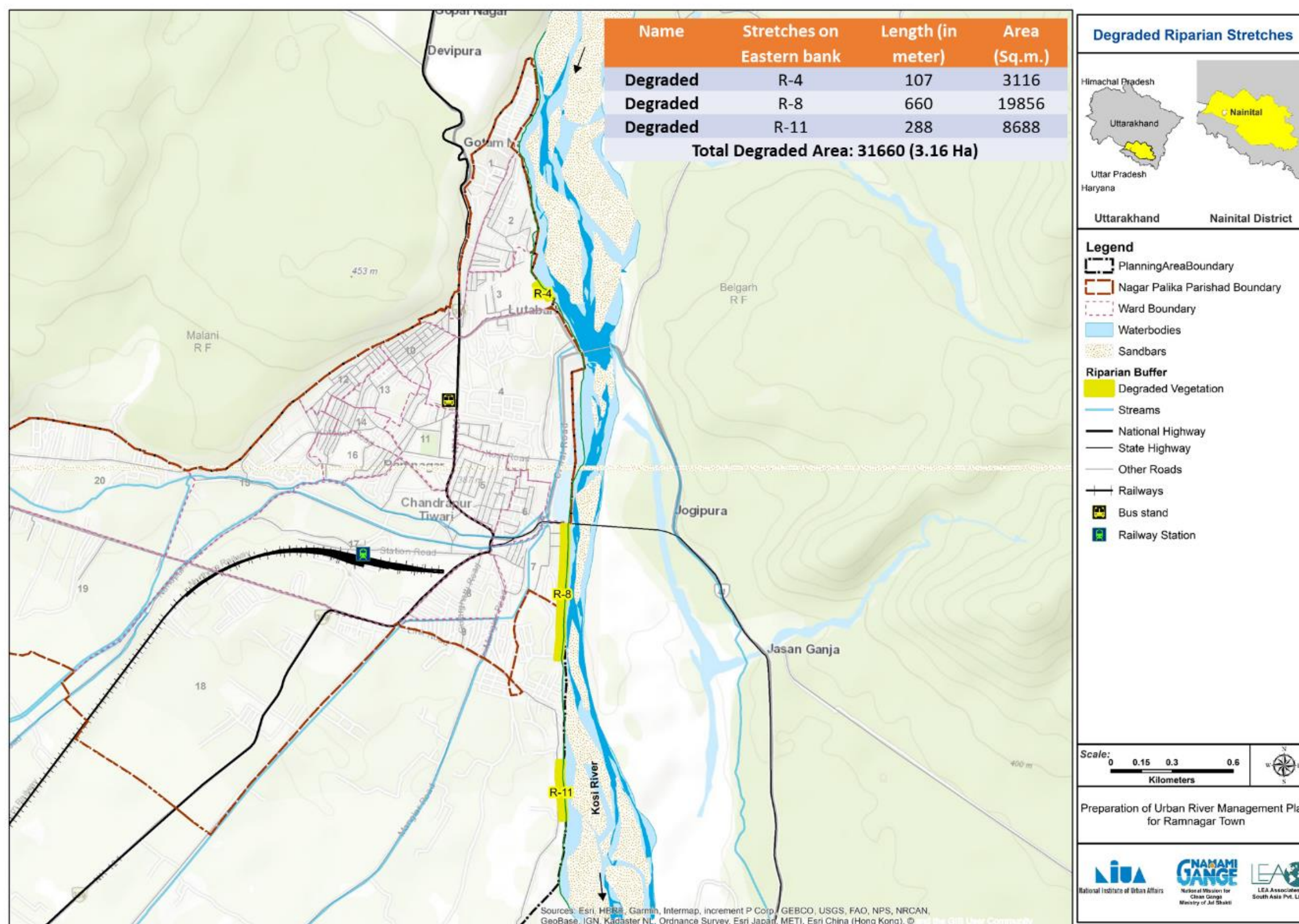
Image 7-12: Dense Riparian stretches along Ward 1



Image 7-13: Degraded Riparian stretches along Ward 2

7.3.1 Intervention 6: Restoration of degraded riparian stretches

To address localized degradation, it was observed that approximately 23.17% stretch of the eastern bank of Kosi River is affected by bank erosion and declining structural stability as shown in Map 7-1. A Three-Zone Riparian Buffer Restoration Strategy is proposed on eastern bank across the identified degraded stretches. This approach systematically restores vegetation in layers based on proximity to the river channel, ensuring that ecological and hydraulic functions are strengthened in a coordinated manner.



Map 7-1: Existing Degraded Riparian Stretches

Proposed key actions for restoration

The proposed riparian restoration measures along the Kosi River focus on strengthening bank stability, improving ecological health, and replacing invasive vegetation with resilient native species. The strategy combines targeted structural works with bio-engineering and native plantation, ensuring long-term stabilization, improved habitat quality and enhanced river corridor resilience.

Component	Description	Key Actions / Species
1. Eastern Bank – Restoration and Slope Stabilization Measures	Sections of the eastern bank show erosion and localized degradation requiring structural and bio-engineering interventions.	Structural: Gabion bank protection along stretches vulnerable to erosion. Bio-engineering: • Linear plantation of Vetiver grass (<i>Vetiveria zizanioides</i>) for soil binding and slope stability.
2. Replacement of invasive species by Native Species Integration	Invasive species along the western edge to be replaced with ecologically compatible native vegetation to enhance resilience.	Recommended native species: • <i>Anisomeles indica</i> (Lamiaceae) • <i>Leucas aspera</i> • <i>Achyranthes aspera</i> • <i>Saccharum spontaneum</i> • <i>Vetiveria zizanioides</i> • <i>Bothriochloa pertusa</i>

Multi-zonal approach for riparian stretches design

A 30m wide riparian buffer zone from the edge of river is proposed to be implemented in the identified stretches. The buffer will have three zones as shown in Image 7-14.

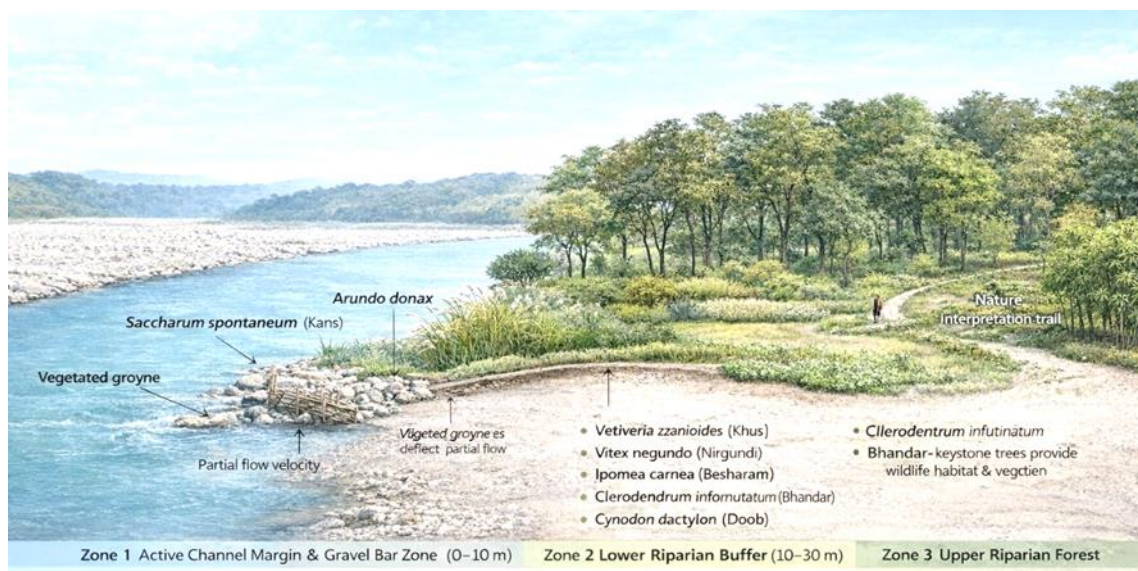


Image 7-14: Section of the Proposed riparian stretch along eastern bank of the river

Zone wise proposed species and its ecological benefits

The riparian buffer is structured into functional zones, with species selected based on hydrological tolerance, rooting depth and ecological performance. Zone-specific plantings are intended to optimize bank stabilization, nutrient filtration and habitat functioning across the river corridor. The buffer will have three zones suitable plant species for the riparian buffer for the Kosi River is listed in Table 7-3.

