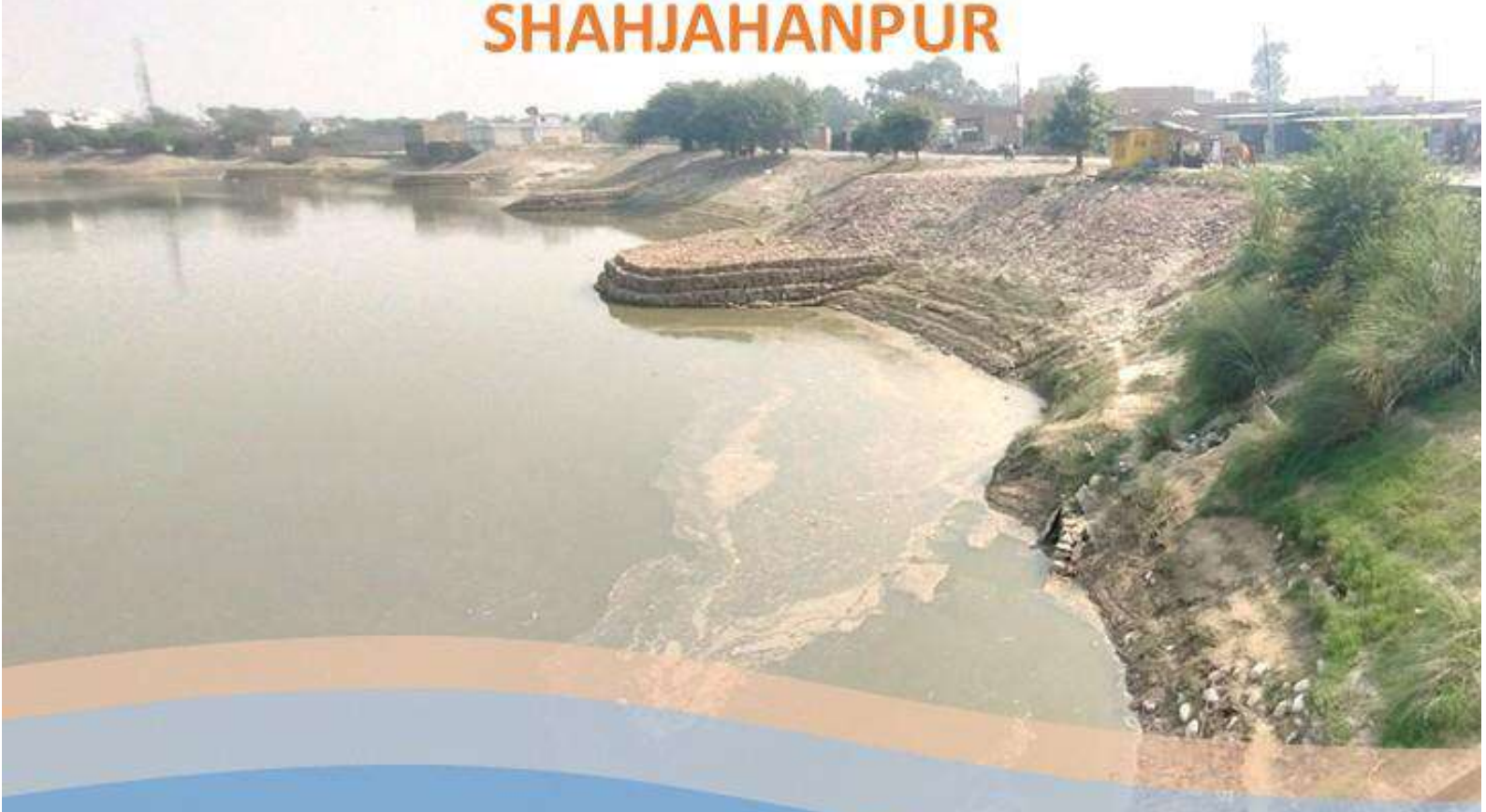
DRAFT

URBAN RIVER MANAGEMENT PLAN

SHAHJAHANPUR



NAMAMI GANGE

National Institute of Urban Affairs

LEA

SHAHJAHNPUR MUNICIPAL CORPORATION

Uttara Pradesh

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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) Shahjahanpur is to develop a dedicated strategy for managing the Garra and Khannaut Rivers 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 Shahjahanpur is to develop a dedicated strategy for managing the extent of Garra and Khannaut Rivers and its tributaries that flow through the city of Shahjahanpur 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 **28 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 city. 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 Shahjahanpur

At the start, a core Multistakeholder Working Group (MSWG) comprising 15 members, chaired by Hon'ble District Magistrate, Shahjahanpur was set up to lead the development of the URMP for Shahjahanpur. 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 city and identify opportunities to enhance river-city interaction. The assessment was based on secondary data, published reports and projects implemented / under implementation within the city. 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 city on rivers, streams and drains.

On the basis of the rapid baseline assessment and discussions with MSWG members, 28 projects/interventions were identified that will be taken up in Shahjahanpur URMP.

Envisaged benefits of the URMP for Shahjahanpur city

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 city, 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 city'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 city'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 28 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: Inclusion and strengthening of provisions in Master Plan of Shahjahanpur, 2031	Town & Country Planning Department, Bareilly; Irrigation Department, Regulatory Authority, SMC		
2	**To keep river free from pollution**	Intervention 2: Optimizing the Unutilized Capacity of the Existing 40 MLD STP	Pay Jal Nigam	₹ 45.6 Cr	Namami Gange
		Intervention 3: Eastern Zone Drainage Interception and Treatment via Proposed 10 MLD STP	Pay Jal Nigam (Urban)	₹ 47.5 Cr	Namami Gange
		Intervention 4: Nature-based treatment for unserved area after the intercepting	Pay Jal Nigam	₹ 3 Cr	Namami Gange, Jal Jeevan Urban and CSRs
		Intervention 5: Resilient Infrastructure Proposal for 32KLD FSTP	Nagar Nigam Shahjahanpur	₹ 0.09 Cr	AMRUT 2.0/ Disaster Resilience Grants

Sl. No.	URMP Objective	Intervention	Responsible Agency	Estimated Cost (In rupees)	Potential Financing Sources
		Intervention 6: Strengthening Faecal Sludge Treatment Capacity	Nagar Nigam Shahjahanpur	₹ 3.5 Cr	AMRUT 2.0, SUDA
		Intervention 7: Preparation of Faecal and Septage Management Plan	Nagar Nigam Shahjahanpur	₹ 0.5 Cr	AMRUT 2.0, SBM-U, SUDA
		Intervention 8: Real-Time River Water Quality Monitoring Units with Dashboard Integration and Public Display	Pollution Control Board and Nagar Nigam Shahjahanpur	₹ 0.45 Cr	AMRUT 2.0, SUDA, SPCB
		Intervention 9: Legacy waste clearance and prevention measures for drain and riverbed pollution control	Nagar Nigam Shahjahanpur	₹ 0.40 Cr	SBM 2.0, SUDA
		Intervention 10: Implementation of Floating Trash Barrier with manual removal mechanism cage	Nagar Nigam Shahjahanpur	₹ 1.8 Cr	Municipal Budget
		Intervention 11: Implementation of Integrated Dairy Waste Management for Bio-Gas Recovery	Nagar Nigam Shahjahanpur	₹ 75 Cr	UP NEDA, SATAT Scheme and MNRE Waste-to-Energy Programme
3	**To rejuvenate waterbodies and wetlands in the city**	Intervention 12: To create Water Body Database at City level	SMC, SDA, UPPCB	₹ 0.97 Cr	Municipal Budget, UP Urban Development funds, 15th Finance Commission – Tied Grants (Water & Sanitation
		Intervention 13: Strategy for Urban Water Body Rejuvenation	Shahjahanpur Municipal Corporation (SMC)	₹ 0.58 Cr (for 1 Waterbody as per DPR & feasibility)	AMRUT 2.0 and SUD Grants

Sl. No.	URMP Objective	Intervention	Responsible Agency	Estimated Cost (In rupees)	Potential Financing Sources
		Intervention 14: Phased Restoration of Lal Kothi Pakka Talab	Shahjahanpur Municipal Corporation (SMC)	₹ 2.1 Cr	AMRUT 2.0 and SUD Grants
4	**To enhance riparian buffer along river bank**	Intervention 15: Restoration of degraded riparian stretches	Forest Department and Irrigation department	₹ 0.97 Cr	Namami Gange, Forest funds, National Green Mission and CAMPA
6	**Good quality return flow**	Intervention 16: Sponge Park Retrofits with Integrated Open Well Recharge	Nagar Nigam Shahjahanpur	₹ 0.5-1.5 Cr (per park/ward depending on scale and site conditions)	AMRUT 2.0, Jal Shakti Abhiyan, Municipal budget, CSR, RWAs
7	**To develop eco-friendly riverfront projects**	Intervention 17: Development of riverfront at Pakka pul	Irrigation department and Nagar Nigam	₹ 12.5 Cr	Namami Gange, Municipal funds and CSR
		Intervention 18: Develop an Eco-friendly ghat at Lodhipur (Chhat ghat)	Irrigation Department, Tourism Department	₹ 5 Cr	Namami Gange, Municipal funds and CSR
9	**To inculcate river-sensitive behaviour among citizens**	Intervention 19: River Awareness Campaign – "Meri Nadi, Mera Shahar"	SMC; Supporting Agencies: NMCG, SHGs, NGOs, educational institutions	Annual cost: ₹ 0.06 Cr	IEC Budget: Nagar Nigam & Namami Gange; CSR: Industries, local banks; Community: RWAs & heritage NGOs.
		Intervention 20: Distribution of Biodegradable Offering Kits at Sacred Sites in Shahjahanpur city	SMC; Supporting Agencies: Temple committees, SHGs, NGOs	Annual cost: ₹ 0.09 Cr	Municipal sanitation budget, CSR (local businesses, flower vendors), Temple trusts & SHG cost-sharing, IEC support (Namami Gange
		Intervention 21: River Storytelling Corners for	SMC; Supporting Agencies:	Annual cost: ₹ 0.13 Cr	SBM(U) and NMCG subsidies, CSR funds from local

Sl. No.	URMP Objective	Intervention	Responsible Agency	Estimated Cost (In rupees)	Potential Financing Sources
		community-led narratives and cultural connection	Religious Boards, SHGs, NGOs		industries/businesses, Funding from religious boards & funeral trusts
		Intervention 22: Behavioral Nudges through Smart Signages at Sacred Sites in Shahjahanpur city	Shahjahanpur Nagar Nigam IEC cell; Supporting Agencies: Schools, SHGs, NGOs, FM radio	Annual cost: ₹ 0.07 Cr	Municipal IEC budget allocation under SBM(U), CSR funds telecom/ All India Radio partners &educational institutions
		Intervention 23: Faith-Based Engagement – Temple & Mosque Drives"	River Sabha Committees; Supporting Agencies: RWAs, SHGs and NGOs	Annual cost: ₹ 0.13 Cr	Municipal IEC budget allocation under SBM(U), CSR funds, Community contributions (RWAs)
10	**To engage citizens in river management activities**	Intervention 24: Formation of River Sabha Committees at City-Level	Shahjahanpur Nagar Nigam; Supporting Agencies: RWAs, SHGs and NGOs	Annual cost: ₹ 0.11 Cr	Municipal budget, CSR contributions.
		Intervention 25: River Festival – "Shahjahanpur Jal Mahotsav"	Shahjahanpur Nagar Nigam; Supporting Agencies: RWAs, SHGs and NGOs	Annual cost: ₹ 0.11 Cr	Municipal budget, CSR contributions.
		Intervention 26: Youth Internship Program – "River Warriors"	Education Department; Supporting Agencies: Schools, Colleges and NGOs	Annual cost: ₹ 0.06 Cr	Education Department, Municipal IEC Budget, CSR contributions from schools and coaching institutes and NGO.
		Intervention 27: Community Composting & Waste Segregation Workshops	Shahjahanpur Nagar Nigam; Supporting Agencies: RWAs, SHGs and NGOs	Annual cost: ₹ 0.09 Cr	Municipal IEC budget

Sl. No.	URMP Objective	Intervention	Responsible Agency	Estimated Cost (In rupees)	Potential Financing Sources
		Intervention 28: River Clean-Up Drives – "Nadi Mitra Abhiyan"	River Sabha Committees; Supporting Agencies: RWAs, SHGs and NGOs	Annual cost: ₹ 0.13 Cr	Municipal IEC budget allocation under SBM(U), CSR funds, Community contributions (RWAs)
	Total			**Approx. 189.09 Cr**	

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, city-level planning. The three tiers of governance and monitoring committees at the center, state and city level is depicted in Figure 1-2.

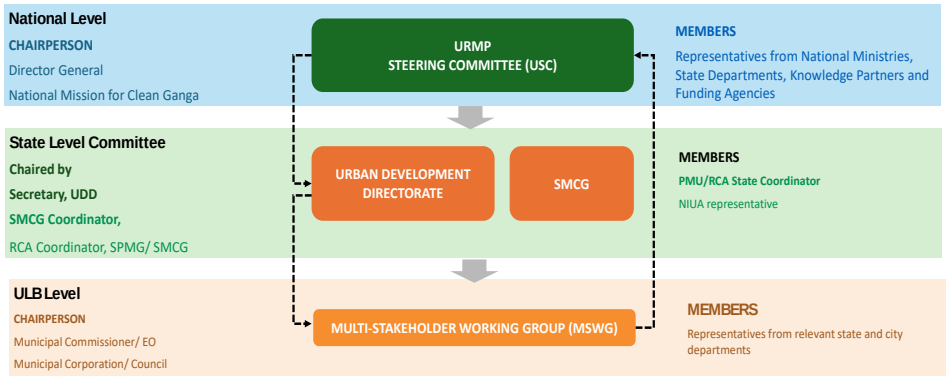


Figure 1-2: National, State & City Engagement for the URMP Preparation

1.1 Process for preparation of the URMP Shahjahanpur

The preparation of an URMP follows a systematic approach as per the 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.

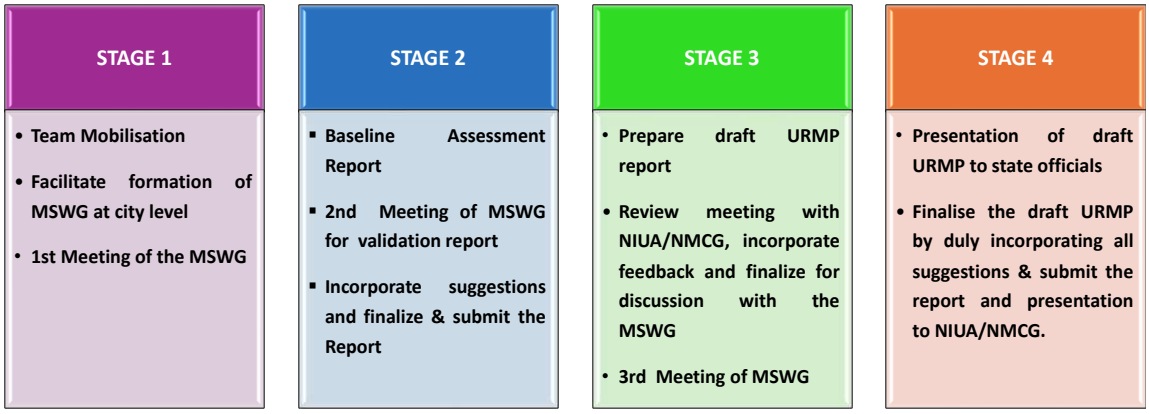


Figure 1-3: Process for preparation of URMP

In order to ensure that the plan is participatory and has involvement of concerned government agencies from the state to the city 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 the previous section 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 Workshop for Uttar Pradesh held on 3rd May 2025 at Lucknow,
- Discussions during 1st Multistakeholder Working Group (MSWG) meeting at Shahjahanpur on 21st June 2025,
- Discussions during 2nd Multistakeholder Working Group (MSWG) meeting at Shahjahanpur on 7th November 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 Workshop

A State-level URMP Committee, chaired by Secretary, Urban Development Department (UDD), Government of Uttar Pradesh has been constituted to oversee the URMP process. A State level Workshop was held on 3rd May 2025 at Lucknow chaired by Deputy Director General, NMCG and attended by Director Local Bodies & Secretary, Urban Development Department (UDD) UP, Director, NMCG, Urban Lead, NMCG, Technical Advisor, State Mission for Clean Ganga (SMCG), UP and representatives from NMCG, SMCG, State UDD, Directorate of ULBs, city representatives ULBs and NIUA.

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: State Level Workshop for Uttar Pradesh on 3 May 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 District Magistrate, Municipal Corporation, Cantonment Board, Forest and Wildlife Department, Tourism Development Board, Uttarakhand Urban Sector Development Agency, Uttar Pradesh Jal Nigam (Urban), Irrigation & Water Resource Department, Jal Kal Department, UP Pollution Control Board, Ground Water Board, Regulatory Authority, TCPO, SMCG, District Industries Centre, District Agriculture and District Horticulture Department. Post the state level workshop, the first MSWG meeting was held on 21st June 2025 under the chairmanship of Hon'ble District Magistrate, Shahjahanpur, to notify the MSWG for the city and the nodal officer for the URMP (refer Image 1-2).

Image 1-2: MSWG held on 21st June 2025 at Shahjahanpur

The second MSWG meeting for finalization of the baseline report was held on 7th November 2025 under the chairpersonship of District Magistrate, Shahjahanpur (refer Image 1-3).

Image 1-3: 2nd MSWG held on 7th November 2025 at Shahjahanpur

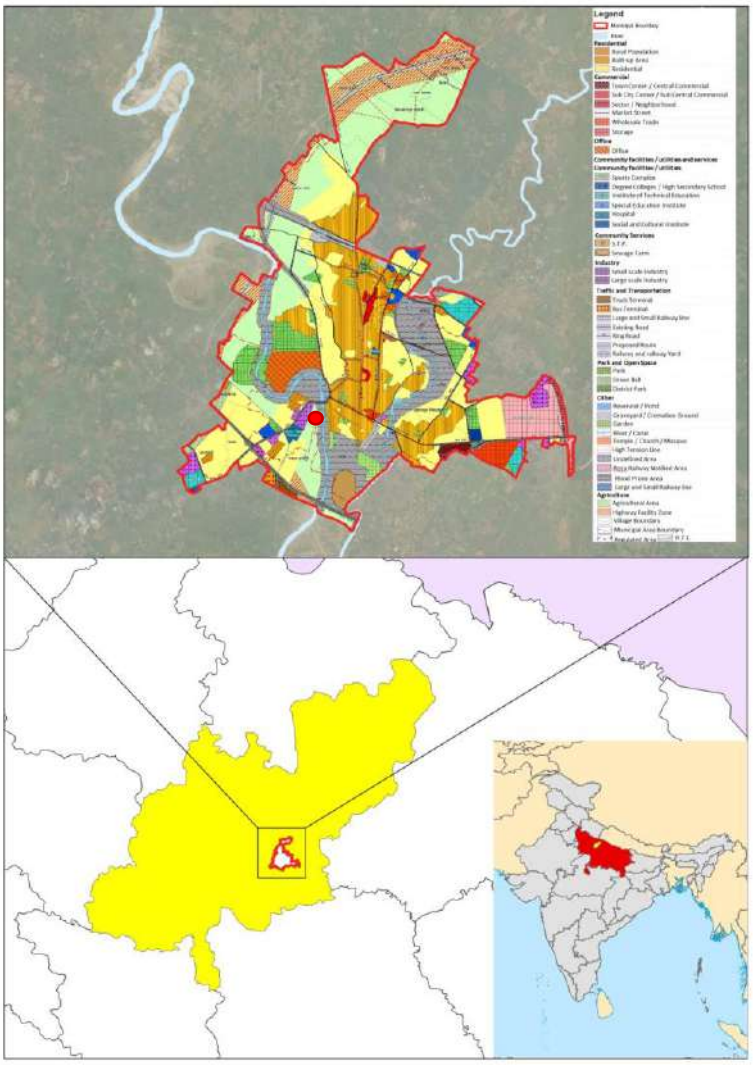
1.2.3 Draft URMP Report

This draft URMP report includes tangible interventions for river conservation and management for each of the ten URMP objectives. Multiple meetings and consultations with all the 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, funding source and the designated implementing agency.

Image 1-4: Consultations and Site Visits

2 CITY PROFILE

Shahjahanpur is a Municipal Corporation located in the Shahjahanpur district, in the north-western part of Uttar Pradesh. It serves as an important urban centre with a strong agricultural and industrial base. The city is situated along the Khannaut and Garra rivers, both tributaries of the Ramganga, which flow along either side of its municipal boundary. Shahjahanpur enjoys strong regional connectivity through National Highway 30 (NH-30), linking it to major centres such as Lucknow (175 km), Bareilly (85 km) and Rampur (135 km). State Highways further connect the city southward to Hardoi and northward to Pilibhit, extending toward Uttarakhand. Though Delhi lies about 330–350 km away and is not directly accessible via NH-30, the city maintains smooth connectivity to the capital through alternate highway routes and the Lucknow–Delhi railway corridor. Shahjahanpur also lies on the Lucknow–Delhi main line, with the Shahjahanpur Railway Station located within SMC. Air travel is supported by Chaudhary Charan Singh International Airport in Lucknow (175 km) and Bareilly Airport (85 km) for domestic flights. The nearest Class I cities are Bareilly and Lucknow.



Map 2-1: Contextual Setting of Shahjahanpur city

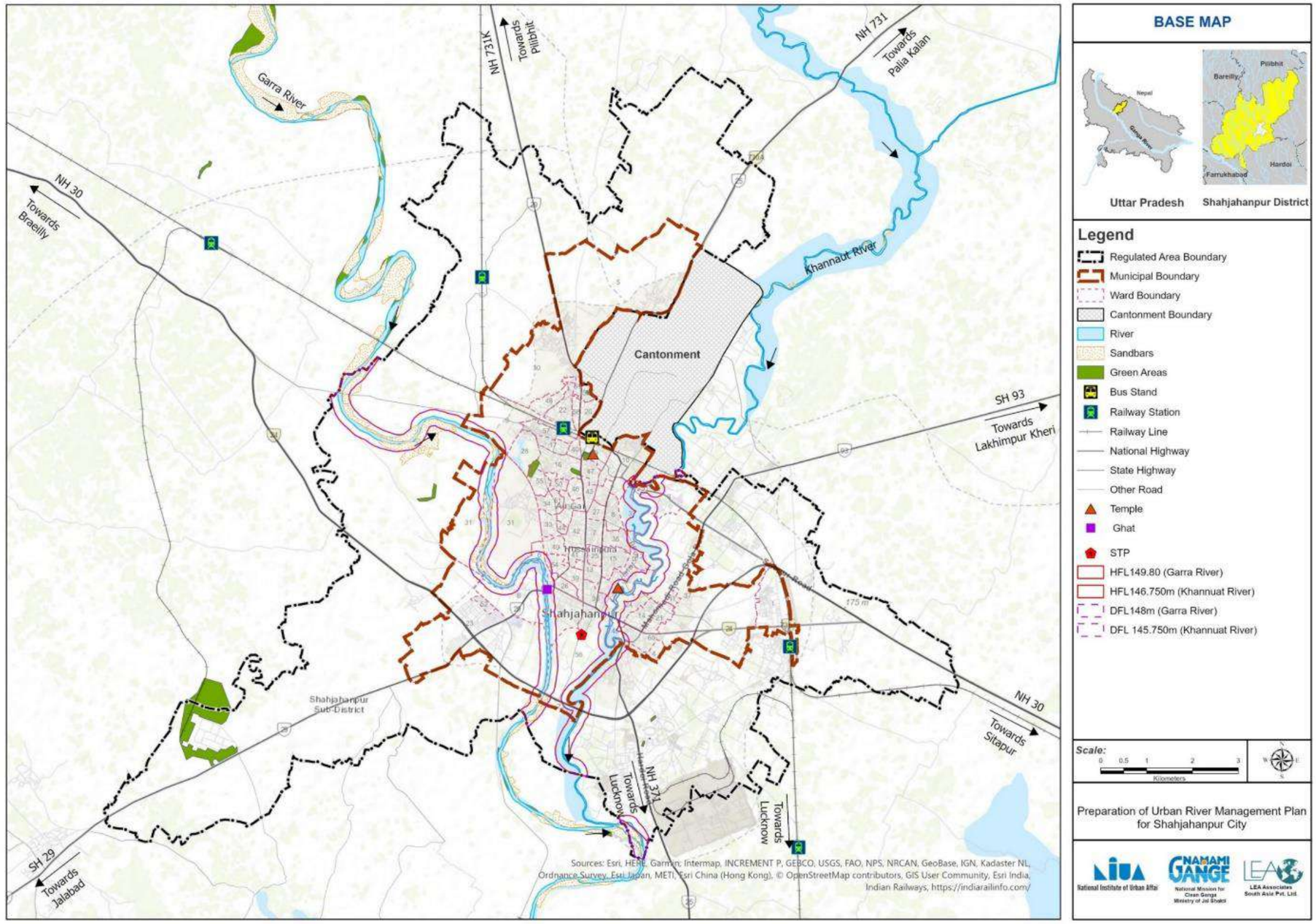
2.1 City Administrative Boundaries

The regulated area of Shahjahanpur spans 131.86 sq. km, covering the municipal limits and 49 villages. Its boundaries expanded with the addition of 28 villages in 1982, 10 in 1993, and 11 in 2007. Managed by the Shahjahanpur Regulatory Authority (established in February 2025, earlier under TCPO, Uttar Pradesh), the area is governed through building permissions, zoning, and development controls to ensure planned growth.

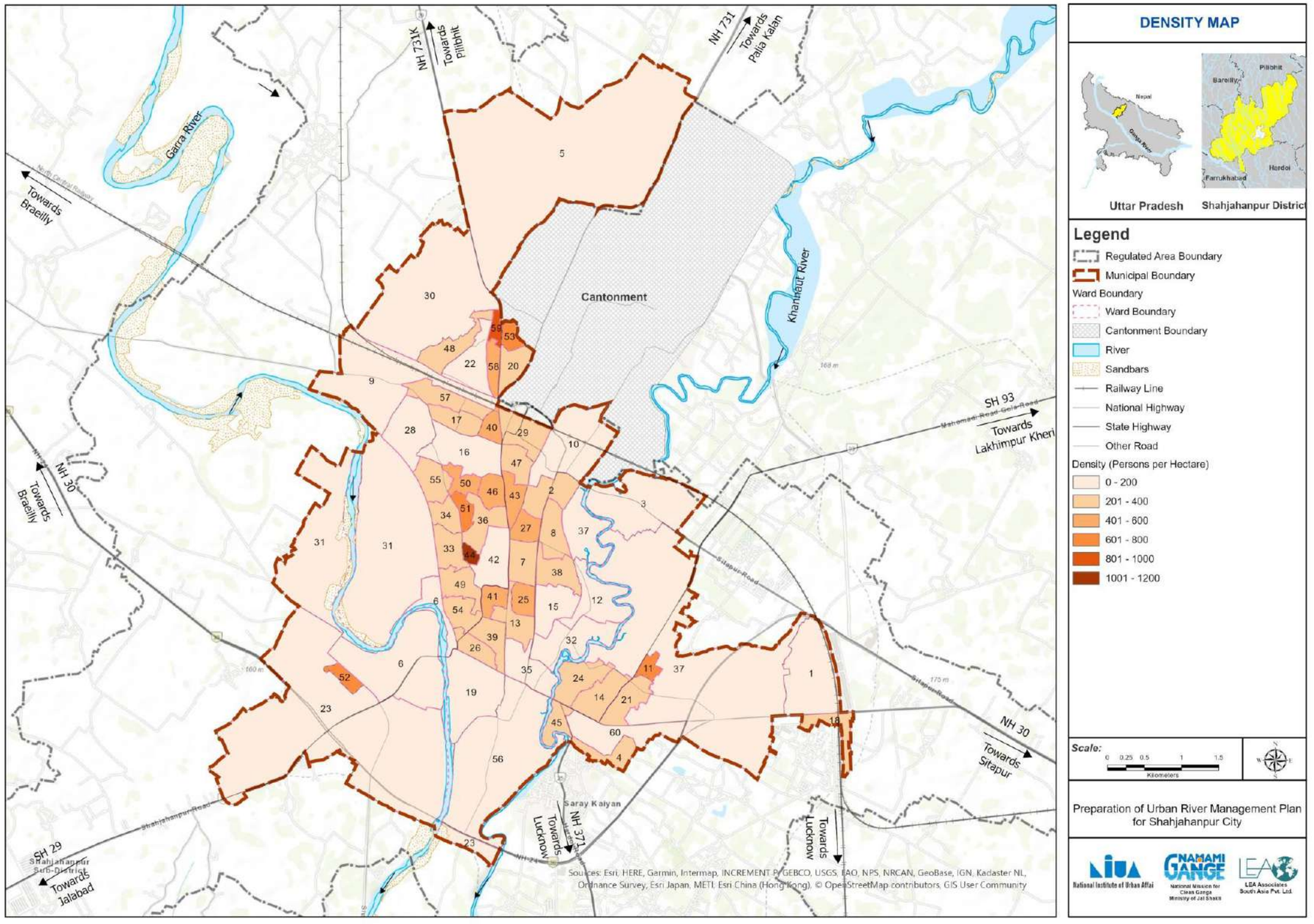
Shahjahanpur was upgraded to a Municipal Corporation in April 2018, expanding from 31 wards to 60 by incorporating 13 new wards, 6 from the Cantonment Board, and 14 villages from the regulated area. A further proposal in December 2019 added 6 more villages (3 fully, 3 partially), raising the municipal area to 56.24 sq. km. Today, the Municipal Corporation serves as the primary civic authority, overseeing urban governance, planning and essential services including water supply, sanitation, waste management, street lighting, roads, and public parks (refer Map 2-2).

2.2 Demography

The total population of the municipal corporation is 3,29,736 (Census 2011) and the population in planning area is 4,78,630 with approximately 1 lakh persons (20%) residing beyond the corporation limits. The current population density within the municipal limits is 6856 people per sq.km. Considering the current decadal growth trend, the estimated population for the year 2025 (base year) is approximately 4.5 lakhs for the municipal area (refer Map 2-3).



Map 2-2: Administrative map of Shahjahanpur



Map 2-3: Population density map of Shahjahanpur

2.3 Physiographic Profile

2.3.1 Topography:

Shahjahanpur city lies in the central part of the Indo-Gangetic Plains. The terrain is largely flat and uniform, with a gentle southward slope. Elevation ranges between 127 m and 175 m above mean sea level, with most of the urban expanse averaging around 150 m. The urban area is hydrologically segmented into three distinct zones by the Garra and Khannut rivers. The interfluvial tract between the two rivers constitutes the central zone, while the Garra West and Khannut East sectors represent the western and eastern divisions respectively.

The Garra and Khannaut rivers define the city's physiographic setting. Their corridors mark the lowest elevations, creating fertile floodplains that contrast with the slightly higher tracts toward the eastern and southern peripheries. The city falls within the Mid-Western Plain agro-climatic zone and exhibits two dominant geomorphic formations: Khadar and Bhangar. The Khadar zone, found along the riverbanks, consists of newly deposited fertile alluvium that is highly productive but prone to seasonal flooding. In contrast, the Bhangar tracts surrounding the city are composed of older alluvial deposits, slightly elevated and less flood-affected, forming the stable backdrop of the urban landscape.

2.3.2 Geophysical Characteristic:

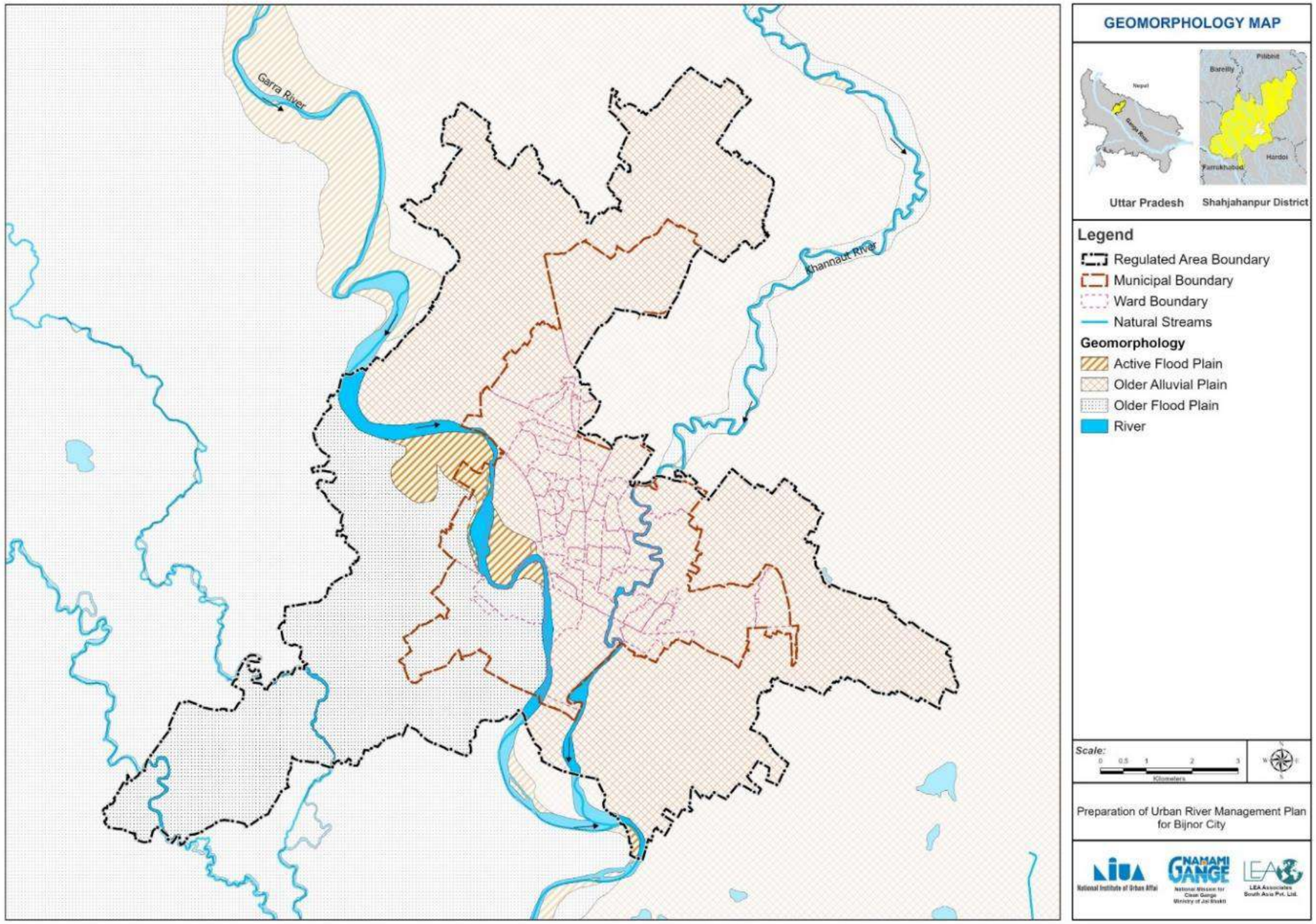
The physical landscape of Shahjahanpur is marked by natural levees and minor erosional features that break the otherwise level terrain. As shown in the geomorphology Map 2-4, soils vary from sandy loam near riverbanks to clayey loam in interior tracts, providing a strong base for agriculture in peri-urban areas.

The rivers enrich these soils but also introduce risk such as seasonal flooding during heavy rainfall alters land use and influences settlement patterns. Groundwater occurs within thick alluvial deposits, forming productive aquifers that serve as a vital source for irrigation and drinking water. This interplay of fertile alluvium and hydrological vulnerability defines the city's geophysical character, highlighting both its agricultural potential and environmental constraints.

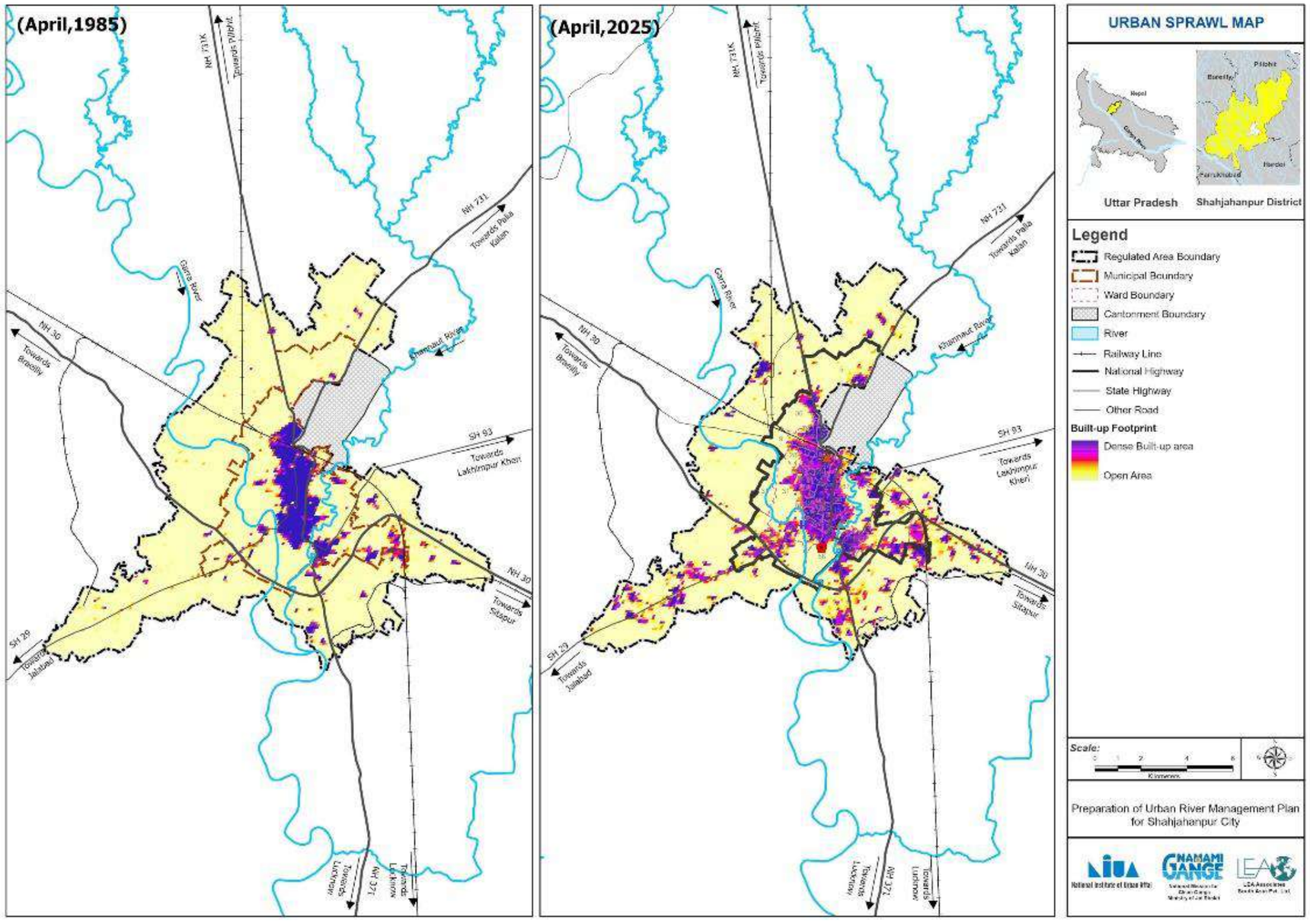
2.4 Urban Sprawl

Over the past four decades, Shahjahanpur has shifted from a compact core to a dispersed urban form. GHSL maps for 1985 show built-up concentration largely confined to central wards (12–17), with growth restricted by the Garra and Khannaut rivers and the cantonment in the north. By 2025, expansion has spread into peripheral wards such as 28, 30, 31, 37, and 56, particularly toward the south, south-east and west (refer Map 2-5). Bridges across the rivers along the Bareilly–Sitapur Road and on the western side unlocked new corridors, spurring residential and commercial growth around Piprala alongside institutional and industrial investments.

The spatial pattern thus reveals leapfrog development, with isolated pockets of high-intensity built-up land beyond the municipal core. At the same time, flood susceptibility along both rivers continues to shape uneven growth, reinforcing spatial imbalance and highlighting the dual role of Garra and Khannaut as both barriers and catalysts of expansion.