Table 7-3: Details of suitable plant species for the riparian buffer for the Kosi River

Zones	Function	Width (m)	Types of vegetation	Recommended flora species
Zone 1 Lower/ Riverside	Slows down runoff and traps sediments Creates habitat for aquatic biodiversity, stabilizes river banks	7.5	Grasses, Herbs, Shrub's detritus, large woody debris etc.	• Vetiver • Lantana camara • Helicteres isora • Shrub/Climber • Mallotus philippensis
Zone 2 Middle	Removes pollutants from subsurface flow of water, filter nutrients and provides shade	1.5	Shrubs and trees	• Bauhinia variegates • Anogeissus latifolia • Cassia fistula • Bauhinia purpurea • Trewia nudiflora • Phyllanthus emblica • Mallotus philippensis • Butea monosperma • Acacia catechu • Morus alba • Haldina cordifolia • Mitragyna parviflora
Zone 3 Higher/ Upper	Removes pollutants from groundwater, support long ter, stability, control flood overflow and provides canopy	7.5	Mature and large Trees	• Mangifera indica • Bombax ceiba • Terminalia alata • Terminalia bellerica • Terminalia chebula • Shorea robusta • Dalbergia sissoo • Pterocarpus marsupium • Toona ciliata • Albizia lebbeck • Ficus benghalensis • Ficus racemosa • Ficus virens • Ficus religiosa • Syzygium cumini • Schleicheria oleosa • Madhuca indica

Expected Outcome:

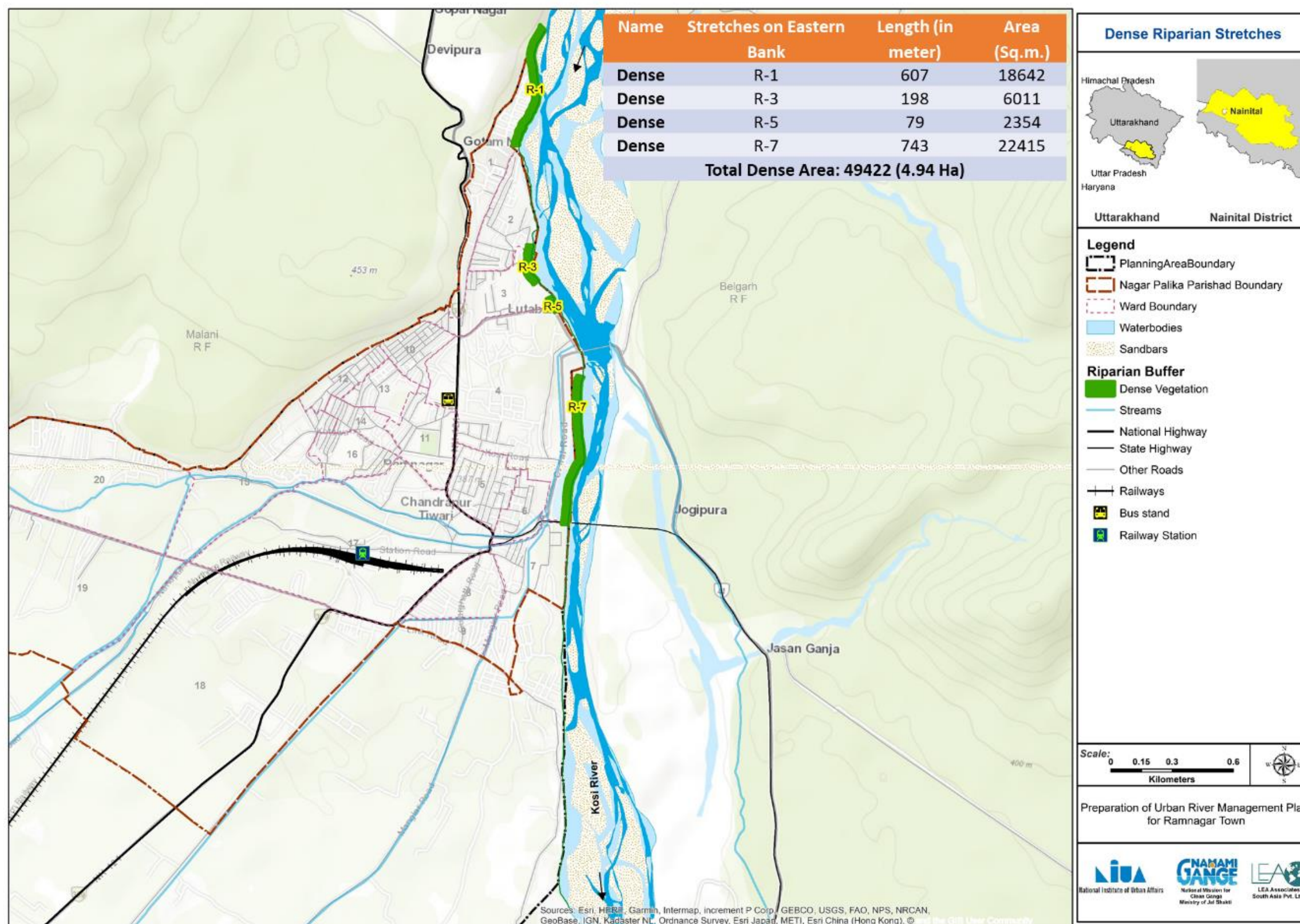
After implementing the proposed zonal riparian intervention, the degraded stretches of kosi river will be transformed into a continuous and dense green buffer. Grasses, shrubs and native trees will work together to stabilize the riverbanks, reduce flood impacts and improve water quality. This intervention will also enhance biodiversity along the river corridor. The before and after intervention conditions are illustrated in the figures below.



Image 7-15: Conceptual representation of Riparian Buffer along the Kosi River

7.3.2 Recommendation 2: Conservation and preservation of natural dense riparian buffer

Strict conservation measures are recommended for the ecologically intact stretches of the Kosi River corridor, where riparian vegetation remains largely undisturbed. These areas currently support approximately 36.17% dense vegetation on the eastern bank, reflecting high-functioning riparian systems. These priority conservation zones are illustrated in the accompanying Map 7-1 These zones provide critical reference conditions (baseline or “benchmark” sites) against which restoration outcomes in degraded reaches can be evaluated and therefore should be protected from clearing, encroachment, grazing and unnecessary disturbance.



Map 7-2: Existing Dense Riparian Stretches

The table below presents the key management actions proposed for the existing riparian buffer along the Kosi River. These measures prioritize conservation of healthy stretches, restoration of degraded banks and targeted interventions to maintain ecological stability and long-term river resilience.