Map 2-4: Geomorphology map of Shahjahanpur



Map 2-5: Urban sprawl map of Shahjahanpur city

2.5 History and Cultural Profile

Shahjahanpur was founded in 1647 by Diler Khan and Bahadur Khan, sons of Dariya Khan, a soldier in Emperor Jahangir's army. In recognition of their service, Emperor Shah Jahan granted them land near the confluence of Garra and Khannaut rivers, where a fort was established and Pathan settlements gradually took shape. During British rule, Shahjahanpur was constituted as a district in 1813 following the transfer of Rohilkhand from Awadh, becoming an important administrative centre. The city later gained national prominence as the birthplace of revolutionaries Ram Prasad Bismil and Ashfaqullah Khan, whose role in the freedom struggle cemented its place in India's modern history. Together, its Mughal origins, colonial legacy, and contribution to independence define Shahjahanpur's historical identity.

Culturally, Shahjahanpur's traditions are deeply tied to its rivers and religious practices. The Garra and Khannaut continue to shape community life, with Raj Ghat and Hanumant Dham Ghat serving as focal points for gatherings and rituals. Temples such as Hanumant Dham, distinguished by its 104-ft statue of Lord Hanuman along with Baba Vishwanath Mandir and Kalibari Temple, act as spiritual and social anchors. These riverfront spaces and shrines sustain the city's vibrant cultural fabric and reflect its enduring spiritual heritage. Table 2-1 below provides a detailed list of the festivals

Table 2-1: Festivals and events in Shahjahanpur

Festival Name	Month	Location	Cultural Significance
Diwali	October–November	Celebrated citywide. Diyas and candles are lit on Raj ghat and Hanumant Dham ghat	Festival of lights symbolizes the return of Lord Rama to Ayodhya.
Makar Sankranti	January	Raj Ghat, Hanumant Dham Ghat and open grounds	Marks the harvest season and change of the sun's position.
Chhat	November	Raj Ghat, Hanumant Dham Ghat and along the banks of river Khannaut and Garra	Prayers offered to Chhati Maiya on the riverbanks

Source – Consultation with the Tourism department, Shahjahanpur, 2025

2.6 Tourism Profile

Shahjahanpur Regulatory Area has several tourist destinations including Shaheed Udyan, Heritage Ghat, Hanuman Dham, Tomb of Maulvi Hafiz Ahmed Ullah Khan, Sunasar Ghat, Parshuram Temple at Jalalabad, Tomb of Ashfaq Ullah Khan at Rudrapur, Pakshi Vihar, etc. The peak tourist season extends from October to March. In the year 2019, the number of foreign tourists was 353.

2.7 Socio – Economic Profile

2.7.1 Economic Activities along the rivers

Economic activities along the city's rivers encompass agriculture on fertile floodplains, sand mining on the Garra, religious tourism and cultural practices on the Khannaut, and traditional services such as Dhobi Ghats on khannaut. Collectively, these riverine functions provide vital livelihoods for the city's residents.

A. Garra River:

- **Agriculture**: Floodplain along the Garra river is actively used for farming due to the rich alluvial soil. Wheat, paddy, and sugarcane are the main crops grown here. Many local households depend directly on this farming activity for income. Seasonal flooding helps improve soil fertility, but crop damage also occurs during years of heavy floods.
- **Mining**: Sand mining takes place on Garra River near Kakra Kakar Kund. This activity has caused visible riverbank cutting and bed lowering at certain points, increasing the risk of erosion during monsoon flows.

Image 2-1 : Agriculture and mining activities along the Garra River

B. Khannaut River:

- **Agriculture:** Farming along the floodplain of Khannaut river is limited, compared to Garra river due to high urban pressure. Crops such as wheat, paddy, and sugarcane are cultivated in the floodplain.
- **Dhobi Ghat:** Located near Pakka Pul, this area serves as a traditional site for washing clothes using river water. Clothes are washed, rinsed and laid out to dry along the banks, with peak activity in the mornings though it remains busy throughout the day. However, used water mixed with detergents is discharged directly back into the river, contributing to local pollution and visible foaming, especially during summer months when water levels are low.

2.7.2 Religious Activities along the rivers

Religious activities in Shahjahanpur are primarily concentrated at Hanumant Dham Ghat and Raj Ghat (Garra Ghat), as detailed in Section 3.3.

- **Raj Ghat (Garra River):** The main point of religious gatherings, especially during Chhath and festivals, supported by temporary stalls selling ritual essentials.
- **Hanumant Dham (Birasat Ghat, Khannaut River):** A major religious and cultural site on an island, with daily temple activities and small-scale economic activity from vendors and shops.


Image 2-2 : Religious and Dhobi activities along the Khannaut River

2.7.3 IEC and Social Engagement (Annual calendar, frequency, target audience)

Creating a river-sensitive society requires behavioural change, active participation and awareness across all sections of citizens. The focus is on integrating sustainable practices into daily life, ensuring that rivers are seen as community assets that need protection.

1. IEC Activities of Municipal Corporation:

The Shahjahanpur Municipal Corporation (SMC) regularly conducts awareness and IEC activities through road rallies, street plays, plogging drives, riverbank cleaning, plantation drives and solid waste collection activities as part of Swachh Bharat Mission and Namami Gange program shown in below images. On occasions like Environment Day and Ganga Utsav, at least one major activity is organized each month, with updates recorded on the SBM portal.

Image 2-3: Ghat cleaning drive near Bisarat Ghat

Image 2-4: Street play in residential areas

Awareness and IEC Activities (2024)

- **Planning and Implementation** – All awareness and IEC programs were coordinated by SMC under the Swachh Bharat Mission framework, in collaboration with local NGOs and self-help groups for community mobilization.
- **General IEC Programs** – A total of 136 awareness programs were conducted across localities such as Aiman Zai, Jalalnagar, Ramnagar Colony, Roza, Sadar Bazar, Aziz Ganj and Lodhipur. These covered source segregation, user charge campaigns, septic tank cleaning and promotion of 'Reduce, Re-use and Re-cycle' Centres, with the support of community-based groups.

- **Zero-Waste Events** – 20 zero-waste events were organized as part of community outreach and awareness drives, including citizen participation meetings and ward-level Swachhta Chaupals. These were implemented in Sadar Bazar, Lodhipur, and Sarayakaiyan.
- **Single Use Plastic (SUP) Ban Campaign** – 47 awareness meetings were conducted with market associations, traders and shopkeepers in Bahadurganj, Ramnagar Colony, Roza, Aziz Ganj and Town Hall areas.
- **World Environment Day Celebrations** – 15 activities were held, including 5 cleaning drives, 4 tree plantation drives, 1 plogging drive and 5 awareness programs across Sadar Bazar, Rapti Riverfront, Aziz Ganj Park and Ramnagar Colony. These events saw involvement of schools, eco-clubs, NGOs, self-help groups and citizen groups.

2. NGO involvements:

- Several active NGOs, including Ganga Vichar Manch, Ganga Samagraha, Lok Bharti, Mera Yuva Bharat Shahjahanpur and Jila Ganga Samiti Shahjahanpur, play a supportive role in IEC activities. While the programs are primarily planned and implemented by the Municipal Corporation these NGOs collaborate by mobilizing communities, spreading awareness on waste segregation, plastic ban enforcement, river cleanliness and encouraging citizen-led initiatives

3. IEC Activities of Namami Gange:

Under the initiative of Namami Gange, the following activities were undertaken in Shahjahanpur with involvement of the citizens (refer below images):

- **Cleaning Drives:** Organized at Chat Ghat (Khannaut River), resulting in the collection of nearly 120 kg of waste with public and NGO participation.
- **Ganga Aarti:** Held at Raj Ghat (Garra River) to promote the cultural and ecological significance of rivers.
- **Tulsi Distribution:** Conducted alongside cleaning efforts at Chat Ghat.
- **Plantation, Drawing Competition and Expert Lecture**: Hosted at the Divisional & Ganga Meeting Hall, DFO Office.

Image 2-5: Rally at Bahadurganj Rd

Image 2-6: Plantation drives

Despite the extensive IEC initiatives undertaken by the Municipal Corporation, NGOs, and Namami Gange program, major hotspots along the rivers and drains continue to exhibit significant

accumulation of solid waste. The details of these critical locations are presented in Section 4.4.

Campaign partners (funding sources, stakeholders involved)

The river awareness and IEC campaigns in Shahjahanpur are primarily funded and led by the SMC under national flagship programs such as the Swachh Bharat Mission (SBM) and Namami Gange.

SMC acts as the nodal agency for planning, coordination and implementation, while working closely with multiple stakeholders to ensure wide outreach and community participation. Key partners include local NGOs such as Ganga Vichar Manch, Ganga Samagraha, Lok Bharti, Mera Yuva Bharat Shahjahanpur and Jila Ganga Samiti Shahjahanpur, which support community mobilization, awareness generation and citizen engagement. Self-help groups, resident welfare associations, market associations, traders, schools, eco-clubs and ward-level citizen groups actively participate in campaigns related to waste segregation, plastic ban enforcement, river cleaning and plantation drives. Government departments such as the Forest Department (DFO Office) and district-level committees also contribute through technical support and joint activities. Together, these funding sources and stakeholders form a collaborative framework that strengthens behavioural change initiatives and promotes shared responsibility for river conservation.

2.8 Institutional Mechanism

The list of existing agencies responsible for planning, development and service delivery within the Shahjahanpur Regulatory Area are presented in below:

Table 2-2: Role and responsibility of key government agencies for Shahjahanpur City

Sl. No.	Department	Key role and responsibilities	Nodal Officer	Applicable for URMP Objectives
A.	**Local Level Agencies**			
1.	District Magistrate Shahjahanpur	• Maintaining law and order, coordinating civic operations and ensuring regulatory compliance across the city. • Land revenue records	District Magistrate	10 objectives
2	Municipal Corporation, Shahjahanpur	• Area jurisdiction: Municipal Area • Urban services and infrastructure – solid waste management, maintenance of road & drainage, • Environment and public welfare activities • Development and planning • Public interface and emergency services.	Municipal Commissioner	Objective 1 to 10
3	Cantonment Board, Shahjahanpur	• Roads, drainage, sanitation, health services, land records, building permissions, grievance redressal	Chief Executive Officer	-
4	Regulatory Authority, Shahjahanpur	• Area jurisdiction: Municipal Area and villages within the Planning Area	Member	Objective 1 to 3

Sl. No.	Department	Key role and responsibilities	Nodal Officer	Applicable for URMP Objectives
		• Land-use planning, conversion approvals, building permissions etc. • Monitor progress and ensure timely execution of projects		
5	Shahjahanpur Jal Kal	• Responsible for day-to-day operation and maintenance of water supply systems.	-	Objective 2 and 6
6	Local NGO/ Civil Society Member	• Community awareness, clean-ups, conservation drives, volunteerism	-	Objective 9 and 10
B.	**Regional/ State level**			
7	Forest and Wildlife Department	• Habitat protection, watershed management, soil conservation	Divisional Forest Officer	Objective 4
8	Shahjahanpur Tourism Development Department	• Tourism policy, eco-tourism, impact monitoring, safety protocols	Secretary, Tourism	Objective 7 and 8
9	State Mission for Clean Ganga, Uttar Pradesh	• Sewage treatment, river rejuvenation, ghat development, awareness campaigns	M&E Officer	Objective 1 to 10
10	Irrigation and Water Resource Department. Uttar Pradesh	• Construct and maintain embankments, spurs, check dams; Develop watershed projects; Plan, design and construct canals, dams, barrages, lift irrigation schemes; Flood management	Executive Engineer	Objective 1, 3, 5, 6
11	Pey Jal Nigam, Uttar Pradesh	• Plan, design and Drinking water supply, rural schemes, STPs, drainage	Executive Engineer	Objective 2, 3, 5, 6
12	Uttar Pradesh, PWD	• Plan, construct and maintain Highways, district & rural roads, bridges.	Executive Engineer	Objective 1, 2, 4, 5, 6
13	Ground Water Board, Bareilly	• Groundwater monitoring, aquifer mapping, recharge guidance	Senior Hydrology	Objective 2, 3, 5, 6
14	Town and Country Planning Department, Uttar Pradesh	• Prepare Master Plans, Zonal Development Plans and Land Use • Prevent unauthorized constructions and encroachments,	Assist. Planner	Objective 1 to 8
15	Uttar Pradesh Pollution Control Board	• Enforce environmental laws, monitor water quality, regulate industries	Regional Officer	Objective 1 to 8
16	DIC, Shahjahanpur	• MSME support, training, industrial profiling	General Manager	Objective 2 & 05
17	Department of Agriculture	• Crop promotion, schemes (PM-KISAN, insurance), irrigation, extension services	District Agriculture Officer	Objective 1, 2, 4, 5, 8
18	Department of Horticulture	• Fruit/vegetable cultivation, irrigation efficiency, farmer training, agro-industries	District Horticulture Officer	Objective 1, 2, 4, 5, 8

2.9 Conclusion

Shahjahanpur stands out as a heritage-rich urban center with strong agricultural foundations and growing industrial activity. Its fertile alluvial soils and strategic location along the Khannaut and Garra rivers provide both opportunity and vulnerability, as seasonal flooding continues to shape land use and settlement. Regional connectivity through highways, rail, and air links reinforces its role as a well-integrated city, while administrative expansion into 60 wards reflects its rising urban stature. Overall, Shahjahanpur's baseline profile highlights a city's well-connected and culturally significant, yet in need of resilient planning to balance growth with environmental risk.

3 ECOLOGICAL PROFILE OF THE CITY

3.1 River Ecosystem:

The Garra and Khannaut Rivers form the primary surface water of Shahjahanpur. Their extents within the municipal and regulatory boundaries are presented below.

Table 3-1: Length of the Waterbodies

S. No.	Waterbodies	Length in Municipal Area (in kms.)	Length in Regulatory Boundary (in kms.)
1	River Garra	7.8 km	13.7 km
2	River Khannaut	7.2 km	10.5 km

Source: Consultant's analysis

Both rivers converge near the ROSA Thermal Plant, and the combined channel flows for approximately 1.2 km along the southern edge of the regulatory boundary.

- **Garra River:** Originates in the Kumaon hills of Uttarakhand, emerging from the Nandhaur range near Haldwani, and enters Uttar Pradesh as the principal river of Shahjahanpur district. A perennial, alluvial river with a medium- to fine-sand bed, it functions as a second-order tributary of the Ramganga River and ultimately contributes to the Ganga system. Flowing along the western edge of the Shahjahanpur Municipal Corporation boundary, the river exhibits pronounced seasonal variability, with very low flows during summer and high monsoon discharges that carry heavy silt loads, alter channel morphology and often cause waterlogging and localized flooding in low-lying areas. As a key component of the city's surface water system, the Garra supports religious activities at Raj Ghat, along with sand mining and floodplain agriculture, thereby influencing both the city's landscape and livelihoods along its banks.

  Garra River at Aziz Ganj (Refer Image 3-1) highlights the interface between the river and adjacent urban landscape. The river channel here spans approximately 67 meters, with the east bank featuring dense residential development and the west bank has significant green space. Sediment accumulation is visible along both banks. Elevation across this section ranges from about 3 meters below ground level at the depth of the riverbed up to +6 meters above ground level in both the east and west bank areas.

- **Khannaut River**: Originates near Jamuniya Khas village in Pilibhit district, close to the Nepal border and flows southward into Uttar Pradesh. Passing through the eastern edge of the Shahjahanpur Municipal Corporation boundary, it functions as a seasonal alluvial river with pronounced variation in discharge between dry and monsoon periods. During heavy rainfall, the river swells rapidly, often causing localized flooding in adjacent low-lying areas, and serves as an important urban and peri-urban drainage channel. The Khannaut supports religious, agricultural and dhobi activities, with several ghats located along its banks. Beyond the southern regulatory boundary of the city, it converges with the Garra River.

  Khannaut River at Dalel Ganj (Refer Image 3-2) shows a channel that spans about 64 meters within a highly urbanized corridor. The east bank is closely lined with residential buildings and

paved areas, with construction extending right up to the river edge. In contrast, the west bank transitions into more open land, featuring agricultural plots and scattered built-up structures. The riverbed sits approximately 2 meters below the ground level of the surrounding area at its deepest point. This sediment build-up reduces the river's effective carrying capacity and suggests heightened vulnerability to waste dumping and localized encroachment, particularly along the densely developed east side.

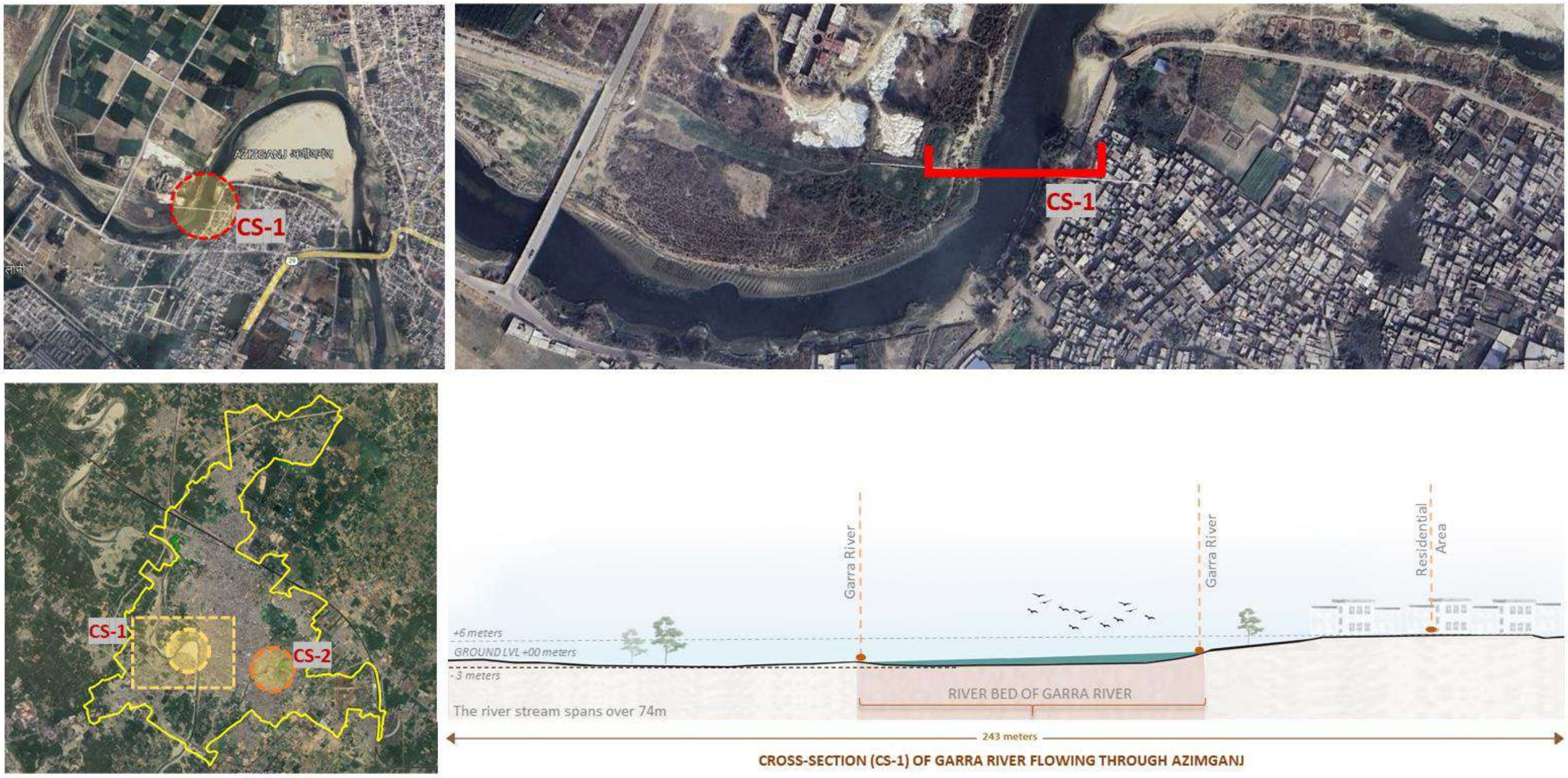
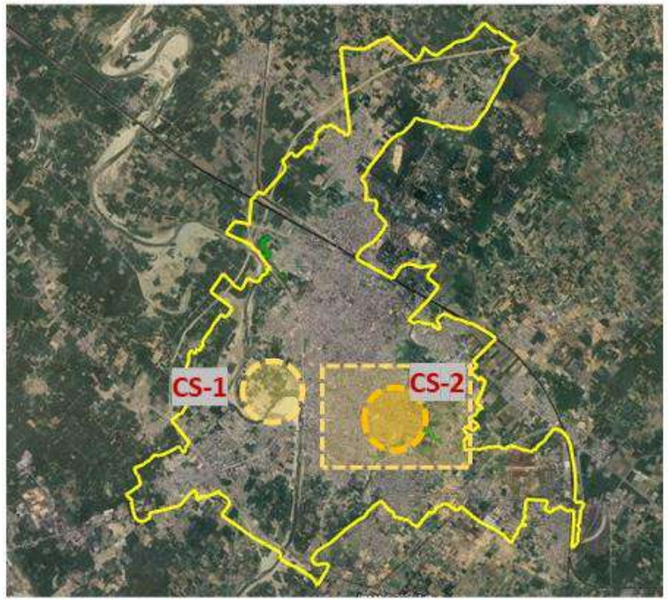
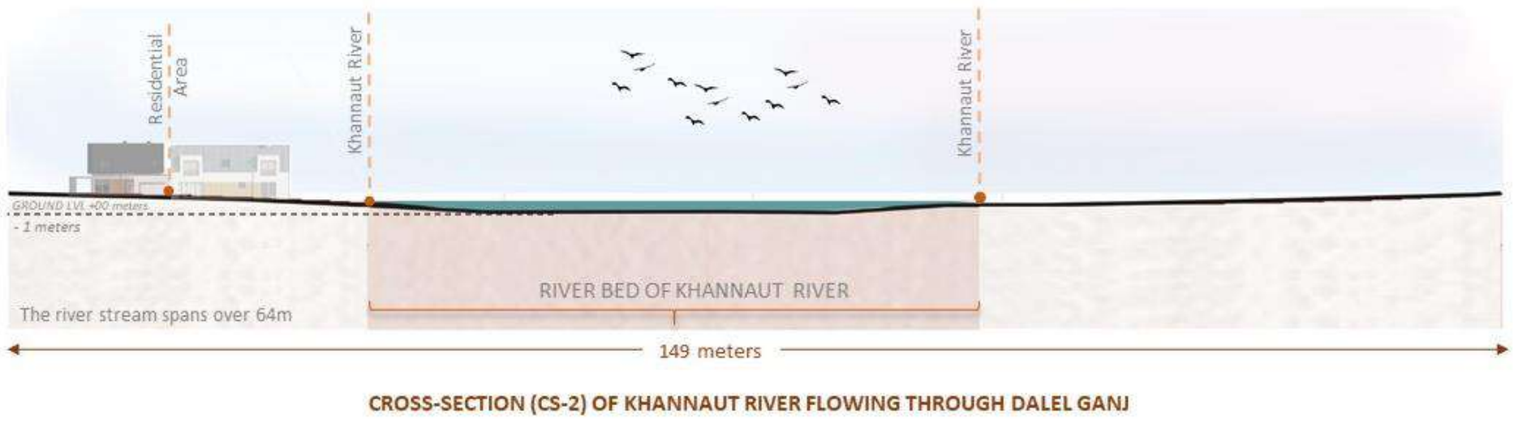


Image 3-1: Cross-section of Garra river flowing through Aziz Ganj





CROSS-SECTION (CS-2) OF KHANNAUT RIVER FLOWING THROUGH DALEL GANJ

Image 3-2: Cross-section of Khannaut river flowing through Dalel ganj

3.2 Blue-Green Resources in the City

According to the Master Plan 2031, Shahjahanpur regulatory area comprises approximately 4.5% of blue area which includes rivers and waterbodies and 5.6% of green areas which includes parks, open spaces and vegetation).

3.2.1 Blue Resources:

Apart from Garra and Khannaut rivers, regulated area of Shahjahanpur contains 45 waterbodies, of which 25 are above 1 acre in size and 20 are below 1 acre. Of these, 19 lie within municipal limits, with 10 above 1 acre. Additionally, 15 notified wetlands (smaller than one acre in size) are present in the regulated area, of which one lies within the municipal boundary. As per the Master Plan 2031, all water bodies recorded in the revenue records (Sajra) must be preserved, with a mandated 9-meter green belt around ponds, lakes or reservoirs exceeding one acre, and a 5–15-meter buffer for other identified waterbodies. Collectively, these waterbodies cover 55.52 hectares, about 0.42% of the regulated area. Despite their limited scale, they play a vital role in groundwater recharge, flood moderation and microclimate regulation, underscoring the need for their systematic rejuvenation and conservation.

The city solely depends on ground water for its water supply through 47 tube wells. There are 26 storm water drains including 17 are major drains of these 12 drains is directly into the existing natural streams flowing through the city. The drains in the city are poorly managed due to solid waste being dumped into them.

3.2.2 Green Resources:

1. **Forest:** The city does not have notified forest cover, though small green patches are found in open spaces, institutional campuses and peri-urban fringes. These areas are commonly planted with species such as Neem, Peepal, Banyan, Pakar, Mango, Babul, etc which contribute to the city's greenery and urban ecology inside the regulatory boundary.
2. **Wildlife:** The forest tracts present in the Shahjahanpur district include species such as jackals, hares, foxes, wild boars and a wide range of birds.
3. **Urban green belt/ parks:** As per the Master Plan 2021, about 413.13 hectares (3.13%) of land have been earmarked for parks, open spaces and green belts, including a 102-hectare regional park (0.77%) proposed along Jalalabad Road to cater to recreational needs. The current share of formal, organized urban greens (3%) is much below the URDPFI-recommended standard of 10%.
    - **Biodiversity Park:** The Bio-Diversity Park (Jaivik Park) in Shahjahanpur, spread over 10 hectares along the Old Shahjahanpur–Bareilly Road, functions as an urban biodiversity hub that integrates recreational amenities with ecological awareness and conservation initiatives.
4. **Agriculture:** The agriculture dominates the land use pattern of the regulated area covering 7,557.17 hectares (59.28%), forming the primary green asset of the city. City's economic profile is strongly agro-based, featuring clusters of small and micro-enterprises engaged in rice milling, oil milling, grain processing, and dairy production. This agricultural base is further supported by large-scale fertilizer manufacturing, most notably the Krishak Bharati Fertilizer (Kribhaco) unit located in Pipraula, which plays a critical role in sustaining farming activities across the region.

Together, these enterprises and industrial linkages highlight the integrated nature of Shahjahanpur's agricultural economy and its importance to the city's overall development framework.

3.2.3 Riparian Buffer

The riverbanks of the Garra and Khanaut Rivers in Shahjahanpur reflect a mix of urban, agricultural, and semi-natural landscapes. Riparian vegetation within the 30-meter buffer zone plays a critical role in regulating water flow, mitigating flood risks and maintaining ecological balance. The eastern banks retain more stratified vegetation, while the western banks face intense pressure from agriculture and built-up expansion in both rivers. This uneven riparian buffer highlights the need for targeted conservation and restoration to sustain hydrological stability and ecological integrity.

1. Eastern Stretches of Rivers

- **Garra River:** The eastern bank shows relatively stronger ecological health. Dense vegetation is concentrated in stretches totaling about 1.5km, while agricultural vegetation dominates with nearly 7.6km of buffer length. Degraded patches are also visible, covering around 0.7km. Built-up encroachments near Ward 56, Aziz Ganj and adjoining settlements have fragmented the grass and herbaceous zone, reducing ecological continuity.
- **Khanaut River:** Eastern stretches across Lodhipur, Hayatpura and Hussainpura retain portions of natural buffer. Dense vegetation stretches cover about 0.4km, while agricultural zones extend over 4.3km. Degraded vegetation accounts for nearly 2.7km. Despite proximity to dense urban zones, Lodhipur and Hayatpura maintain wider buffers that support flood moderation and ecological continuity. However, expansion of colonies near Pakka Pul, Adarsh Nagar Colony, and Hanumant Dham is fragmenting these green corridors.

2. Western Stretches of Rivers

- **Garra River:** The western bank is heavily influenced by agriculture and urban expansion. Agricultural vegetation covers about 1.6km, while degraded stretches account for nearly 4.5km. Dense vegetation is minimal, with only a small patch of around 0.2km remaining. Built-up areas are concentrated near transport corridors and urban edges, leaving little space for riparian buffer development.
- **Khanaut River:** Western stretches face severe development pressure. Agricultural vegetation spans about 5.7km, degraded zones cover nearly 1.2km, and dense vegetation is limited to around 1.9km. Continuous habitation and infrastructure growth along Dalelganj, Keru Ganj Chauraha, and the NH 731 corridor have substantially reduced natural riparian cover.

Table 3-2: Assessment of existing riparian buffer in Shahjahanpur Municipal Corporation

Zone	Riparian zone	Bank of the river	Existing Status	Width range
I.	**Khannaut River – 7.2 km**			
1	Ward 37, Lodhipur (RS-1)	East Bank – 0.66 km West Bank – 0.85 km	The buffer along the river exists in four stretches covering a mere one-third of the river length in the municipal area.	>7.5 to <30 M
2	Along ward 12 and 37, Hayatpura (RS-2)	East Bank - 0.54 km West Bank – 0.79 km		>7.5 to <50 M

Zone	Riparian zone	Bank of the river	Existing Status	Width range
3	Along ward 32 and 37, Hussainpura (RS-3)	East Bank – 0.09 km West bank – 0.08 km		>7.5 to <30 M
4	Along ward 56, Mishripur (RS-4)	West bank – 2.21 km		>7.5 to <35 M
II.	**Garra River – 7.8 km**			
1	Along ward 56, Tarai region (RS-6)	Eastern bank – 0.5 km	In contrast, the Garra River's riparian area is shorter, reducing its effectiveness in providing flood mitigation and habitat functions.	>25 to <70 M

The details and map of the riparian buffer along the rivers are provided in Map 3-1.

3.2.4 Biodiversity

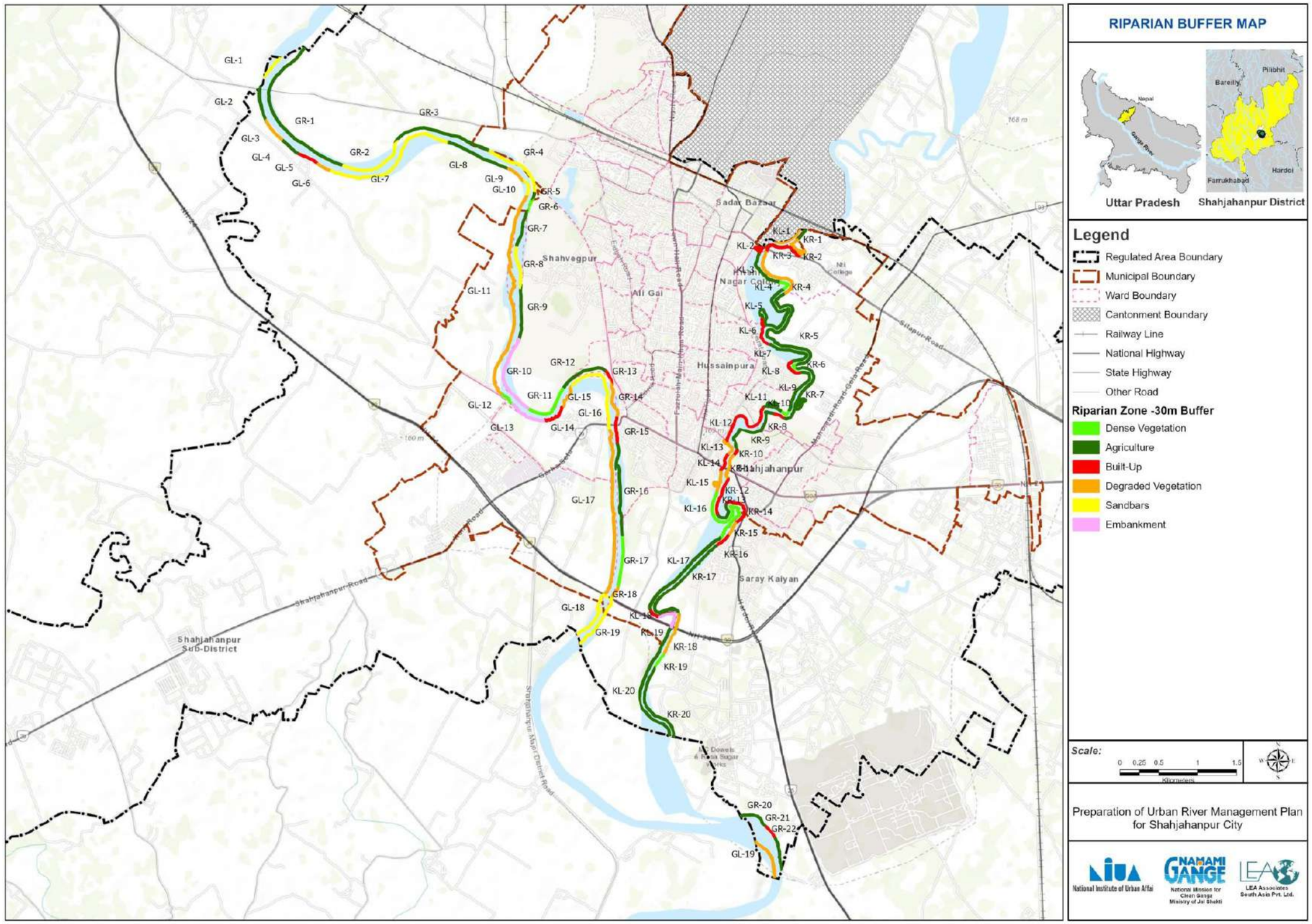
The typology of flora and fauna found along both Garra and Khannaut rivers is listed below table which can help to stabilize banks and filter runoff.

Table 3-3: Flora & Fauna of the Riparian buffer

Parameter	Garra River	Khannaut River
Flora	Mix of grasses, shrubs, and scattered trees: Common species include Acacia nilotica (Babul), Prosopis juliflora (Vilayati Babul), Ficus religiosa (Peepal), Saccharum spontaneum (Kans grass), and Cynodon *dactylon* (Doob grass). Babul and Prosopis provides soil retention and windbreaks, Peepal supports carbon sequestration and nesting habitat for birds. Kans and Doob grasses reduce surface runoff and promote natural regeneration.	Dominated by native grasses, herbs and shrubs with sparse tree cover providing limited structural stability during high flood events. Common species include Babul, Vilayati Babul, Peepal, Kans grass and Doob grass. Tree species are Shisham, Jamun and Mango.
Buffer Width and Condition	Varies from 25 to 70 meters. In several stretches, encroached by cultivation and small-scale development, significantly reducing its functional width.	7.5–50 m; fragmented by agriculture and urban activities, lowering continuity.
Fauna	Mammals: *Macaca mulatta* (Rhesus Monkey) and *Herpestes edwardsii* (Indian Grey Mongoose). Bird species: Common Kingfisher, White-breasted Kingfisher, Pond Heron and Cattle Egret and; Reptiles: *Varanus bengalensis* (Monitor Lizard) and various snake species. Fish species: Catla catla (Catla), Labeo rohita (Rohu), Cirrhinus mrigala (Mrigal), Mahseer, Murrel, and local catfish	Mammals: *Macaca mulatta* (Rhesus Monkey) and *Herpestes edwardsii* (Indian Grey Mongoose). Bird species: Common Kingfisher, White-breasted Kingfisher, Pond Heron and Cattle Egret Reptiles: *Varanus bengalensis* (Monitor Lizard) and various snake species. Native fish species

Image 3-3: Flora at kakra kund along Garra River

Image 3-4: Flora at Banka ghat along Khannaut River



Map 3-1: Riparian stretch within Shahjahanpur

3.3 Activity mapping along the rivers:

The following activities are observed along Khannaut and Garra rivers (refer Map 3-2).

- **Agriculture:** as mentioned in section 3.2.2, 59% of total regulated area. The fertile alluvial plains along the Khannaut and Garra rivers create ideal conditions for growing crops such as wheat, paddy and sugarcane. Agricultural activities are concentrated along the banks of the Garra River in areas like Tarai, Rausar, Kari Makuapur, Udhaupara, Aziz Ganj and Kakra Kakar Kund. In contrast, agricultural activities along the Khannaut River are comparatively lesser, with key areas including Mishripur, Lodhipur and Brij Vihar Colony.
- **Dhobi Ghat:** Dhobi activities in Shahjahanpur take place along the Khannaut River near the Pakka Pul, where traditional washermen use the river water for washing clothes.
- **Sand Mining:** Sand mining is not a major economic activity within SMC; however, it is observed at around six locations along the Garra River, near Kakra Kakar Kund.
- **Ghats:** Major developments are concentrated along the Khannaut River. There are four ghats namely, Banka Ghat, Chhat Ghat, Birasat Ghat (Hanumant Dham) and Chhoti Birasat Ghat have been developed on this river. On the Garra River has only one ghat, Garra Ghat (also known as Raj Ghat) which is detailed below.
    a) **Banka Ghat:** Western bank near Hayatpura Mohalla which is undeveloped, used for buffalo bathing, impacted by solid waste and Banka Ghat Drain discharge.
    b) **Chhoti Birasat Ghat:** Eastern bank near SH-29; open land with no facilities, used for buffalo bathing, polluted by Dalelganj and Khwaja Firoz Drain.

Image 3-5: Banka Ghat at Hussainpura

Image 3-6: Chhoti Birasat Ghat at Pakka pul

- **Religious:** Religious activities are mainly concentrated on the Raj ghat and Hanumant Dham ghat.
    a) The **Hanumant Dham temple** is a major religious and cultural site located on an island in the middle of the Khannaut River and has evolved into a small but active economic hub. Daily economic activity is driven by local shops and informal vendors selling souvenirs, puja materials, food and other essentials, many of which operate from stalls rented out and managed by the Municipal Corporation. Additionally, a two-

wheeler parking facility operated by the Municipal Corporation contributes to municipal revenue, along with periodic vendor fees collected during festive events.

Image 3-7: Hanumant Dham (Birasat Ghat) along Khannaut River

b) **Garra Ghat/ Raj Ghat:** During Chhath and other religious events, temporary stalls are set up by local vendors selling food items, puja materials, flowers, earthen lamps and other ritual essentials.

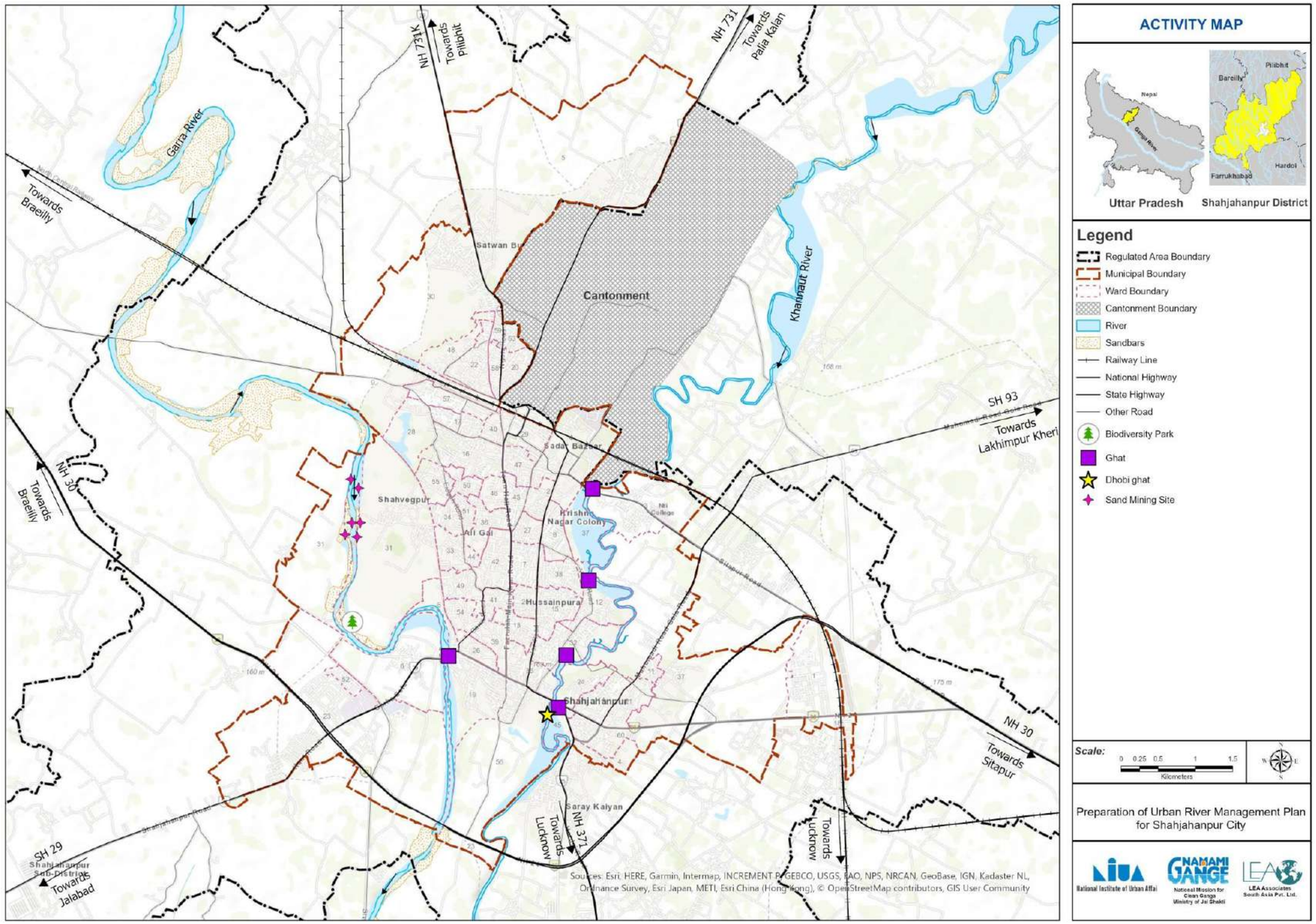
c) **Chhat Ghat:** This ghat is majorly used for chhat puja has only a concrete platform and no infrastructure facilities which lies on western bank of Khannaut river along NH-731, used for buffalo bathing.