Recommendation for existing riparian stretch conservation and preservation

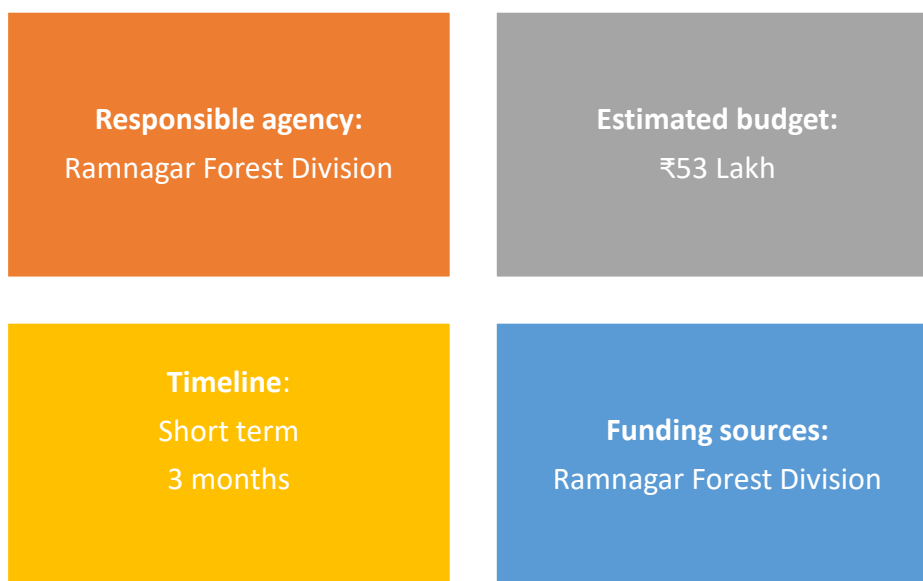
Well-developed, ecologically functional riparian vegetation that must be preserved in its current state.

The key recommended actions are given below:

- Integration of buffer width into flood plain zoning regulations.
- Prohibited Permanent construction mining, dumping and river bank encroachment.
- Control grazing and fencing in sensitive stretches.
- GIS based demarcation and geo fencing of buffer stretches.
- Periodic drone and satellite monitoring.
- Formation of Community level protection committee.
- Penalty, restoration liability and compensatory plantation for violation.

Implementation Plan

The implementation of the riparian buffer restoration along the Kosi River will be guided by a clearly defined management framework to ensure effective execution, accountability and resource utilization. Key elements of the framework include:



This framework provides a clear and practical approach for restoring degraded riparian stretches of the Kosi River. It defines roles, timelines, costs and funding arrangements to ensure efficient and sustainable implementation, while aligning restoration activities with the river’s flood behaviour, ecological needs and overall river management objectives.

7.4 Objective 5 Intervention for reuse of treated used water

7.4.1 Intervention 7: Enhance the reuse of treated used water in the Town

Ramnagar presently has no operational system for reuse of treated water. The town has 2 STP (i.e., 7 MLD and 1.5 MLD) which generates approximately 4.40 MLD of treated water daily, which is currently discharged without beneficial utilization. The treated effluent consistently achieves Biological Oxygen Demand (BOD) levels below 10 mg/L, meeting the CPHEEO recommended norms for reuse in irrigation, landscaping, horticulture and certain industrial applications.

A reuse commitment exists for Nagar van lies on eastern bank of the kosi river with total area of 17 Ha offers a sustainable alternative to freshwater, significantly reducing urban water pressure and preventing excessive groundwater extraction. This practice provides nutrient-rich effluent containing nitrogen and organic matter that enhances soil health and acts as an effective natural fertilizer. Beyond this town has 6 parks along the canal with total 1.39 Ha of area. These green spaces serve as vital recreational hubs and ecological buffers for the community.

Proposed Intervention:

The estimated daily water requirement for Nagar Van is about 1.02 MLD, calculated at 6 litres per square metre per day. This demand can initially be met through tanker supply until the proposed 0.8 km pipeline (200 mm diameter) is laid (Refer Image 7-16).

In addition to meeting Nagar Van's needs, approximately 0.08 MLD of treated water from the 7 MLD STP is proposed to be diverted to the nearby green areas covering 1.39 hectares (Refer Map 7-6). The treated effluent already meets CPHEEO standards (BOD ≤ 10 mg/L, turbidity < 2 NTU, nil faecal coliform) and absence of foul odour making it suitable for reuse in horticulture, landscaping, and other non-potable applications.



Image 7-16: Proposed reuse of treated used water from 38 MLD STP in various organized greens in close proximity

Implementation Framework

Responsible agencies:

Jal Nigam; Supporting Agencies:
NMCG and Forest dept

Estimated budget:

₹3.32 Cr

Timeline:

Short term
1- 1.5 Years

Funding sources:

State Urban Development Funds
CSR funding

7.5 Objective 7 Interventions to develop eco-friendly riverfront projects

This intervention is under the jurisdiction of multiple agencies from the land ownership perspective. The agency owning the land parcel would have to propose riparian zone development and bear the expenditure. Considering this, Forest Department and Irrigation Department can either independently or jointly develop land for the proposed plantation.

Rationale: Ramnagar is a primary hub for wildlife tourism in India and serves the role as the "Gateway to Jim Corbett National Park." However, most tourists pass through the town without staying or engaging with its local landscape of which Kosi River forms an integral part. An integrated riverfront at Ramnagar can transform the banks of the Kosi River into a tourist destination and encourage longer stays of tourists and boost the local economy.

The proposed strategy is to integrate the Kosi Barrage, City Forest (Nagar Van), and surrounding parks into a cohesive day-long destination for Corbett visitors which would provide a "Buffer Day" experience for tourists who either didn't get Safari tickets or want a relaxed day outside the jungle. The following three interventions have been identified.

1. Connecting the riverfront parks with Riverfront promenade,
2. Theme based development of existing Ramnagar Riverfront parks on Kosi River western bank,
3. Infusion of additional activities at City Park on Kosi River eastern bank

7.5.1 Intervention 8: Connecting the riverfront parks with Riverfront promenade

Ramnagar presently has five riverfront parks of different sizes, of which one is on the eastern bank of Kosi River while the rest are on the city side on western bank. The Kosi Barrage and the Bypass Road bridge are the two links between the eastern and western banks of the river. (Refer Image 7-17)

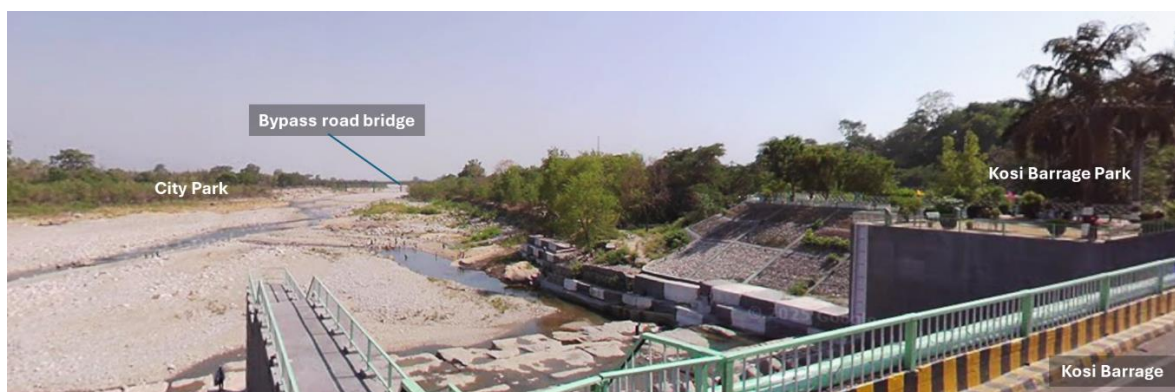


Image 7-17: Kosi Barrage and Bypass Road bridge links the eastern and western banks of Kosi