Image 3-8: Raj Ghat at Rahi tourist bungalow

Image 3-9: Chhat Ghat at Lodhipur

- **Biodiversity Park:** A developing ecological and recreational zone at Kakra Kund along the Garra River, designed to conserve native flora and fauna while offering green space for community use and eco-tourism.

Image 3-10: Bio-Diversity Park (Jaivik Park) at Kakra kakar kund



Map 3-2: Activity mapping along the Garra and Khannaut Rivers

3.4 Flooding

Fluvial Flooding:

The Draft Master Plan of Shahjahanpur (Chapter 8, Sub-section 8.10) outlines floodplain zoning to regulate land use in flood-prone areas. Land within the 10-year flood frequency zone is reserved exclusively for open and recreational uses such as gardens, parks, and playgrounds, with no residential, commercial, or industrial construction permitted. In the 25-year flood zone, residential development is allowed only under safeguards—construction on stilts, minimum plinth levels, prohibition of basements, and adequate road access. Buildings are encouraged to be two-storey, with the ground floor used for non-residential purposes. The 50-year and 100-year flood zones serve as broader regulatory buffers, restricting high-risk development.

It includes 100 meters on both banks of the Garra River designated as a "No Development Zone", 250 meters uniform buffer proposed in the southern regulated area based on the 162-meter High Flood Level (HFL) and 6 meters green belt on both sides of city drains to prevent encroachment.

The Irrigation Department has recommended a 100-metre no-development zone along both banks of the Garra River to preserve natural floodplains, since no embankments exist. This buffer is designated as a No Development and Construction Zone (NDCZ) under River-Centric Urban Planning Guidelines. For the Khannaut River, flood-prone zoning follows the Master Plan 2021, with demarcation being undertaken by the Irrigation Department in line with National Green Tribunal (NGT) guidelines. Consultants have also mapped flood lines (Map 3-3). Official gauge stations record the Danger Flood Line (DFL) and High Flood Line (HFL):

- Khannaut River at Lodhipur bridge: DFL 145.750 m, HFL 146.750 m
- Garra River at Azimganj bridge: DFL 148.000 m, HFL 149.800 m

At several locations, HFL and DFL overlap, indicating heightened flood risk. Field observations show agricultural areas and peri-urban settlements within flood-prone zones, alongside widespread dumping of plastic and organic waste on floodplains. In some stretches, waste heaps extend into the river channel, while multiple drains discharge untreated Used water directly into both rivers, further degrading water quality.

The areas of concern within the floodplain are illustrated in Map 3-4, with details provided below.

1. **Settlements within flood prone areas**: Although the Master Plan 2031 marked the flood-prone zones of both rivers as non-buildable, settlements have continued to expand into these high-risk areas. Along the Garra River, houses have emerged in Aziz Ganj, while along the Khannaut River, localities such as Lodhipur and Pakka Pul have construction within the floodplain.

Image 3-11: Residential settlements along Garra and Khannaut river

2. **Critical infrastructure within the flood prone area**: The Sewage Treatment Plant (STP), Faecal Sludge Treatment Plant (FSTP) and a Degree College in Bahadurpura are situated within the flood-prone zone delineated in the Master Plan 2031. The new Municipal Corporation building is also being constructed along the flood prone zone of Garra river in Aziz Ganj.
3. **Solid waste dumping:** it is a concern on the floodplains, notably at Chota Bisarat ghat (Pakka Pul) and Banka Ghat on the Khannaut River and Raj Ghat on the Garra River, where plastics, construction debris, and organic waste degrade the landscape and pollute water.

Image 3-12: Solid waste dumping along Banka Ghat Drain

Image 3-13: Open dumping at Pakka Pul along Khannaut river

4. **Sandmining along river Garra**: at Kakra Kankar Kund is in clear deviation from the *Sand Mining Management Guidelines (2020)*, which mandate that mining must be carried out at least 7.5 metres away from the bank or ¼ of the river's width - whichever is larger**.** Mining on the bank poses serious concerns: it accelerates bank erosion, weakens embankments and increases the likelihood of channel shifting during high flows. Moreover, edge mining reduces riparian vegetation cover, heightens sediment load downstream, and compromises the river's natural flood-moderation capacity.

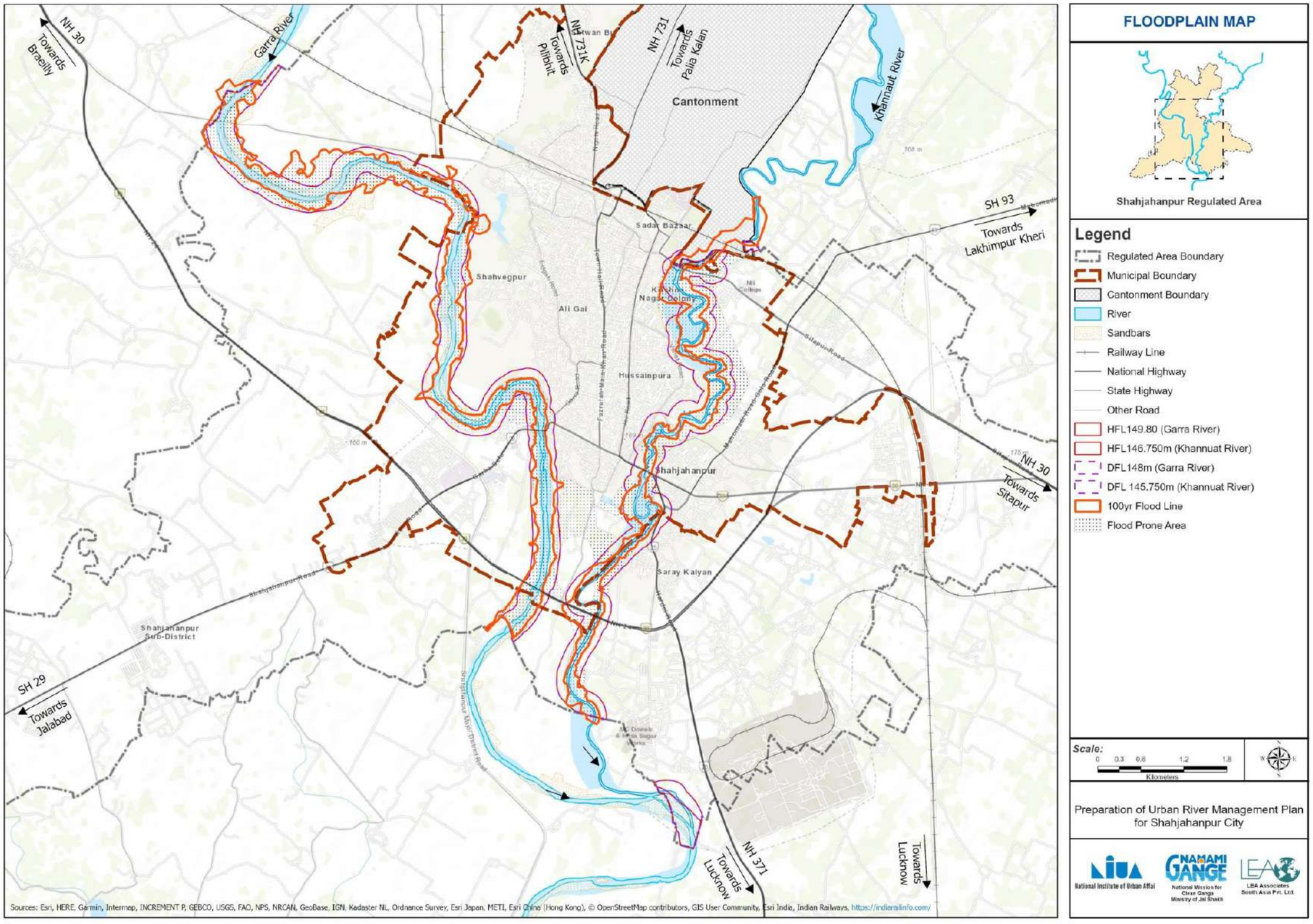
Pluvial Flooding:

Pluvial flooding in Shahjahanpur city occurs when intense rainfall overwhelms the stormwater drainage system, leading to widespread waterlogging across low-lying urban pockets. Heavy monsoon downpours cause runoff to accumulate in areas such as Bhawalkhera, Lodhipur, Aziz Ganj and Kakra

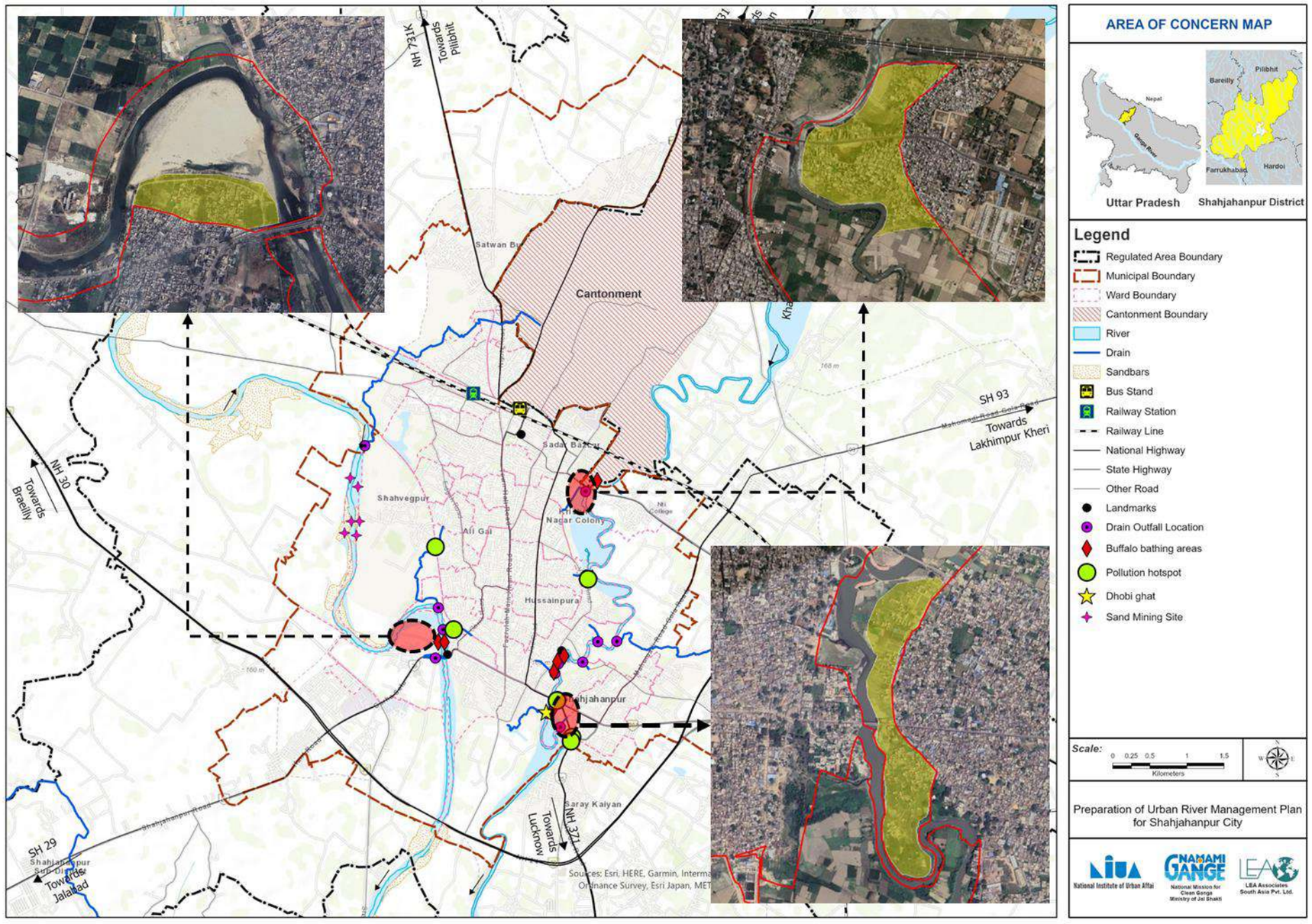
Kund, where blocked drains and encroachment on floodplains restrict the natural flow of water. The runoff often backflows into the Garra and Khannaut rivers, as multiple drains discharge directly into them, further aggravating flooding in adjoining colonies like Brij Vihar, Mishripur, and Rausar.

Flooding in Shahjahanpur occurs as solid waste clogs drainage channels, reducing their capacity to carry rainwater. This leads to water spreading across roads and settlements, inundating key infrastructure such as the Government Medical College, hospitals, schools, and even the Delhi–Lucknow highway, disrupting connectivity and local economic activity.

The impact is most severe in peri-urban settlements and agricultural fields along the Garra River, where the absence of embankments allows rainwater to spread across floodplains. The stagnant pools in the city core heighten risks of vector-borne diseases.



Map 3-3: Flood Plain Map



Map 3-4: Areas of concern within Flood Plain

3.5 Existing/ Upcoming/ Proposed Projects:

The riverbanks along the Garra and Khannaut rivers in Shahjahanpur are vulnerable to erosion and flood risks that threaten local infrastructure and settlements. The Irrigation Department, is presently undertaking several erosion and flood protection measures and details of these works are presented in the Table 3-4.

Table 3-4: On-going Works by Irrigation Department

Sl. No	Works by irrigation department for flood protection in Garra and Khannaut Rivers:
1	Embankment along river Garra in Aziz Ganj which includes repair of the existing embankment along with addition of boulders and barricade.
2	RCC piling is being undertaken along the river Khannaut to prevent flooding.
Source: Irrigation Department Shahjahanpur, 2025	

During the 2nd MSWG meeting and consultation, the District Magistrate highlighted that in the 2025 floods, the water level rose above the danger mark of 148.00 m, creating a serious risk to the new city bridge at Kakra Kund and causing floodwaters to enter the city in the absence of protective embankments.

Table 3-5: Proposed Works by Irrigation Department

Sl. No	Works by irrigation department for flood protection in Garra and Khannaut Rivers:
1	**Bridge Raising:** The new city bridge at Kakra Kund will be elevated by 1 m to safeguard against future floods (already sanctioned).
2	**Embankment Construction:** The Irrigation Department has proposed a 3 km long embankment from Kakra Kund to Subhash Nagar to protect adjoining settlements and agricultural areas from floodwaters

3.6 Institutional Mechanism:

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

4 PHYSICAL INFRASTRUCTURE

4.1 Water Supply

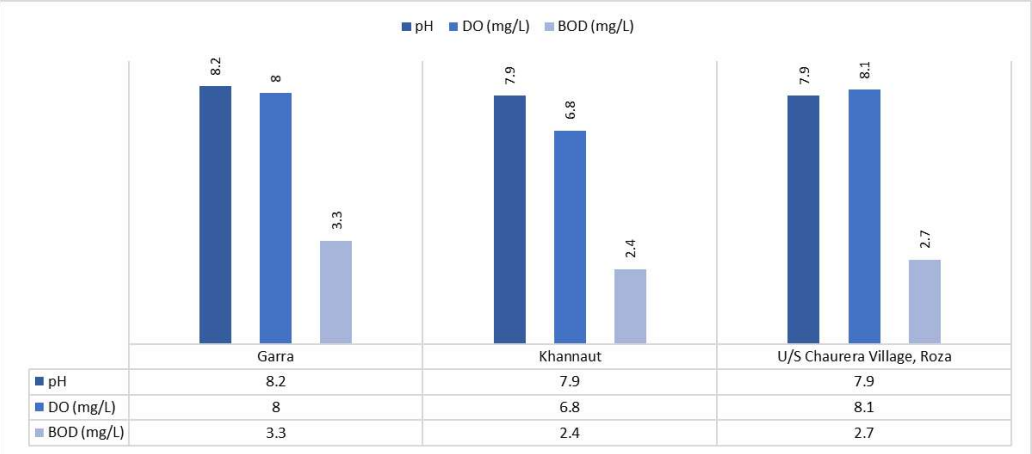
As mentioned in section 3.2.1 above, though the Shahjahanpur city as well as the regulatory area is primarily served by two main rivers, the Garra and Khannaut rivers, they are not currently used to meet the city's water demand. The city is entirely dependent on groundwater to meet domestic and commercial water requirements

4.1.1 Water Demand and Supply

The city currently operates 41 functional tube wells out of a total 47 ensuring consistent groundwater extraction of 53.1 MLD against a total demand of 54.04 MLD, leaving a shortfall of 0.94 MLD. The average daily water supply per capita is 118 LPCD. The distribution network is anchored by 16 overhead tanks, of which 12 are currently operational, and spans 280 kilometers of hydrant lines. The city also maintains 2,915 handpumps, with 2,885 in active use, ensuring decentralized access to groundwater. The Non-Revenue Water (NRW) is 42.1%. Water quality is maintained through electronic dosing chlorination systems. The city has a total of 16 overhead tanks of which 12 are currently operational.

4.1.2 Water Quality

Water quality assessment is carried out periodically by the SPCB. The results of the July 2025 water-quality sampling results at where Shahjahanpur Road Bridge intersects both Garra (near, Aziz Ganj) and Khannaut (near, Dalelganj) river show Faecal Coliform concentrations of 4800 MPN/100 ml (Garra) and 3500 MPN/100 ml (Khannaut), indicating significant faecal contamination stemming mainly from untreated or partially treated sewage discharge. Thus, water quality of Garra River and Khannaut River near Shahjahanpur road bridge has been classified as D (Propagation of Wild life and Fisheries) by CPCB mentioned in Table 4-1. Elevated BOD levels in the Garra River (3.3 mg/L) further indicate organic pollution and oxygen-demanding waste loading.



	Garra	Khannaut	U/S Chaurera Village, Roza
pH	8.2	7.9	7.9
DO (mg/L)	8	6.8	8.1
BOD (mg/L)	3.3	2.4	2.7

Figure 4-1: Water quality of Garra and Khannaut river and Chaurera Village, Roza; the confluence points of the rivers (July 2025)

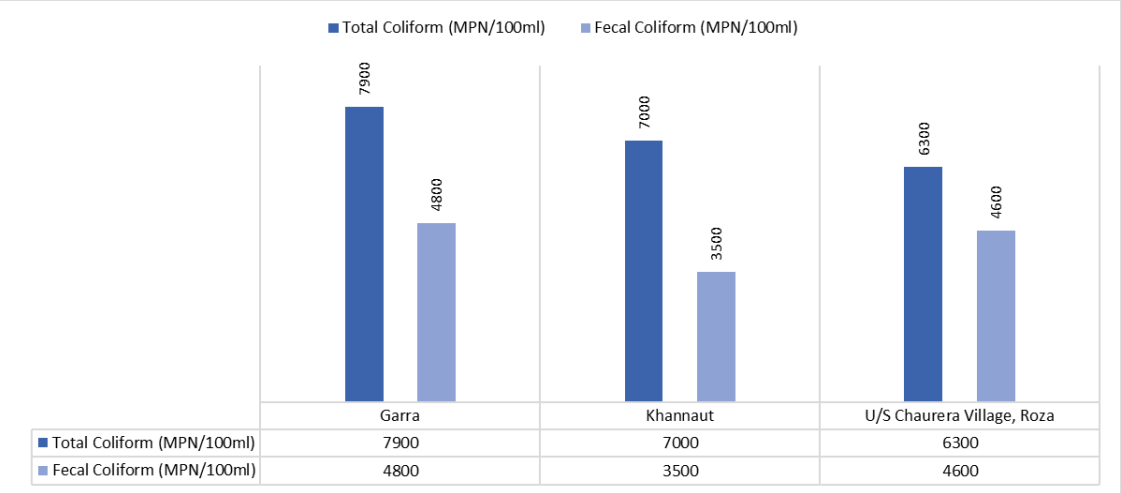


Figure 4-2: Total and Faecal Coliform for Garra and Khannaut river near and U/S Chaurera Village, Roza (July 2025)

Table 4-1: Classification of Garra & Khannaut River Water (Parameter-wise Evaluation)

Parameter	Garra	Khannaut	U/S Chaurera (Roza)	CPCB Class Criteria Met
pH	8.2	7.9	7.9	✔ Class A, B, C, D, E (all within pH limits)
DO (mg/L)	8.0	6.8	8.1	✔ Meets Class A (≥6), B (≥5), C (≥4), D (≥4)
BOD (mg/L)	3.3	2.4	2.7	✘ Garra fails A/B/C (BOD too high); ✔ D/E
Total Coliform (MPN/100 ml)	7900	7000	6300	✘ Fails A (≤50), B (≤500), C (≤5000); ✔ D
Faecal Coliform (MPN/100 ml)	4800	3500	4600	✘ Fails A/B/C; ✔ D

Source: SPCB, 2025

4.1.3 Groundwater

As per the Central Ground Water Board's National Compilation on Dynamic Ground Water Resources of India (2023 assessment), the groundwater in Shahjahanpur has been categorized as 'Safe', indicating that annual extraction remains within the permissible limits of recharge at the block scale.

However, as per the Ground Water Department (UP Division–Bareilly) monitoring data the ground water table is declining from the 2019 to 2024. GWD has three hydrograph stations installed across the city wherein, the average water table depth stands at 8.41 m below ground level (BGL), with several locations showing significant seasonal fluctuation and long-term decline. Notably, Mohalla Hadaq recorded a sharp drop of 3.40 m, while Meeranpur Katra (Khudaganj) showed a fluctuation of 2.25 m, indicating recharge imbalance and extraction pressure.

The city's low-relief alluvial plain, combined with south/southeastward drainage toward the Garra and Khannaut rivers, limits natural recharge in the urban core. Additionally, waste dumping on floodplains, blocked drains, and lack of embankments further restrict infiltration, exacerbating groundwater

stress. Urgent measures are needed to integrate aquifer protection, rainwater harvesting, and floodplain conservation into Shahjahanpur's urban planning framework to ensure sustainable groundwater management. In this context, the Master Plan mandates: (i) installation of rainwater harvesting systems and recharge pits for all new developments to ensure groundwater recharge and balance extraction; and (ii) limiting paved construction in parks to 5% of the area, with footpaths and tracks recommended to use permeable or semi-permeable blocks instead of solid concrete to enhance infiltration and reduce runoff.

4.1.4 Institutional Mechanism

For water supply, the Jal Kal Vibhag functioning under SMC is responsible for the operation and maintenance of the city's water distribution network. This includes sourcing, treatment and supply of potable water to residential, commercial and institutional users. The Uttar Pradesh Jal Nigam (UPJN) also plays a critical role, particularly in planning and executing large-scale infrastructure projects related to water supply under schemes like AMRUT (Atal Mission for Rejuvenation and Urban Transformation) and Jal Jeevan Mission.

4.2 Sewerage System

4.2.1 Sewage Generation and Coverage

Domestic used water: Shahjahanpur generates an estimated 42.18 MLD of sewage per day (as per the consultant analysis). Out of 81,428 households, only 26,000 households (32%) are connected to the sewer network. The existing system comprises 167.5 km of sewer lines, covering nearly 46% of the city against a requirement of 368 km. At present, 28 wards are fully sewered, 6 wards are partially sewered and 26 wards remain unsewered (refer Map 4-1).

Onsite sanitation: Faecal sludge generated daily from 53,928 households across 26 unsewered wards is estimated at 90 KLD (as per the consultant analysis), with containment primarily through septic tanks.

Industrial used water: As per the District Ganga Plan and CPCB Uttar Pradesh, Shahjahanpur district has 10,063 registered industrial units, including 13 grossly polluting industries (GPI) such as sugar mills, distilleries, paper mills, fertilizer plants and power plants, located outside the Shahjahanpur regulatory area. These industries discharge used water ranging from 160 KLD to 13,000 KLD depending on sector and capacity.

4.2.2 Existing Sewage infrastructure

Domestic used water: The city is serviced by a single 40 MLD Sequential Batch Reactor (SBR)-based Sewage Treatment Plant (STP) commissioned under AMRUT in 2020. Despite its installed capacity, the plant currently receives only 18 MLD, functioning at 45% utilization. Of this, 12 MLD is conveyed through the sewer network, while 6 MLD is intercepted from storm water drains via five I&D chains. The entire inflow is routed through the 55 MLD MPS, highlighting underutilization of available infrastructure. The untreated used water i.e., 24.18 MLD (58%) of used water flows through 12 major open drains, ultimately entering the river system and degrading downstream water quality. Post-treatment, the STP releases 17.8 MLD of effluent, of which 1.5 MLD is reused for agriculture, while the remainder is discharged into the Khannaut River through a 1600 mm pipeline spanning 12 km. The

ROSA industry has expressed willingness to utilize treated Used water, provided the available quantity is 20 MLD or more.

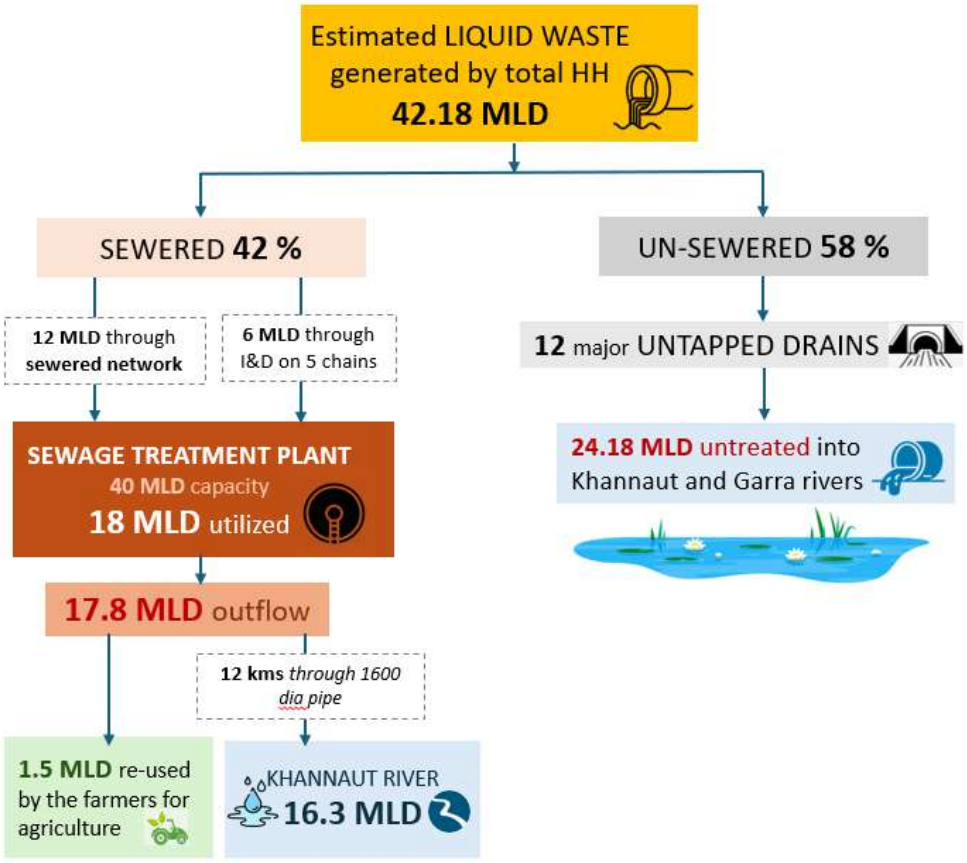


Figure 4-3: Flow of liquid waste in Shahjahanpur

Onsite sanitation: Shahjahanpur operates a 32 KLD Faecal Sludge Treatment Plant (FSTP) near Kakra on New City Bridge Road. While this facility is the primary infrastructure for faecal sludge management, it falls short of demand. Against a daily generation of 90 KLD, the treatment capacity leaves a gap of 58 KLD, underscoring the need for augmentation.

Image 4-1: FSTP facility at kakra kund

Industrial used water: Industrial units manage their Used water through Effluent Treatment Plants

(ETPs) employing physical, chemical and biological processes. Many industries achieve Zero Liquid Discharge (ZLD) through recycling or evaporation, while others discharge into designated drains such as Garai and Bakshi outside the regulated area. These systems ensure compliance with environmental standards, reduce waterbody outfall and support sustainable industrial operations.

4.2.3 Institutional Mechanism

Departments	Role
Pey Jal Nigam (Urban)	Prepare Detailed Project Reports (DPRs) and execute works for water supply, sewer networks, sewage treatment plants (STPs) and drainage systems

4.3 Storm Water Management

Shahjahanpur city is served by 26 storm water drains, comprising 17 major drains and 9 minor drains. Of the major drains, 5 are tapped and channel approximately 6 MLD of grey water into the STP, while the remaining 12 untapped drains discharge about 24.18 MLD directly into natural water bodies i.e., 10 drains into the Khannaut River and 2 drains into the Garra River. To address pollution loads, nature-based solutions (NBS) have been introduced using phyto-remediation techniques. These interventions were implemented for the Jalal Nagar drain discharging into the Garra River and the Reti Nallah drain discharging into the Khannaut River.

To assess discharge quality, dissolved oxygen (DO) levels were sampled from five representative drains. These included major drains carrying Used water and solid waste, as well as the outfalls from the bio/phyto-remediation systems. The results are presented in the table below.

Table 4-2: DO levels of Storm Water Drains

Sl. No	Name of Drain	DO Level – Locations	Maximum value (mg/L)	Minimum value (mg/L)
1	Lodhipur Drain	27.8N, 79.9E	3.7	0.7
2	Banka Ghat Drain	27.87N, 79.92E	1.1	1.0
3	Ahmadpur Reti Drain (NBS)	27.86N, 79.920E	2.3	1.4
4	Dalelganj Drain	27.85N79.91E	3.9	3.1
5	Jalalnagar Drain (NBS)	27.88N, 79.89E	1.6	1.2

Source: Primary Sample Survey by Consultants, 2025

The findings reveal that DO levels across all drains remain below the CPCB-prescribed limit of 6 mg/L, required for sustaining healthy aquatic ecosystems. Even in the Ahmadpur Reti and Jalal Nagar drains which have phyto-remediation, average DO levels were observed between 1.2 mg/L and 1.4 mg/L, indicating that current interventions are insufficient to restore ecological balance. The DO levels in all of these drains are below the permissible limit of 6 mg/L prescribed by the CPCB for maintaining healthy aquatic ecosystems.

Image 4-2: Phyto-remediation at Ahmedpura Reti drain

4.3.1 Cleaning Mechanism

Solid waste carried by storm water drains and surface runoff often accumulates in river stretches, obstructing flow and degrading ecological health. Plastics, packaging materials, and floating debris are particularly problematic as they disperse downstream, creating pollution hotspots and affecting water quality which is detailed in the section 4.4. At the same time, solid waste frequently chokes sewage flows at Interception and Diversion (I&D) structures, reducing their operational efficiency and causing untreated Used water to bypass into rivers. This dual impact—waste accumulation in drain stretches and obstruction at I&D points intensifies pollution loads and undermines Used water management systems.

4.3.2 Institutional mechanism

Drainage in Shahjahanpur is managed jointly by SMC and UPJN. While SMC handles routine maintenance of storm water drains and sewer lines, UPJN is tasked with the design and implementation of sewerage infrastructure, including sewage treatment plants (STPs). These agencies work under the policy guidance of the State Urban Development Department (UDD), which provides funding and technical support for urban sanitation projects. The city's drainage system has historically faced challenges due to low-lying terrain and monsoon flooding, prompting recent investments in automated pump stations and early warning systems.

4.4 Solid Waste Management

4.4.1 Residential Waste

According to SMC, the city generates approximately 154.46 TPD of solid waste. This comprises 39.5% (61.01 TPD) dry waste, 60% (92.68 TPD) wet waste. Further it also comprises of 0.5% (0.77 TPD) domestic hazardous and sanitary (DH&S) waste. During stakeholder consultations, it was reported that 100% of the waste is collected through a combination of door-to-door services and community bins, with 20% of waste segregated at source. Field observations reveal that unauthorized dumping along nallahs continue in certain pockets of the city.

SMC has deployed 129 GPS-enabled vehicles to support the collection and transportation of municipal solid waste and facilitate real-time monitoring of waste management operations across the city. A

workforce of 986 sanitation personnel is engaged in primary and secondary waste collection, as well as transportation activities.

4.4.2 Waste Processing Facilities

The city has established systems for managing the waste routed to waste-to-energy pathways. For wet waste, two processing facilities provide a combined capacity of 220 TPD, comprising the older 90 TPD operational facility and the newly inaugurated 130 TPD facility at Sindhauli (approximately 14 km from the city). The Sindhauli complex includes a trommel-based composting plant for mechanical segregation and a dedicated Material Recovery Facility (MRF).

In contrast, dry waste management remains inadequate: the city operates seven dry-waste processing facilities with a total capacity of only 35 TPD against an actual dry waste generation of 61.01 TPD, resulting in a processing deficit of 26.01 TPD. An incinerator is installed at the MRF near Kakra to manage infectious domestic hazardous and sanitary (DH&S) waste. Although about 20% source segregation is reported during primary collection, segregation is not maintained at the ATS facilities and the Kakra dumping site, where mixed waste is ultimately received and handled without secondary segregation, thereby limiting the effectiveness of upstream segregation efforts.

Construction and demolition (C&D) waste generation is approximately 1 TPD and is manually processed at the 10 TPD C&D facility located at Rai Khurd on Subhash Nagar Road, outside the municipal limits.

Legacy waste challenges had earlier been mitigated through the bioremediation and closure of around 60,000 tonnes of accumulated waste at the Kakra Kakar dumpsite; however, at present, nearly 1 lakh tonnes of legacy waste is again deposited at the site, along with ongoing municipal waste dumping. The legacy waste from this site is presently being transferred to the Sindhauli processing complex for treatment.

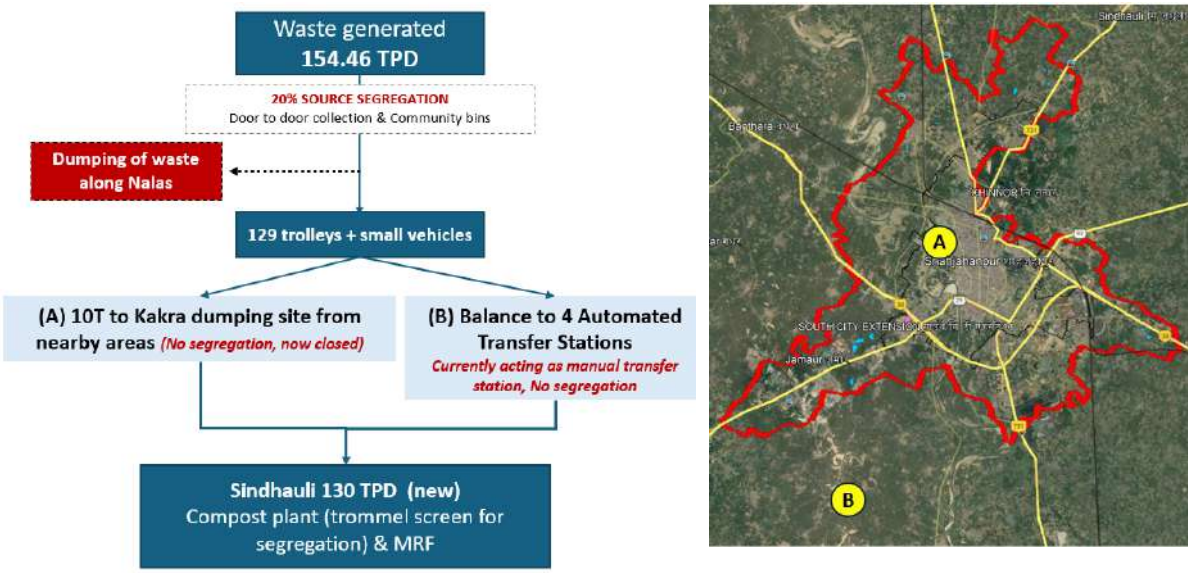


Figure 4-4: Solid waste management system in Shahjahanpur

Image 4-3: Dump site at Kakra Kakar Kund

4.4.3 Waste from Dairies

Shahjahanpur city has nearly 10,500 bovines (cows and buffaloes), as reported by the Chief Veterinary Officer. Based on CPCB guidelines, each animal produces about 15 kg of dung per day, resulting in a total generation of approximately 157.5 tons daily. Currently, there is no organized collection system by the Municipal Corporation. A few private vendors collect dung from small dairies and sell it at around ₹400 per cart (as noted in the primary survey), but coverage is limited and unstructured. Smaller dairies with only 2–3 cattle generate quantities too small to be commercially viable, and therefore often discharge dung and Used water directly into drains, streets or open spaces. This unmanaged disposal significantly increases pollution loads entering the Khannaut and Garra rivers and worsens sanitation conditions in narrow lanes where cattle are kept outdoors.

In contrast, larger dairies generate sufficient dung to sell for manure production or biogas use, but this resource remains underutilized. A 5 TPD dung processing unit at Kakra, located beside the electric charging point, was established to process dung, yet it is currently non-functional, leaving most of the waste untreated. As a result, dairy waste continues to be a major contributor to river pollution and urban sanitation challenges, while the potential for sustainable waste-to-resource solutions remains untapped.

4.5 Institutional Mechanism

Solid Waste Management in Shahjahanpur city is overseen by the Municipal Corporation, which is responsible for key functions such as door-to-door waste collection, transportation, and processing.

4.6 Key issues/ gaps

- **Solid Waste dumping along nallahs and rivers:** Field observations indicate that the Khannaut River is more polluted than the Garra River, mainly due to solid waste dumping and drain-borne waste (refer Map 4-2). Accumulated waste clogs drain, lowering their capacity, which exacerbates pollution and contributes to recurrent urban flooding.
- **Discharge of nallahs into the rivers:** A major source of river pollution in Shahjahanpur is the direct discharge of 24.18 MLD of untreated Used water through 12 major nallahs and drain outfall location is shown in Map 4-1. The continuous inflow of this polluted water leads to high organic loading, pathogen contamination, foul odour and sludge deposition in the receiving stretches of Garra and Khannaut rivers, degrading its ecological health.