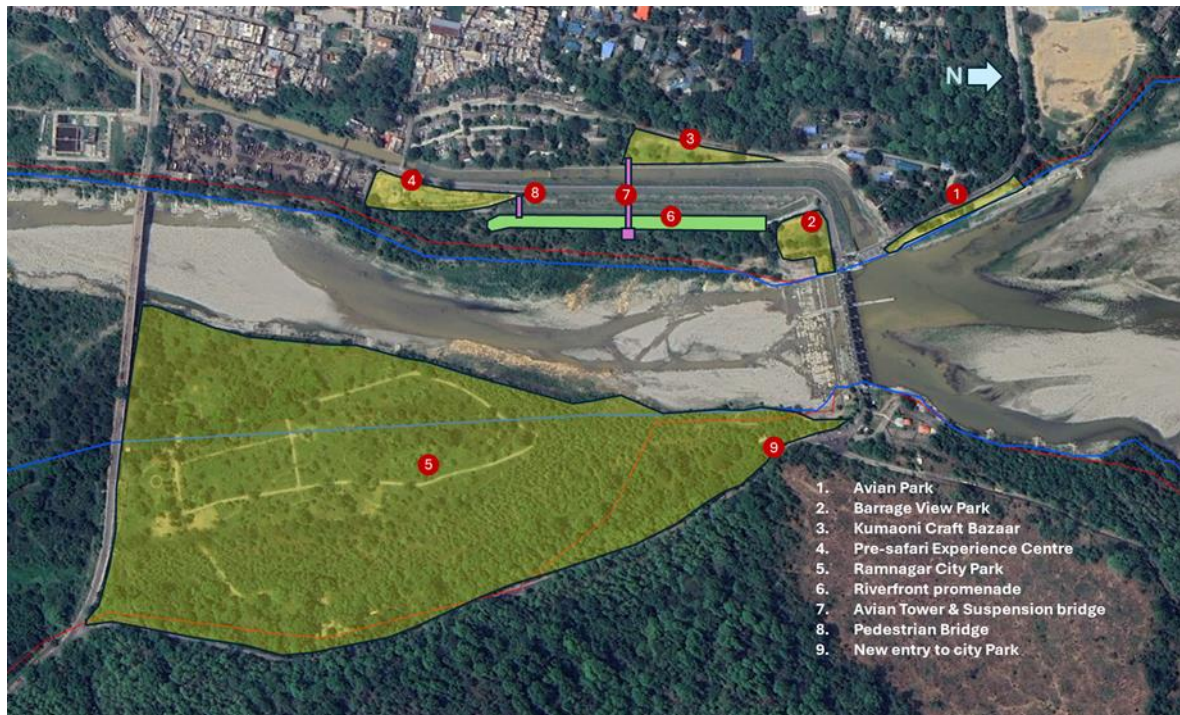
Three key interventions to ensure spatial integration and connectivity are recommended to activate the Kosi riverfront and enhance economic potential of the river theme-based development of these parks and establishing connectivity between them needs to be sensitively planned as officials of forest department have informed about occasional tiger movement along the river stretches (refer Map 7-3).

The proposed riverfront promenade for linking the theme parks comprises three components as follows (Refer Map 7-4)

- Development of pedestrian and bike promenade between canal and the Kosi River riparian stretch,
- Bird watching tower cum Suspension bridge connecting the riverfront promenade with the Canal west bank Municipal Park, and
- Pedestrian bridge connecting the riverfront promenade with the Canal east bank Municipal Park



Map 7-3: Existing riverfront parks of Ramnagar and reported tiger movement corridor



Map 7-4: Proposed riverfront promenade and theme parks

Development of pedestrian and bike promenade: The existing canal bank pathway adjacent to the Kosi River riparian stretch is proposed to be developed into a promenade with the following interventions:

- **Pathway:** Replacement of the existing tiles of pathway with permeable paver blocks
- **Cycle-Track:** A dedicated cycling path of porous concrete
- **Chaing link fence with creepers:** A barrier to protect riparian stretch (tiger corridor)
- **Seating Spaces with Landscape Area:** Designated spots for rest and viewing.
- **Gazebos:** Intermittent gazebos to serve as rain and sun shelter





Image 7-18: Pedestrian and bike promenade

Bird watching tower cum Suspension bridge: A tall structure towering over the trees to provide a view of the river and other parks in the vicinity of the promenade. It supports a pedestrian suspension bridge linking to the Canal west bank Municipal Park.



Image 7-19: Avian watch tower cum suspension bridge across Kosi canal

Pedestrian bridge: A small pedestrian and bike bridge across the canal silt ejector channel connecting the riverfront promenade with the Canal east bank Municipal Park.



Image 7-20: Pedestrian bridge across the canal silt ejector channel

7.5.2 Intervention 9: Theme based development of Ramnagar Riverfront parks

Avian Park: The newly developed park by the Forest Department upstream of the barrage was done to provide a view of the birding site in the barrage lake. It is proposed to convert this park into an Avian Park with additional infrastructure provisions such as:

1. Binoculars,
2. Avian information boards,
3. Steel dustbins
4. Eco-shop and Cafe
5. Viewing Decks & Hides
6. Guided Walk Trails



Image 7-21: Converting upstream Barrage Park into an Avian Park

Kumaoni Crafts Bazaar: The Kumaoni Crafts Bazaar in Ramnagar will serve as a vibrant hub showcasing the artistic heritage of the Himalayan foothills through authentic, sustainable, and locally sourced products. Visitors can explore iconic crafts such as Aipan art with its red terracotta designs, intricate Likhai wood carvings, Ringaal bamboo baskets and mats, eco-friendly pine needle creations, and Rambaans fibre crafts including Panchachuli woolens and traditional Pichora.



Image 7-22: Converting canal side Municipal Park to Kumaoni Culture & Craft bazaar

"Pre-Safari" experience center

Ramnagar Pre-Safari Interpretation Centre: Instead of taxidermy (which is at Dhangarhi), This centre will house a series of integrated zones designed to bridge the gap between urban life and raw wilderness of the Himalayan foothill. More than just a centre, it will be an immersive sensory journey that will prepare the visitors to enter the forest not as a mere spectator, but as an informed and responsible “Kosi Gardina”. Through a blend of heritage storytelling, cutting-edge digital monitoring, and interactive sensory zones. Listed below are the activities that people would experience in the interpretation centre.

- **Corbett Heritage Walk:** Gallery tracing Jim Corbett’s journey from hunter to conservationist.
- **VR Safari Orientation:** 360° virtual drive through park zones to teach ethical wildlife spotting.
- **“Jungle Pulse” Acoustic Library:** Booth to learn forest sounds and predator alarm calls.
- **Eco-Safari Workshop:** Orientation for assembling eco-friendly safari kits and pledging forest etiquette.



Image 7-23: Virtual Reality Safari Orientation Zone



Image 7-24: Interpretation centre at Amrit Vatika Park”

7.5.3 Intervention 10: Infusion of additional activities at City Park

The City Forest in the eastern bank has the potential to be positioned as a "Mid-Day Activity" in the hours between 11:00 AM and 3:00 PM when safari zones close. Similarly, in the evening the linear parks along canal can be positioned as "Cool-down" experience after a hot day of safaris to increase tourist footfall at these locations.



Image 7-25: Ramnagar City Park along eastern bank of Kosi River

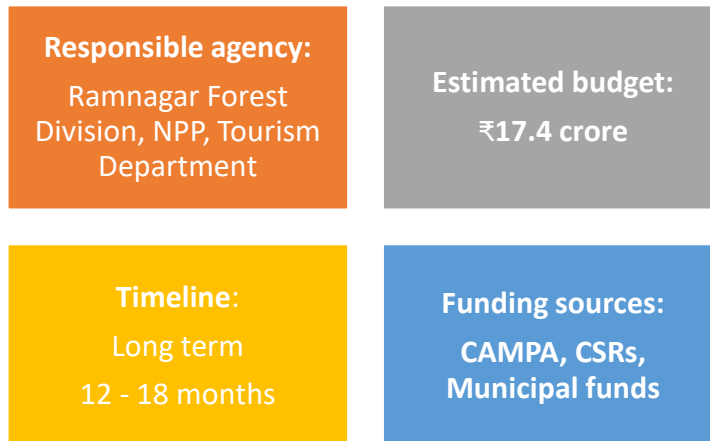
Since walking is prohibited inside Corbett, the City Forest should offer the "jungle walk" experience tourists crave but cannot get in the core zones.

- **Canopy Walkways:** Install elevated wooden boardwalks or suspension bridges (rope bridges) 10–15 feet above the ground. This minimizes soil trampling and allows visitors to see birds and monkeys at eye level.
- **Nature Interpretation Centre:** A semi-open bamboo or timber structure explaining the local flora (Sal, Teak) and the "Science of the Forest" (termites, decomposition, food webs), which is often missed during high-speed jeep safaris.
- **Zone of Silence:** Create specific meditation zones with stone benches for "Forest Bathing" (Shinrin-yoku), appealing to wellness tourists.

Budget:

Component	Broad cost estimate
Intervention 1: Connecting Riverfront Parks with Promenade	
Pedestrian & Bike Promenade	1.3 Cr
Bird Watching Tower cum Suspension Bridge	3.2 Cr
Pedestrian Bridge across Canal Silt Ejector	1.2 Cr
Intervention 2: Theme-Based Development of Riverfront Parks	
Avian Park (Upstream Barrage Park)	2 Cr
Kumaoni Crafts Bazaar (Canal-side Park)	2.3 Cr
Pre-Safari Interpretation Centre (Amrit Vatika Park)	3.6 Cr
Intervention 3: Infusion of Activities at City Park (Eastern Bank)	
Canopy Walkways (500 m elevated boardwalks)	2.5 Cr
Nature Interpretation Centre (semi-open bamboo/timber)	0.8 Cr
Zone of Silence (meditation areas, landscaping)	0.5 Cr
Total	17.4 Cr

Implementation framework:



7.6 Objective 8 Interventions to leverage the economic potential of river

7.6.1 Recommendation 5: Riverfront Tourism & Recreation

Leverage the proposed Kosi Riverfront Park to generate tourism centric economy for the local people such as:

1. **Craft Bazaar:** Organising a "Kumaoni Haat" where local artisans sell Aipan art, copperware, and woolen goods to tourists waiting for trains or heading up to Nainital.
2. **Birdwatching Eco-Tours:** The Kosi catchment is a biodiversity hotspot for migratory birds. Local youth can be trained as birding guides with the help of Forest Department to lead morning tours along the barrage and upstream forest areas near Rani Bagh.
3. **VR Safari orientation (paid headset immersion + free screen view):** will serve as an immersive gateway for visitors before entering Corbett. Through ticketed entry, VR experiences, the centre will generate direct revenue streams while enhancing tourist engagement.

7.7 Objective 9 Interventions to inculcate river-sensitive behavior among citizens

The interventions under Objective 9 are designed to weave ecological awareness and cultural pride into the everyday life of Ramnagar, ensuring that both residents and visitors adopt river-sensitive behaviors. As the gateway to Jim Corbett National Park, Ramnagar experiences a highly seasonal tourist influx, making it essential to integrate awareness measures that resonate with citizens while also engaging the large number of visitors who interact with the Kosi River. From awareness corners in schools and tourist entry points, biodegradable kits at temples and resorts and digital IEC platforms accessible to both locals and tourists, to the institutionalization of an annual “Kosi River Day,” these initiatives collectively strengthen emotional, cultural and behavioural ties with the Kosi River. The detailed interventions are outlined in the following sections.

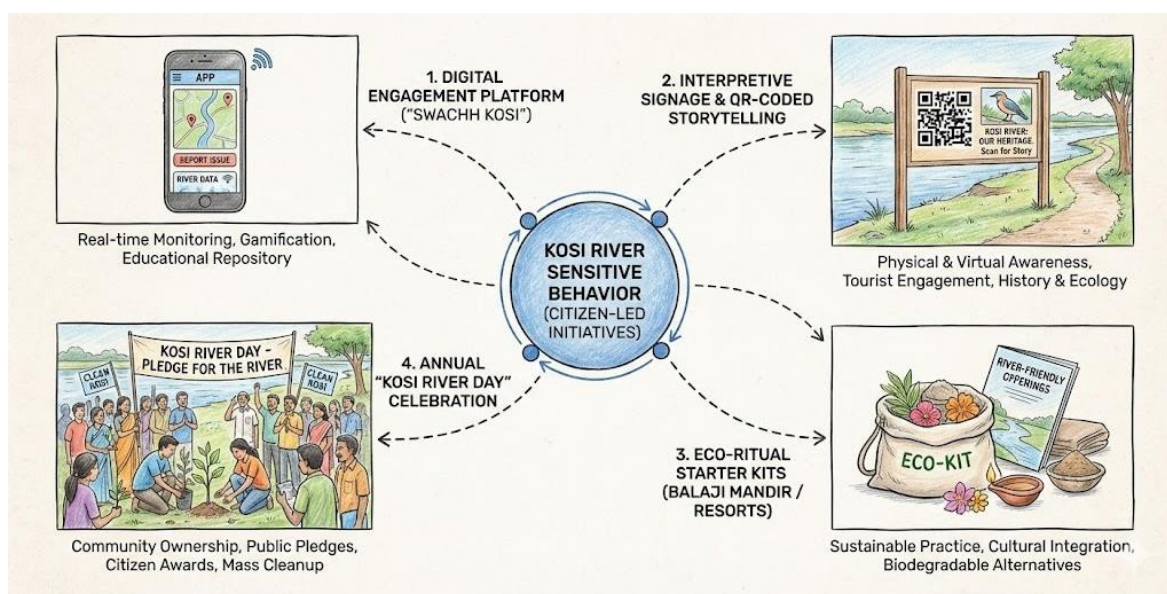


Image 7-26: River-sensitive practices and cultural awareness

7.7.1 Intervention 11: Interpretive Signage and QR-Coded Storytelling Boards

Despite Ramnagar’s active IEC campaigns, there is no permanent infrastructure that visually or digitally connects citizens and tourists to the ecological and cultural significance of the Kosi River. The absence of interpretive signage at high-footfall zones limits awareness, while lack of QR-linked storytelling content prevents sustained engagement and behavioural change. The baseline assessment highlights the following key concerns:

- No river-centric interpretive infrastructure exists at key tourist and civic locations.
- IEC efforts are episodic and lack spatial continuity across the town.
- Absence of digital storytelling tools restricts long-term citizen and tourist engagement.
- Local communities are not involved in content creation, reducing authenticity and ownership.

Proposed Intervention:

- **Installation of Boards:** 20–25 multilingual interpretive boards to be placed at Balaji Mandir, barrage stretch, Ramnagar bus stand, railway station, Corbett safari entry gates, municipal parks, and bridges over the Kosi.
- **Visual Storytelling:** Each board will narrate folklore, biodiversity, and river history, with QR codes linking to “Swachh Kosi” digital content (pledges, conservation tips, heritage stories).
- **Tourist Integration:** Resorts and hotels will display QR codes in lobbies, encouraging visitors to engage with river stories.
- **Community Engagement:** Schools, RWAs, SHGs, and Waste Warriors will co-create content, ensuring local ownership and authenticity.
- **Monitoring:** QR analytics tracked by RMC to measure citizen and tourist interaction.