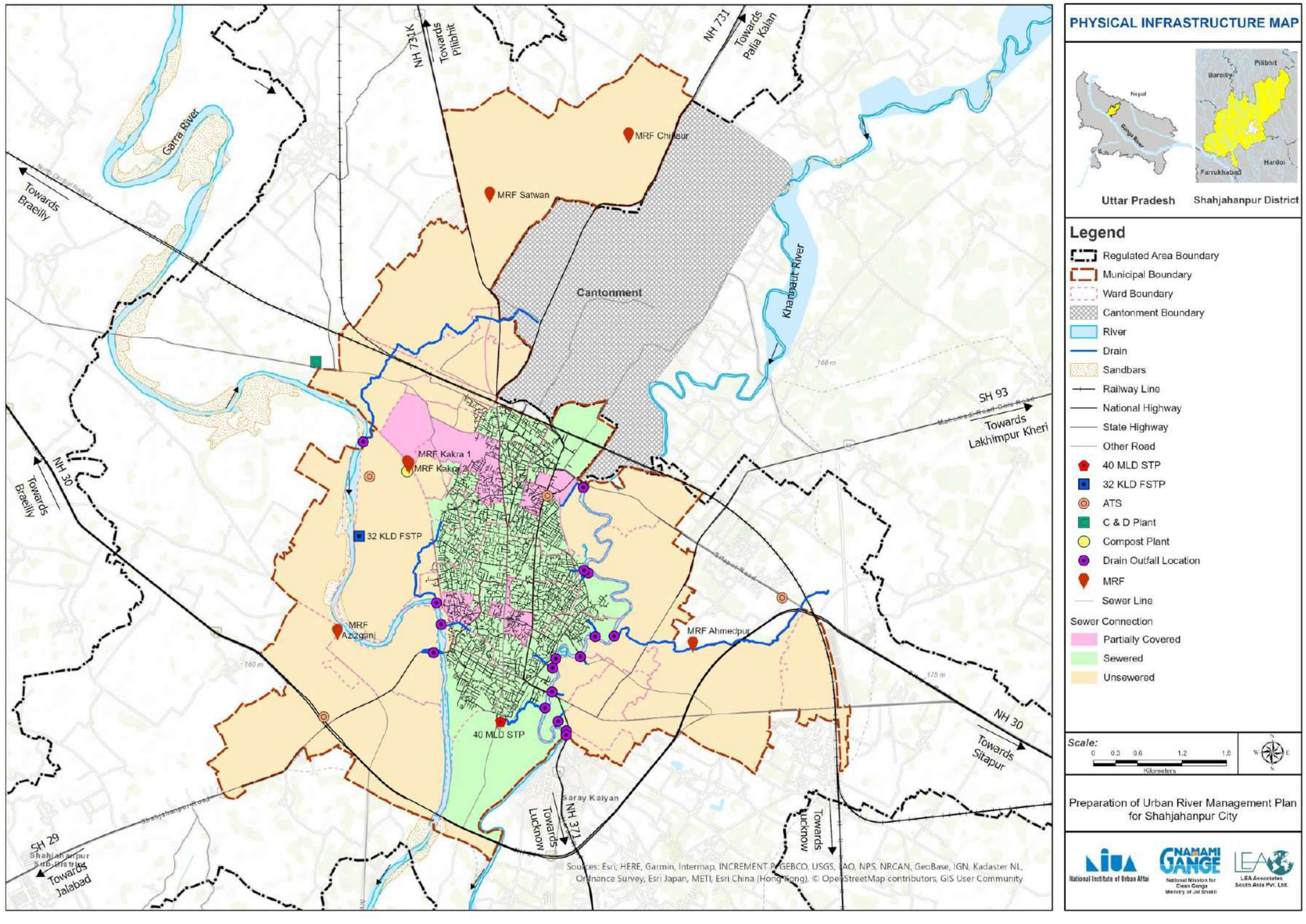
Image 4-4: Solid waste accumulated at Banka drain

Image 4-5: Solid waste accumulated at Roshan Ganj drain into the Khannaut river

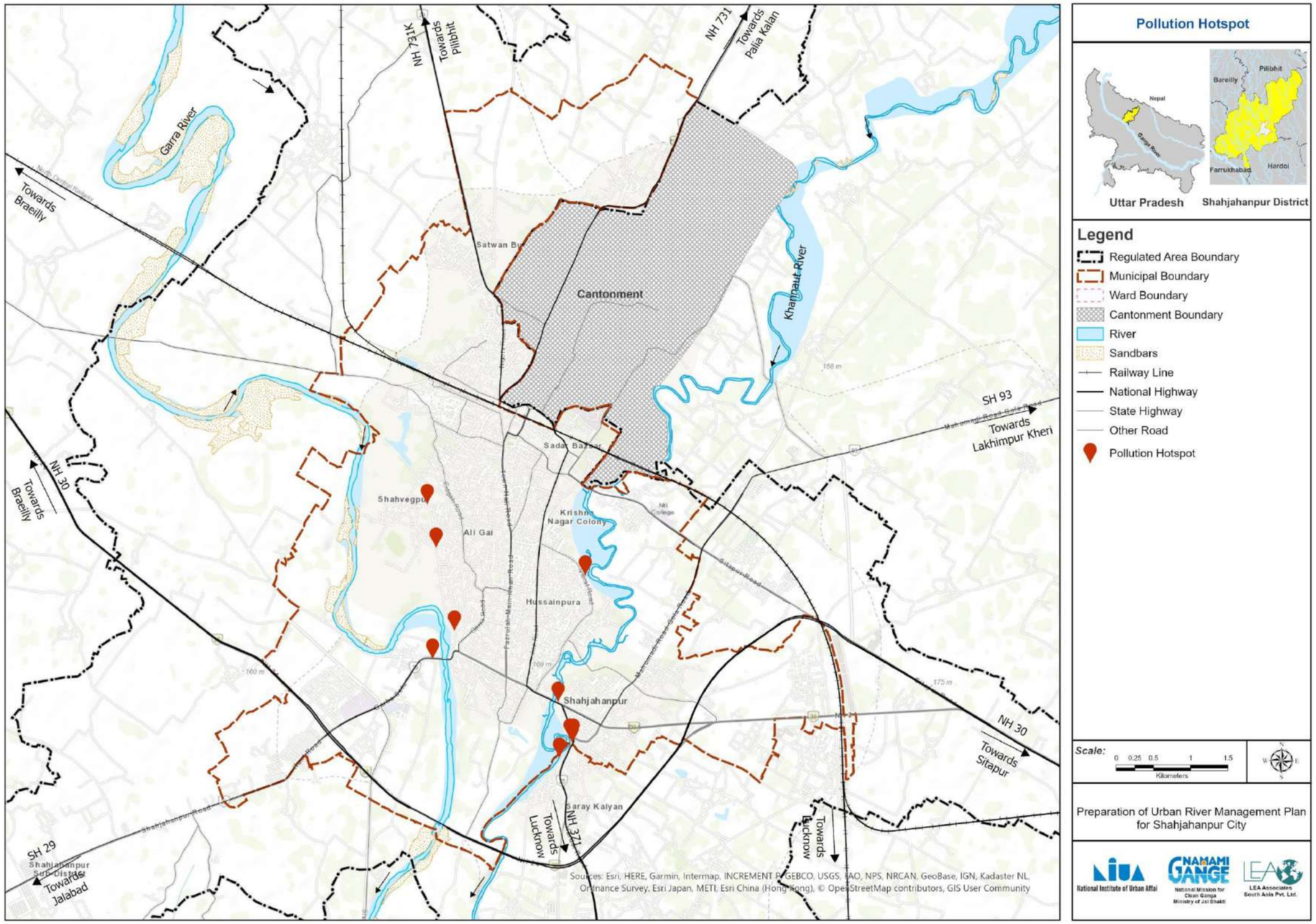
- **Solid waste from dairies:** Dairy dung waste in Shahjahanpur is a major source of pollution, significantly impacting the Khannaut and Garra rivers. The unmanaged disposal of dung adds to solid waste loads and worsens urban sanitation challenges. Small dairies and individual cattle owners, who often lack proper infrastructure, discharge dung and Used water directly into drains and streets, thereby reducing the efficiency of sewage treatment plants and resulting in improper waste management. Few dairy dung is sold for manure or biogas production; however, this resource remains underutilized, leaving considerable potential for sustainable waste-to-resource solutions untapped.

Image 4-6: Cow dung flowing into storm water drains

Image 4-7: Smaller dairy units located along very narrow lanes lack dung storage space



Map 4-1: Physical Infrastructure Map



Map 4-2: Pollution Hotspot Map

5 SWOC ANALYSIS AND URM INDEXING OF THE CITY

5.1 SWOC Analysis

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

	**STRENGTHS** • Master Plan 2031 demarcates No Development Zones (NDZ) in floodplains, with 100m buffer along Garra and 10m buffer along all water bodies. • Flood-prone areas and High Flood Level (HFL) identified for Garra and Khannaut rivers. • 40 MLD STP operational, with effluent quality compliant with NGT standards. • Riparian stretches provide ecological buffers; Garra's wider zone (25–70 m) offers stronger protection. • Cultural landmarks: Birasat Ghat - Hanumant Dham Temple (104-ft statue), Raj Ghat attract tourism and community engagement. • IEC activities: NGO partnerships, eco-clubs, school programs, and cultural events (e.g., Ganga Aarti, Tulsi distribution).
	**WEAKNESS** • Weak enforcement of NDZ; encroachments in flood-prone areas. • Flood lines (5,25 & 100-years) not demarcated, notified and integrated in the Master Plan. • Only 42.6% sewage treated; 24 MLD untreated flows into rivers. • Sewer coverage below 50%; 12 drains discharge directly into rivers. • Significant faecal contamination in both the rivers with high Faecal Coliform concentrations. • 100% dependence on groundwater; semi-critical stage. • Limited initiatives for treated water reuse. • Awareness drives lack continuity and citizen-led participation. • Economic activities around riverfront largely informal, limiting municipal revenue.
	**OPPORTUNITIES** • Expansion of 200 km sewer network to maximize STP utilization. • Reuse treated water for agriculture, landscaping, industry, and maintaining river flow. • Rooftop rainwater harvesting, recharge pits, check dams, ponds, and nallah bunds. • Surface water augmentation to reduce aquifer pressure. • Riparian buffer restoration through plantation drives and green corridors. • Strengthen citizen participation via river committees and ward-level planning. • Revitalize underutilized ghats with eco-sensitive design. • Cultural tourism leveraging Hanumant Dham and festivals (e.g., Chhath Puja). • Potential for eco-parks, walking/cycling tracks, and agro-horticulture initiatives. • Bio-CNG generation from animal waste. • ROSA industries willing to use treated water. • NGO/SHG capacity building for water monitoring, afforestation, eco-tourism.

	**CHALLENGES** • Seasonal flooding and erosion threaten infrastructure and ecological stability. • Climate variability and poor catchment management reduce resilience. • Sand mining, informal settlements and unregulated activities weaken ecological resilience. • Over-extraction without recharge interventions risks aquifer depletion. • Hydrogeological limitations constrain recharge potential.

5.2 URM Indexing of the city

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 city, an assessment has been made using the URM_{index}. With a score of 1.85, Shahjahanpur is Elementary level urban river management. This score shall improve upon implementation of proposed interventions against each objective. The figure below shows the current status of the city against each of the objectives of urban river management.

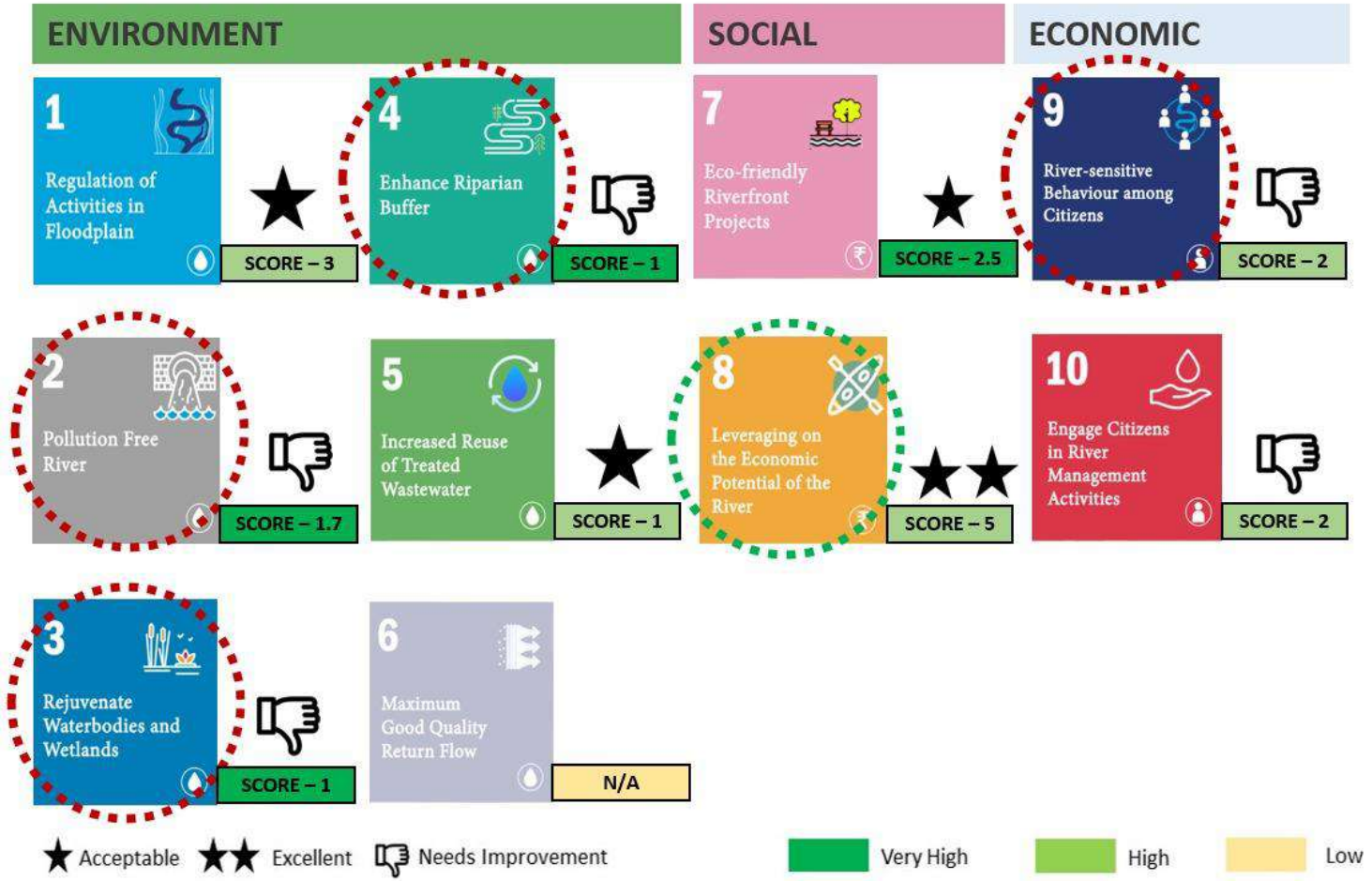


Figure 5-1: Prioritization matrix Shahjahanpur

6 URMP VISION FOR THE CITY AND ZONING

6.1 URMP Vision for Shahjahanpur

The Urban River Management Plan (URMP) envisions Shahjahanpur as a resilient river city, where the Garra and Khannaut rivers are restored as living systems that ensure flood safety, clean water, ecological health, and sustainable livelihoods. Once central to agriculture and culture, these rivers now face pressures from urbanization, sewage inflows, and degraded floodplains.

The plan repositions them as urban assets, proposing blue-green infrastructure and nature-based solutions—such as riparian buffer restoration, eco-ghats, sponge parks, floating trash barriers, and bio-CNG recovery. By integrating river management with land use planning, Shahjahanpur aims to reduce disaster risks, strengthen community participation, and secure the long-term sustainability of its rivers.

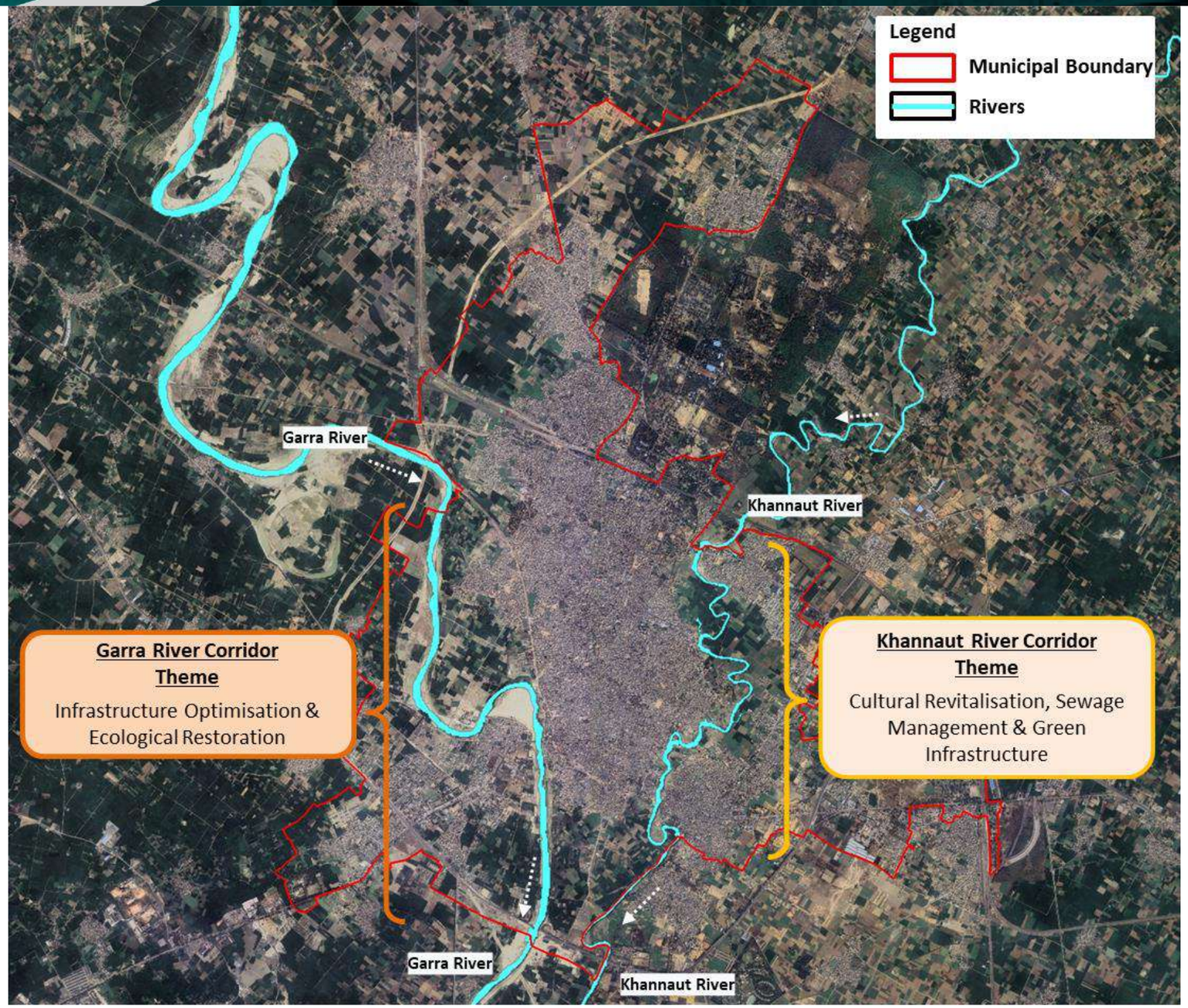
Riverfront Zoning – Shahjahanpur Municipal Corporation

Garra and Khannaut rivers flow through open floodplains, agricultural land, dense settlements, ghats, drains and industrial sites.

Based on the river characteristics and nature of river city interaction the entire stretch of the two rivers along the Municipal Corporation limits has been divided into two stretches as stated below. This zoning approach ensures interventions are location-specific, flood-safe, and socially appropriate, rather than applying a uniform design across the entire river stretch.

Stretch A: Garra River Corridor – Infrastructure Optimisation & Ecological Restoration		
Location	:	Subhas Nagar to Garra river bridge
Theme	:	Maximise sewage treatment, reuse, and flood-safe infrastructure while restoring ecological buffers.
Goal	:	This upstream stretch, with perennial water flow regulated by the barrage and high scenic value, is the "face" of the river. It already attracts visitors but lacks structured ecological management. The vision is to formalize recreation while safeguarding the riparian edge.
Key Strategies	:	• Sewage Management: Intercept untapped drains, add SPS at Kakra, upgrade STP with co-treatment, and deploy mobile FSTPs for complete sewage capture and reuse. • Riparian & Waste Management: Restore native buffers, install monitored trash barriers, and clear legacy waste to strengthen resilience. • Resource Recovery: Implement dairy waste-to-bio-CNG systems for sustainable energy and reduced organic pollution.
Stretch B: Khannaut River Corridor – Cultural Revitalisation, Sewage Management & Green Infrastructure		
Location	:	Lodhipur to Khannaut river bridge
Theme	:	Socio-Cultural Revitalisation, Pollution Abatement & Sponge Infrastructure
Goal	:	Enhance cultural identity, eliminate sewage inflows, and integrate green infrastructure
Key Strategies	:	• Sewage Interception & Treatment: Implement I&D on untapped drains and construct a 10 MLD STP along with SPS to comprehensively capture and treat sewage inflows. • Nature based & Flood adaptive Infrastructure: Introduce NbS treatment systems at Lodhipul and Sarai Kaivan drains, develop eco-friendly ghats at Lodhipur and

		design a flood adaptive riverfront at Pakka Pul to integrate resilience with cultural spaces. • Community Engagement & Cultural Revitalisation: Strengthen civic identity through IEC campaigns ("Meri Nadi, Mera Shahar"), River Clubs, storytelling corners, river clean up drives ("Nadi Mitra Abhiyan") and the annual Shahjahanpur Jal Mahotsav.