Implementation Framework:



7.7.2 Intervention 12: Eco-Ritual Starter Kits at Balaji Mandir, Dhikuli & Tourist Resorts

Ritual practices at temples and ghats continue to generate plastic waste due to the use of non-biodegradable offerings. Despite seasonal tourist inflow, there is no structured mechanism to promote eco-sensitive rituals or empower SHGs and temple committees to distribute sustainable kits. The baseline assessment highlights the following key concerns:

- Ritual waste contributes significantly to plastic accumulation along riverbanks.
- SHGs lack formal training and roles in eco-kit preparation and distribution.
- Priests and temple committees are not mobilized to advocate sustainable practices.
- Tourist resorts are not integrated into eco-ritual outreach strategies.

Proposed Intervention:

- **Kit Preparation:** SHGs trained to prepare biodegradable kits with dried flowers, tulsi leaves, and compostable containers.

- **Distribution Channels:** Kits sold at temple kiosks, SHG stalls, cremation ghats, mela grounds, and resorts.
- **Priest Advocacy:** Temple committees and priests promote eco-kits during rituals, encouraging devotees and tourists to adopt sustainable practices.
- **Tourist Outreach:** Resorts include kits in welcome packages for visitors, linking religious practice with eco-tourism.
- **IEC Messaging:** Slogans such as “Offer devotion, not pollution” displayed at kiosks, temples, and resort lobbies.
- **Monitoring:** Municipal staff and Waste Warriors track kit usage during festivals to assess reduction in plastic waste.

Implementation Framework:



7.7.3 Intervention 13: Digital River Engagement Platform (“Swachh Kosi”)

IEC activities remain offline, limiting outreach to digitally active youth and tourists. There is no centralized platform for sharing river-related content, pledges, or clean-up schedules, and citizen reporting of violations lacks structured response mechanisms. The baseline assessment highlights the following key concerns:

- No digital platform exists for river awareness, citizen pledges, or reporting.
- Youth and RWAs are not engaged in content creation or dissemination.
- Tourist engagement is minimal due to lack of QR-linked digital access points.
- Municipal response to citizen reports is unstructured and lacks accountability.

Proposed Intervention:

- **Platform Launch:** Create WhatsApp/Telegram channel “Swachh Kosi” managed by RMC.
- **Weekly Content:** Share reels on waste segregation, citizen pledges, clean-up schedules and eco-tourism tips.

- **Tourist Integration:** QR codes at bus stand, railway station, Corbett safari gates and resorts link visitors directly to the platform.
- **Citizen Content:** Youth clubs and RWAs contribute videos; Waste Warriors provide technical inputs.
- **Reporting:** Platform doubles as tool for reporting waste dumping along Kosi, with municipal staff responding.

Implementation Framework:



7.7.4 Intervention 14: Annual Celebration of “Kosi River Day”

Ramnagar lacks a symbolic cultural event that anchors river stewardship in public consciousness. Without a dedicated celebration, the Kosi River remains peripheral to the town’s identity and tourism branding. The baseline assessment highlights the following key concerns:

- No annual event exists to culturally connect citizens and tourists to the river.
- IEC activities are disconnected from seasonal tourism cycles.
- SHGs, RWAs, and schools lack platforms to showcase river-related contributions.
- Tourism calendars do not feature river-centric events, limiting visibility.

Proposed Intervention:

- **Annual Event:** Organize “Kosi River Day” in March–April, aligned with peak tourist season.
- **River Walks:** Guided walks along barrage stretch highlighting biodiversity and heritage.
- **Cultural Activities:** Eco-art exhibitions in municipal parks, folk performances at Balaji Mandir, competitions at PNGPG College.
- **Tourist Participation:** Resorts host eco-awareness booths; visitors join clean-up drives.
- **Community Showcases:** SHGs display eco-products; RWAs present segregation initiatives; Waste Warriors share case studies.

- **Tourism Branding:** Position “Kosi River Day” as part of Ramnagar’s tourism calendar, attracting visitors beyond wildlife safaris.

Implementation Framework:



7.8 Objective 10 Intervention to engage citizens in river management activities

Objective 10 in Ramnagar emphasizes building structured platforms for citizen and community stewardship of the Kosi River. While the Municipal Council and Waste Warriors have already mobilized residents through rallies, awareness meetings, and clean-up campaigns, these efforts remain largely episodic. To ensure continuity and accountability, interventions are proposed that formalize citizen participation and extend it to the seasonal tourist population. By creating ward-level “Kosi Guardians” groups, encouraging schools, RWAs, and resorts to adopt stretches of the riverbank, and promoting creative competitions and street plays in both local markets and tourist zones, Ramnagar can institutionalize community involvement. These measures empower youth, residents, and visitors alike, transforming them into active custodians of river health and resilience. The detailed interventions are outlined in the following sections.

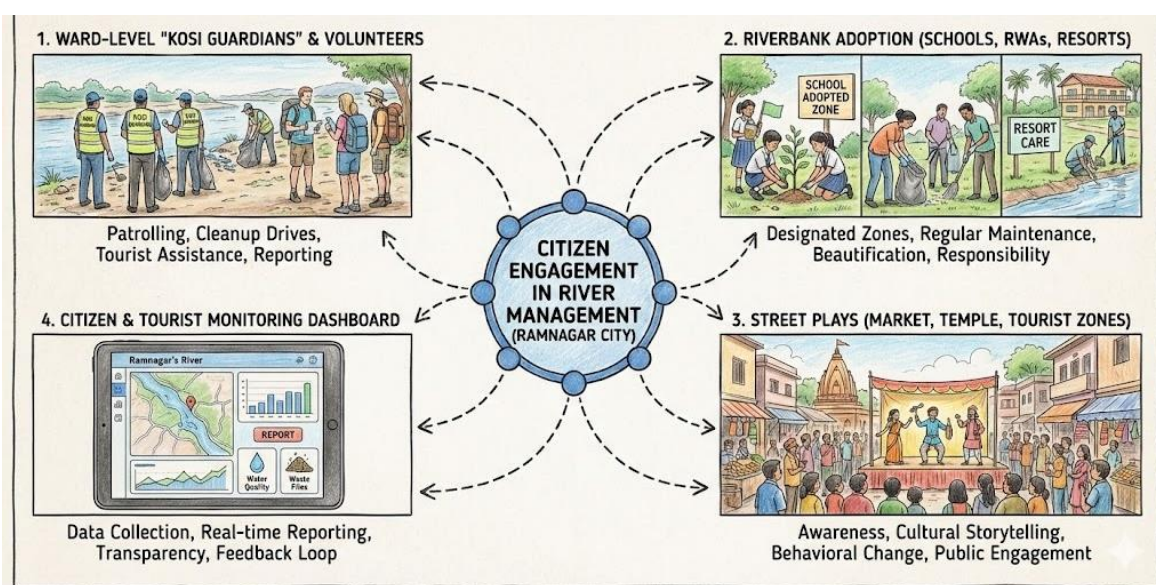


Image 7-27: Citizen participation in river management

7.8.1 Intervention 15: Ward-Level “Kosi Guardians” with Tourist Volunteers

Citizen participation in river monitoring is fragmented and lacks ward-level structure. Tourists remain untapped as contributors, and there is no formal mechanism to recognize or sustain community-led stewardship. The baseline assessment highlights the following key concerns:

- No structured citizen-led groups exist for ward-level river monitoring.
- RWAs, SHGs, and youth leaders lack defined roles in identifying violations.
- Tourist engagement in clean-up activities is absent despite seasonal potential.
- Recognition systems for citizen and tourist contributions are missing.

Proposed Intervention:

- **Group Formation:** Create ward-level “Kosi Guardians” groups with RWAs, SHGs, youth leaders, and ward officials.

- **Tourist Engagement:** Resorts and safari operators encourage visitors to join monthly clean-ups as “Guest Guardians.”
- **Monthly Monitoring:** Guardians identify waste dumping hotspots (Forest Colony, PWD Vishram Bhawan) and report via SBM Swachhta App.
- **Recognition:** Annual awards at Municipal Council Parishad honour active guardians and tourist contributors.

Implementation Framework:



7.8.2 Intervention 16: Riverbank Adoption by Schools, RWAs & Resorts

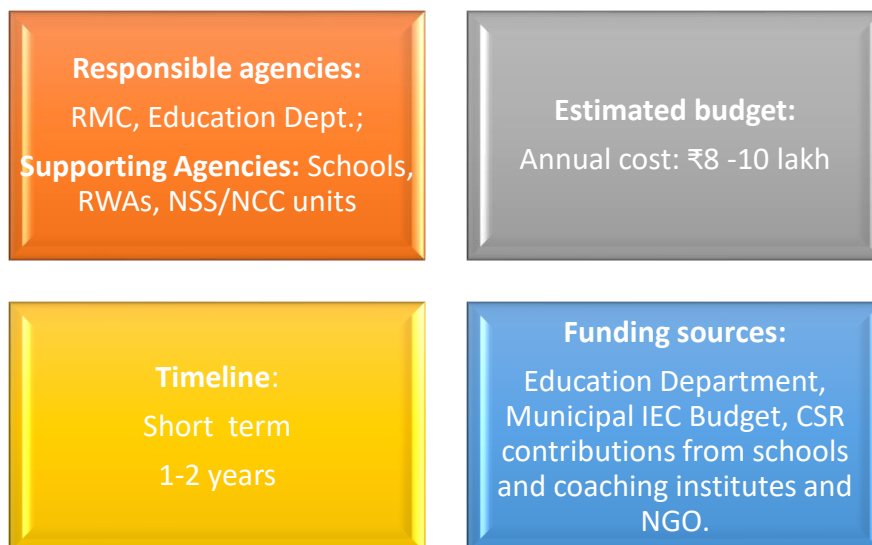
Clean-up drives are sporadic and lack continuity due to absence of institutional ownership. Schools, RWAs, and resorts are not assigned responsibility for specific river stretches, leading to inconsistent maintenance and visibility. The baseline assessment highlights the following key concerns:

- No formal adoption model exists for riverbank stewardship.
- Citizen and tourist contributions fade post-campaign due to lack of continuity.
- Resorts are not integrated into long-term clean-up frameworks.
- Absence of signage and recognition reduces public accountability.

Proposed Intervention:

- **Adoption Model:** Schools, RWAs, and resorts adopt 200–300m stretches of Kosi riverbank (e.g., near Motimahar Primary School, Dhikuli Gram Panchayat, resort clusters).
- **Monthly Clean-Ups:** Organized by students, residents, and resort staff, supported by municipal staff.
- **Signage:** Boards installed stating “Adopted by [School/RWA/Resort].”
- **Recognition:** Annual “Best Adopted Stretch” award during Kosi River Day.

Implementation Framework:



7.8.3 Intervention 17: Street Plays in Market, Temple & Tourist Zones

IEC campaigns rely on static mediums that fail to culturally resonate with diverse audiences. There is no structured program to train youth and SHGs in creative formats like street theatre, limiting emotional impact and reach. The baseline assessment highlights the following key concerns:

- IEC messaging lacks cultural depth and creative delivery formats.
- Youth clubs and SHGs are not trained in performance-based outreach.
- Tourist zones and markets are underutilized for thematic storytelling.
- No recognition framework exists for impactful performers or groups.

Proposed Intervention:

- **Training:** SHGs and youth clubs trained to perform monthly Nukkad Nataks.
- **Performance Venues:** Ramnagar bazaar, Girjiya Mandir grounds, mela days, and resort courtyards during peak season.
- **Themes:** Scripts dramatize plastic pollution, segregation, eco-spiritual values.
- **Rotation:** Plays rotated across wards and tourist hubs for wider reach.
- **Recognition:** Annual awards for impactful performers during Kosi River Day.

Implementation Framework:



7.8.4 Intervention 18: Citizen & Tourist Monitoring Dashboard

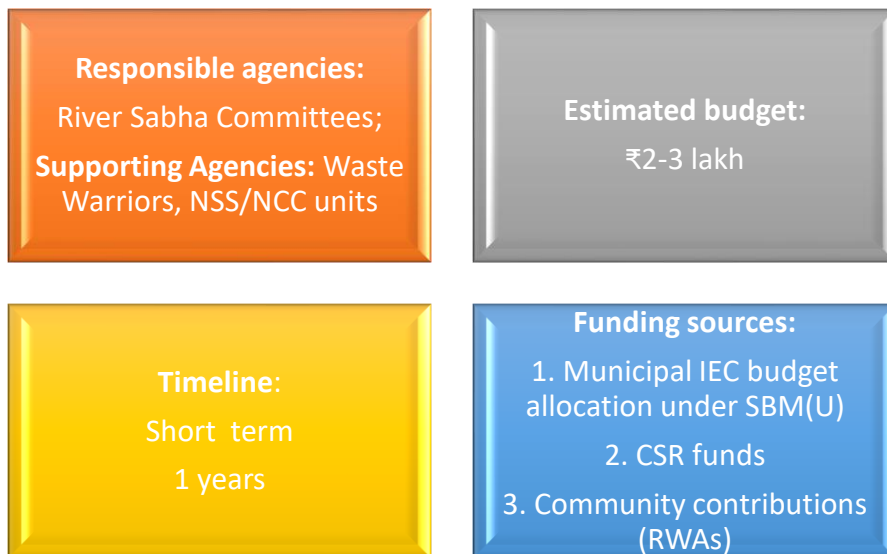
Despite frequent IEC activities, there is no integrated system to monitor participation, waste collection, or CSR contributions. Lack of public access to data reduces transparency and limits civic feedback. The baseline assessment highlights the following key concerns:

- No centralized dashboard exists to track river-related citizen and tourist activities.
- Resorts and safari operators are not mandated to report visitor involvement.
- IEC and clean-up data are not publicly visible or regularly updated.
- Absence of feedback loops limits transparency and adaptive planning.

Proposed Intervention:

- **Dashboard Creation:** Develop online dashboard (Google Sheets/municipal portal) to track clean-ups, IEC activities, CSR investments, and tourist participation.
- **Data Entry:** Updated monthly by RMC IEC cell.
- **Tourist Inputs:** Resorts and safari operators report visitor involvement in clean-ups.
- **Public Access:** Dashboard displayed at Municipal Council office and shared via “Swachh Kosi” platform.
- **Transparency:** Ensures visibility of citizen and tourist contributions.

Implementation Framework:



ANNEXURE

Annexure 1: Technical Specifications for the Gabion Structure

Technical Specifications for the Gabion Structure as per IS 14262:1995, IS 16014:2012, IRC: P:116-2018

1. Gabion Boxes

- **Dimensions:** 2.0 m × 1.0 m × 1.0 m
- **Material:** Double-twisted hexagonal wire mesh, PVC/zinc coated, 4 mm dia (IS 14262:1995)

2. Fill Material

- **Angular stones**, size range **100–250 mm**
- **Source:** Locally available rockfill (IS 16014:2012)

3. Gabion Aprons

- **Thickness:** 0.23–0.30 m
- **Width:** 6–8 m (equivalent to 1.5–2 × expected scour depth, per IRC: SP:116-2018)

4. Wall Height

- **2–3 tiers** of gabion boxes
- Total structural height: **2–3 m**

5. Foundation Depth

- Minimum embedment: **1.0 m below bed level** (IRC: SP:116-2018)

6. Alignment and Extent

- Continuous gabion structure stretches: **3.79 km** along the **western riverbank**
- Alignment: **Critical upstream section**, designed in accordance with floodplain zoning and river training guidelines

Annexure 2 : Calculations for controlled disposal of septage in the collection tank of 7 MLD STP

In order to dispose septage in existing STP, the following conditions were evaluated as a pre-feasibility assessment

1. Current Utilization of the volumetric capacity of the STP
2. Current Utilization of the loading capacity with respect to BOD, COD and TSS.
3. Volume of septage feasible for direct disposal.

Table 1 Influent Sewage Characteristics at 7 MLD STP

Parameters	Average Influent Concentration (mg/l)	Designed Concentration (mg/l)
BOD	87	230
COD	184	450
TSS	123	400

Source: 7 MLD STP Lab data

Table 2 Faecal sludge and septage characteristic collected in the town

Parameters	Average Concentration (mg/l)
BOD	3420
COD	9040
TSS	35236

Source: Characteristic Study of faecal sludge Ramnagar/ NIUA/2022

2.Load Utilization

Using the data provided in table 1, the design load was calculated

Table 3 Design load of the STP

Parameters	Design Capacity (MLD)	Design Concentration (mg/l)	Design load (kg/d)
BOD	7	230	1610
COD		450	3150
TSS		400	2800

Table 4 Load Utilization of the STP

Parameters	Design Capacity (MLD)	Influent Concentration (mg/l)	Load Utilization (kg/d)
BOD	3.5	87	305
COD		184	644
TSS		123	431

Table 5 Load Utilization (%) of STP

Parameters	Design Capacity (MLD)	Load Utilization (kg/d)	Load Utilization (%)
BOD	1610	305	18.94%
COD	3150	644	20.44%
TSS	2800	431	15.39%

Table 6 Unutilized load of the STP

Parameters	Design load (kg/d)	Load Utilization (kg/d)	Unutilized load (kg/d)
BOD	1610	305	1305
COD	3150	644	2506
TSS	2800	431	2369

Table 7 faecal sludge and septage handling capacity of the STP

Parameters	Unutilized load (kg/d)	Concentration of Septage (mg/l)	Handling Capacity (KLD)
BOD	1305	3420	382
COD	2506	9040	277
TSS	2369	35236	67

We must choose the least of the Handling Capacity, as If we choose BOD as the constraining parameter, it might handle BOD parameter up to 382 KLD but will surely introduce more COD and TSS along with it. Therefore, TSS is considered as constraining parameter

Table 8 Design and Actual flow rate at the STP

Parameter	Quantity (m ³ /h)
Design flow rate	292
Actual flow rate	146

Table 9 Organic and solids loading rate at STP

Parameter	Flow Rate (m3/h)		Concentration (mg/l)	
	Design	Actual	Design	Actual
BOD	292	146	230	87
COD			450	184
TSS			400	123
Parameter	Loading Rate (kg/h)		Unutilized loading (kg/h)	
	Design	Actual		
BOD	67	13	54	
COD	131	27	104	
TSS	117	18	99	

Table 10 Faecal Sludge and Septage Load

Parameter	Concentration (mg/l)	Truck Capacity (KL)	Truck Load (kg/h)
COD	3420	4	14
BOD	9040	4	36
TSS	35236	4	141
Per day decanting	8	trucks	
1 truck load at every	3	hours	

If direct addition of FSS is to be done in the receiving well sump, then feasible load that can be added is 1 truckload in 0.6 hours with TSS as the constraining parameter. An arrangement of removing silt before direct disposal to inlet tank is recommended Mapping and geotagging the locations of biodiversity in plants, birds, and animals via citizen.

Annexure 3: Draft Scope of Work for Faecal Sludge and Septage Management (FSSM)

Scope of Work for Faecal Sludge and Septage Management (FSSM) study for Ramnagar Planning Area

Objective: To undertake Sanitation Value Chain Assessment and evaluate the adequacy of ongoing sanitation infrastructure projects in the Ramnagar Planning Area and formulate a supplementary plan to bridge the gap between committed capacity and projected future demand.

Scope of works:

1. Sanitation Value Chain Assessment (The "As-Is" Analysis)

- **A. Containment (The Capture):**
 - Structural Audit: Survey a representative sample (5-10%) to determine the percentage of "Properly Built Septic Tanks" vs. "Single Pits" vs. "Direct Discharge to Nallah."
 - Terrain-Specific Checks: Specifically, for Kathgodam (Rocky/Hilly terrain), assess if soak pits are failing due to low soil permeability or high-water table, leading to groundwater contamination.
- **B. Emptying (The Service):**
 - Accessibility Mapping: GIS mapping of road widths to quantify households that are "Inaccessible" to standard 3000L vacuum trucks (often a major issue in older unplanned colonies).
 - Mechanization Index: Determine the ratio of mechanical emptying (vacuum trucks) vs. manual emptying.
- **C. Transport (The Logistics):**
 - Illegal Dumping Surveillance: Identify "Hotspots" where private operators dump sludge illegally (e.g., banks of the Kosi River or forest edges) to save fuel.
 - Travel Time Analysis: Measure the turnaround time from the furthest peripheral ward to the designated disposal site to determine if "Transfer Stations" are needed.
- **D. Treatment & Disposal (The Endgame):**
 - Effluent Quality: Test the final output of current disposal methods (if any) against NGT/CPCB discharge standards.
 - Reuse Potential: Specific assessment of the local market for treated biosolids (co-compost) in the nearby Terai agricultural belt.

2. Review of Ongoing Initiatives (Infrastructure Audit)

- **Review of Active Tenders & Contracts:**

- Analyze the Detailed Project Reports (DPRs) of ongoing sewerage/STP works (specifically UUSDA/ADB Package-2 or Package-3) to determine the committed Faecal Sludge Co-treatment capacity.
- Key Check: Specific design parameters of the "Septage Receiving Stations" in currently under-construction STPs (e.g., screening mechanism, holding tank volume).
- **Technology Compatibility Check:**
 - Assess if the ongoing STP technology (e.g., SBR/MBBR) is chemically and biologically compatible with the projected characteristics of septage from the un-sewered peripheral wards.
- **Timeline Synchronization:**
 - Map the "Commissioning Timeline" of ongoing plants against the immediate sludge disposal needs of the city to identify interim bottlenecks.

3. Demand Forecasting & Gap Analysis

- Future Generation Scenarios (Horizon Years: 2030, 2040, 2055): Forecast population growth for the Core City vs. Peri-urban outgrowth (Kathgodam/Bhotia Parao areas).
- Estimate the "Shift Factor": Assess of the number of households likely to move from septic tanks to the sewer network once ongoing sewerage projects are complete.
- Net Residual Septage Load: Calculate the volume of sludge that will *remain* outside the sewer network (the true FSSM demand).
- Determine if the ongoing STP augmentations are sufficient or if a Satellite FSTP (new standalone plant) is required for distant wards.

4. Strategic Planning for Future Capacity

- **Scenario A: Augmentation of Ongoing Projects (Retrofitting)**
 - If the gap is small (<10-20 KLD): Propose specific "Retrofits" to the current STP designs (e.g., adding a larger equalization tank or a specialized dewatering unit) before construction is finalized.
- **Scenario B: Decentralized Expansion (New Nodes)**
 - If the gap is large or spatially disconnected: Identify land parcels for Decentralized FSTPs in growth corridors (e.g., towards Lalkuan or Kaladhungi road) to reduce truck travel time.
- **Phasing Plan:**
 - **Phase 1 (Immediate - 0 to 2 Years):** Operationalize co-treatment at existing/upgrading STPs.

- **Phase 2 (Medium Term - 2 to 5 Years):** Commission satellite FSTPs for peri-urban gaps identified in the analysis.
- **Phase 3 (Long Term):** Transition FSSM infrastructure to handle "sewer mining" or specialized industrial sludge if sewerage coverage hits 100%.



 Kosi Barrage



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