Map 6-1: Riverfront Zoning of Garra and Khannaut River in Shahjahanpur City

6.2 Objective 1: Regulation of activities in flood plains

Objective 1 strengthens the Shahjahanpur Master Plan 2031 by integrating flood-resilient land use, river-centric planning and groundwater sustainability. Key measures include delineation of flood lines, updated building bye-laws aligned with 2025 floodplain zoning guidelines, designation of riparian buffers and ecological corridors, preparation of a city-wide recharge map and comprehensive hydrological studies of the Garra and Khannaut rivers in the city. Together, these interventions reduce disaster risks, safeguard communities and infrastructure, conserve water systems, and ensure balanced, climate-resilient urban growth.

6.2.1 Intervention 1: Inclusion and strengthening of provisions in Master Plan of Shahjahanpur, 2031

As mentioned in section 3 (ecological profile) and 4 (physical infrastructure) above, the following gaps have been identified with respect to inclusion of river-centric planning measures in the Master Plan 2031:

- Flood frequencies are described textually, but mapped flood lines (1-in-5, 1-in-25, 1-in-100 years) are absent from the Land Use Maps, leading to regulatory ambiguity.
- The "No Development" threshold is based on a 10-year flood frequency, whereas modern standards require a 1-in-5-year line to be protected as active floodway.
- There is no dedicated land use category for rivers and water bodies, as they are currently included under "Other Land Use."
- Reliance on outdated 2002 General Zoning Regulations and does not incorporate the 2025 Technical Guidelines on Flood Plain Zoning, which include updated climate-resilient construction standards.
- These settlements located within the flood plain such as areas near Aziz Ganj (Garra River) and Hanumant Dham (Khannaut River) are high-risk areas which lack flood-resilient construction standards. The current bye-laws do not mandate elevated plinths, stilt-based structures, or restrictions on basement construction in flood-vulnerable zones. Without targeted modifications, these settlements remain highly exposed to recurring flood damage and infrastructure loss.
- Although recharge pits are proposed, the Master Plan lacks a hydrological map identifying high-potential recharge zones.
- While the Master Plan 2031 mandates rainwater harvesting and has identified temporary locations for recharge pits based on Garra and Khannaut river flow studies, it lacks a comprehensive hydrological map for long-term high-potential recharge zones. The city's groundwater levels have steadily declined from 2014 to 2019, with pre-monsoon depths exceeding 6.5 m, underscoring the need for targeted recharge interventions.
- A comprehensive hydrological study has not yet been integrated to validate existing High Flood Level (HFL) data and predict flood behaviour across Shahjahanpur city. This gap is critical, as severe floods in 2024 and 2025 repeatedly inundated in Jalalnagar, Fatehpur, dhalel ganj, tarai, Aziz Ganj area and peri-urban settlements, damaging infrastructure and agricultural belts along the Garra and Khannaut rivers.

The following priority interventions are proposed for inclusion in the Master Plan 2031:

Table-6-1: Proposed Interventions for Flood and Water Management in Shahjahanpur Master Plan 2031

S.no.	Aspects	Section Name & Reference in Master Plan	Current Vision	Recommendation	Rationale/Justification
1	Flood Management	Section 8.10 – Flood Plain Zoning	10-year and 25-year flood frequencies considered for land use restrictions.	Delineate 1-in-5-year return period flood line and designate it as the primary "No Development Zone."	High-risk settlements are expanding in Aziz Ganj and Lodhipur because "no-development" zones lack the legal clarity of mapped flood lines
2	Building Regulations	Chapter 11 – Zoning Regulations	Refers to outdated 2002 General Zoning Regulations.	Modify Building Bye-laws to align with Technical Guidelines on Flood Plain Zoning, 2025.	The public buildings and infrastructure are in flood zones; updated laws are needed to ensure these critical structures are flood-proofed
3	River-Centric Planning	Section 9.11 – Other land uses	Proposes 100m/250m buffer based on existing HFL (162m).	Include explicit flood lines for 1-in-5, 1-in-25, and 1-in-100 years directly on Master Plan GIS maps.	Provides legal clarity for enforcement and prevents encroachment by making flood risks visible to developers.
4	Rainwater Harvesting & Water bodies	Rainwater Harvesting (section 11.7)	Plot-level recharge pits and preservation of Sajra (revenue records) ponds.	Mandate RWH structures for all new constructions on plots ≥ 300 sq. m. Require RWH installations in all public buildings, schools, hospitals, and open spaces. Integrate recharge pits, percolation tanks, and	Moves beyond individual plots to a systematic approach to stop groundwater decline and enhances groundwater recharge in core city area and peri-urban wards.

S.no.	Aspects	Section Name & Reference in Master Plan	Current Vision	Recommendation	Rationale/Justification
				bioswales in parks and institutional campuses. Link RWH compliance to building plan approval process. Establish municipal monitoring cell for enforcement.	
5	Proposed Land use	Other Land Use: Water Bodies and Buffers (Section 9.11)	Water bodies are not designated as a separate land use category.	Explicitly include natural streams, water bodies, and riparian corridors in the land use plan.	Ensures ecological integrity of rivers, ponds, and streams; maintains hydrological connectivity; supports biodiversity corridors; and strengthens long-term conservation of urban water systems.
6	Hydrological Assessment	Section 9.11 – Proposed Mitigation	Proposes DPR/Hydraulic study for Garra and Khannaut rivers, but not yet undertaken.	Execute a comprehensive hydrological study for Garra and Khannaut rivers covering the entire Shahjahanpur city.	Scientific modelling is essential to validate flood behavior, predict channel shifting, and guide improvement or new construction of embankments along both rivers.

6.3 Objective 2 interventions to keep river free from pollution

These interventions aim to prevent liquid and solid waste pollution in the Garra and Khannaut Rivers by improving sewage interception, faecal sludge management, solid waste control, and dung waste processing. The city's low sewerage coverage, high faecal sludge generation, and poor waste segregation contribute significantly to river degradation.

6.3.1 Intervention 2: Optimizing the Unutilized Capacity of the Existing 40 MLD STP

As outlined in Section 4.2.2, the existing Sewage Treatment Plant (STP) is currently operating below its design capacity. Of the 10 major drains located in the central part of the city, only 5 have been tapped - 2 discharging into the Garra River and 3 into the Khannaut River. Additionally, a minor drain from Anandpuram Colony connects to the Chotta Kakra drain downstream before merging into the Garra River. In the western part of the city, the Aziz Ganj drain remains untapped and also flows into the Garra River.

Despite these interventions, 12 MLD is received from sewerage system from 26,000 households and only 6 MLD of sewage from the 5 tapped drains is presently conveyed to the STP. Consequently, 7 drains with approx. 10-11 MLD untreated sewage continue to discharge directly into both rivers. Furthermore, the Chotta Kakra drain although tapped has received additional sewage from newly connected households' post-interception, exacerbating pollution levels in both the Garra and Khannaut rivers.

Proposed Intervention (A): Construct I&D on 7 untapped drains and SPS support at Kakra to collect sewage from central part of the city.

Seven drains from the central part of the city will be intercepted and diverted through sewer lines in two segments:

- **Segment 1:** Sewer line from Jalalnagar drain, passing through Chotta Kakra drain and Anandpuram colony drain, with a total length of approximately 4.8 km, connected to the truck sewer at existing 40 MLD STP.
- **Segment 2:** Sewer line from Banka Ghat drain, connected via Husainpura, Hanumant, and Magai Tola drains, spanning approximately 2.6 km, also diverted to the STP.

However, due to slope limitations in the Jalalnagar–Chotta Kakra stretch, gravity flow alone is insufficient to ensure conveyance to the STP. To address this constraint a 5 MLD sewage pumping Station (SPS) is proposed at Kakra Chauraha (Kakra dumping site) with an area requirement of approximately 20 × 20 m, with tentative locations identified in the Figure 6-1 The SPS with horizontal or vertical pump dry-pit can be used to lift sewage from the Jalalnagar chamber, where slope limitations prevent gravity flow. The pumped sewage will be conveyed up to the highest point before Chotta Kakra, from where it will subsequently flow by gravity to the 40 MLD STP for treatment. The exact flow requirements and final siting of the SPS will be determined during the DPR stage and implemented based on land availability and SPS design criteria.

Proposed Intervention (B): Construct I&D and SPS at Aziz Ganj to collect sewage from western part of the city.

An interceptor sewer will be constructed at the Aziz Ganj drain and connected to the proposed sewer line from the Jalalnagar drain at Police Chowki Rajghat. This will involve:

- A sewer stretches of approximately 0.4 km.
- Construction of a 5 MLD SPS beside Moksha dham to manage diverted flows.

These proposed interventions (A and B) are illustrated in Map 6-2. The I&D structure may be constructed outside the road right-of-way, requiring an area of approximately 15 × 15 m. The outlet of the I&D structure shall be connected to the sewer line.

The flow arrangement of proposed I&D structure is presented in Figure 6-1, the conceptual arrangement is shown in Figure 6-2 and the conceptual arrangement of SPS is illustrated in Figure 6-3.

Figure 6-1: Flow arrangement of proposed I &D Structure

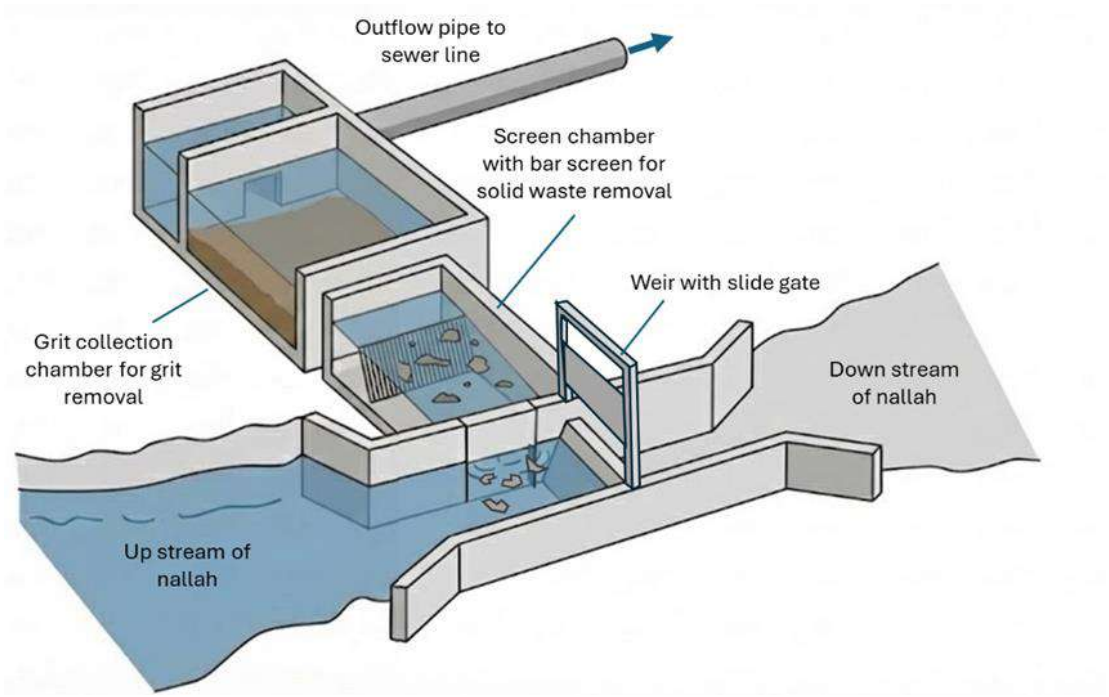


Figure 6-2: Conceptual arrangement of proposed I&D components

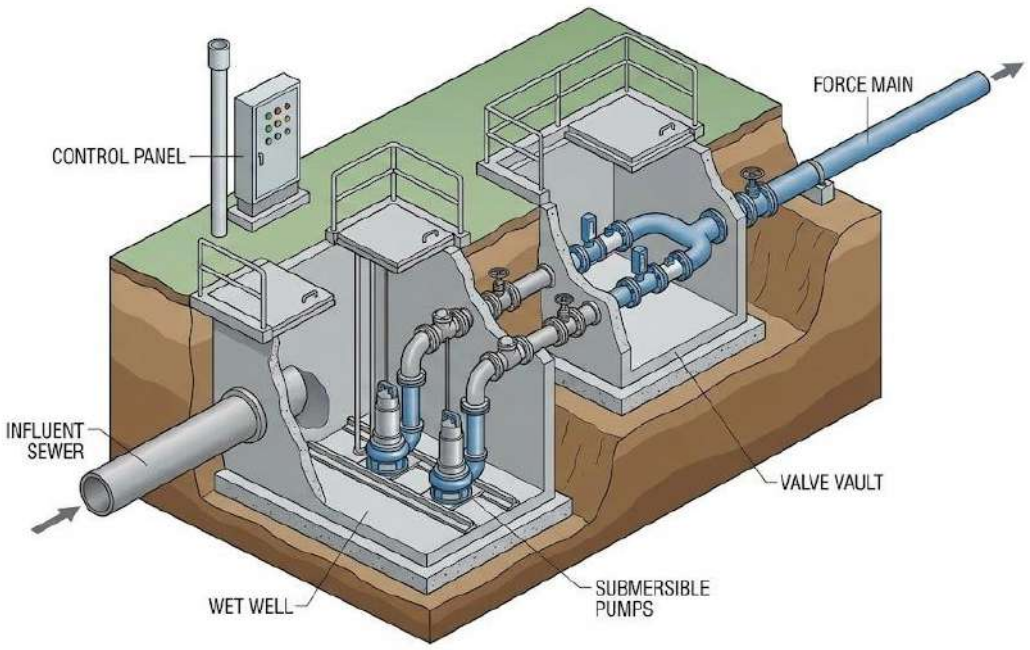
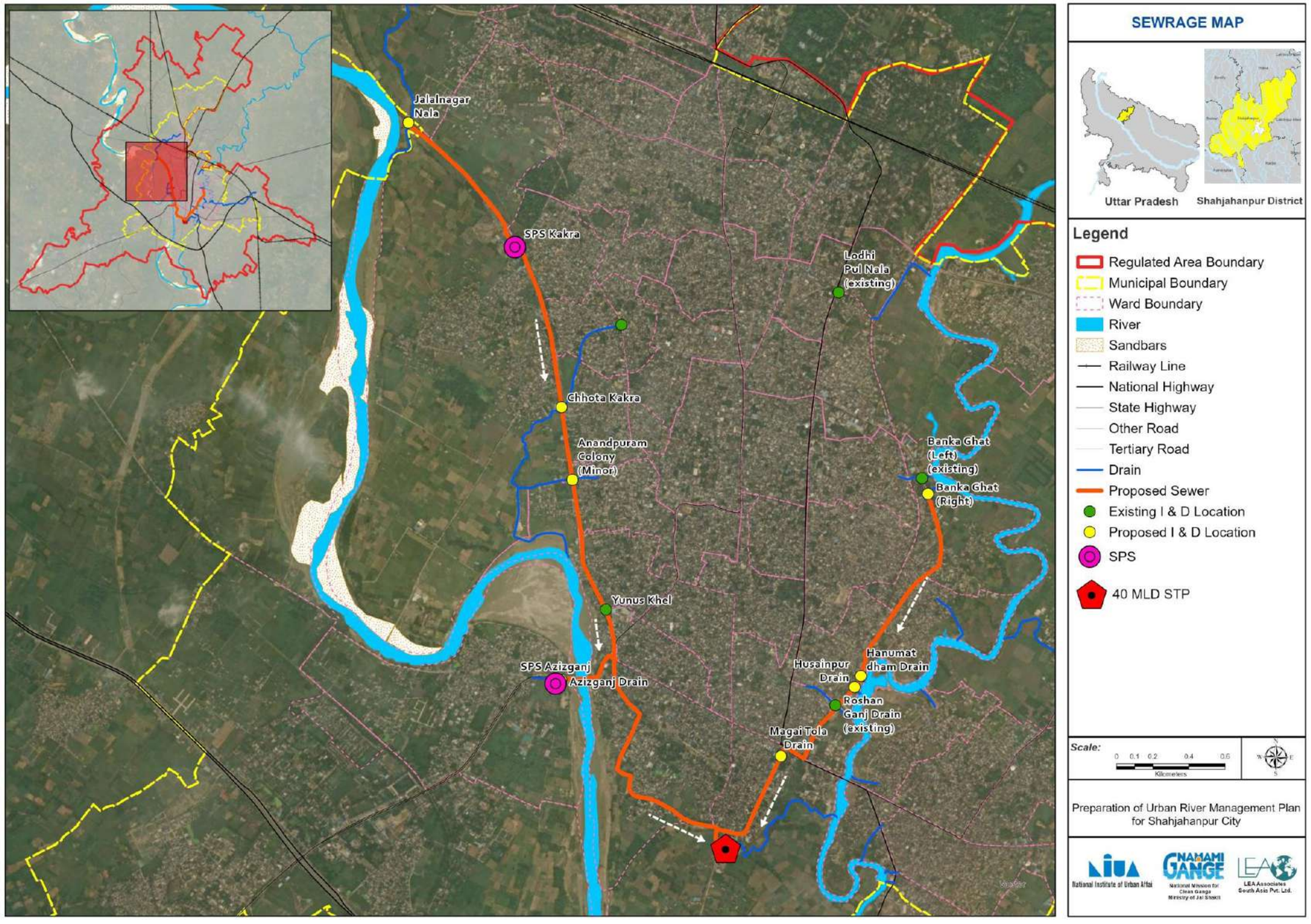
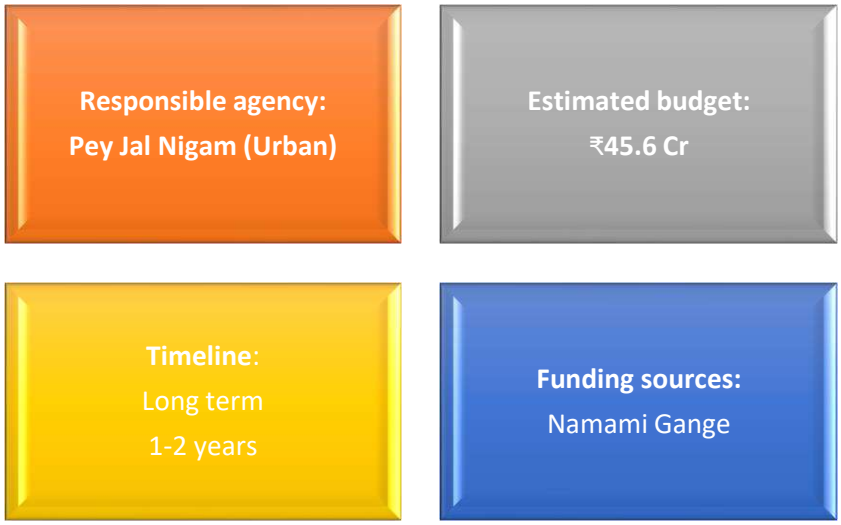


Figure 6-3: Conceptual arrangement of SPS



Map 6-2: Proposed I&D structures and sewer pumping stations in the central and western part of city

Implementation Framework:



6.3.2 Intervention 3: Eastern Zone Drainage Interception and Treatment via Proposed 10 MLD STP

As outlined in section 4.3, seven major drains located in the eastern part of the city remain untapped and discharge directly into the Khannaut River, contributing approximately 6–7 MLD of untreated sewage. No interception infrastructure currently exists in this zone, resulting in persistent pollution and degradation of river water quality.

Proposed Intervention (A): Interception and Diversion of Seven Untapped Drains into Khannaut

Interceptor sewers will be constructed along the Khannaut River to intercept and divert Used water from seven untapped drains, beginning at Fatehpur Reti and extending to Sarai Kaiyan (2), passing through Ahmedpur Reti, Khwaja Firoze, Dalel Ganj, Rambagh Mishripur, and Sarai Kaiyan (1). The proposed alignment spans approximately 2.5 km and will follow road rights-of-way and municipal land to minimize land acquisition requirements and avoid utility conflicts. This alignment has also been designed to allow future integration with the city's sewerage system.

The diverted flows will be conveyed to a newly proposed STP for treatment, ensuring compliance with discharge standards and improving river health.

Proposed Intervention (B): Construction of 10 MLD SPS and STP using SBR Technology

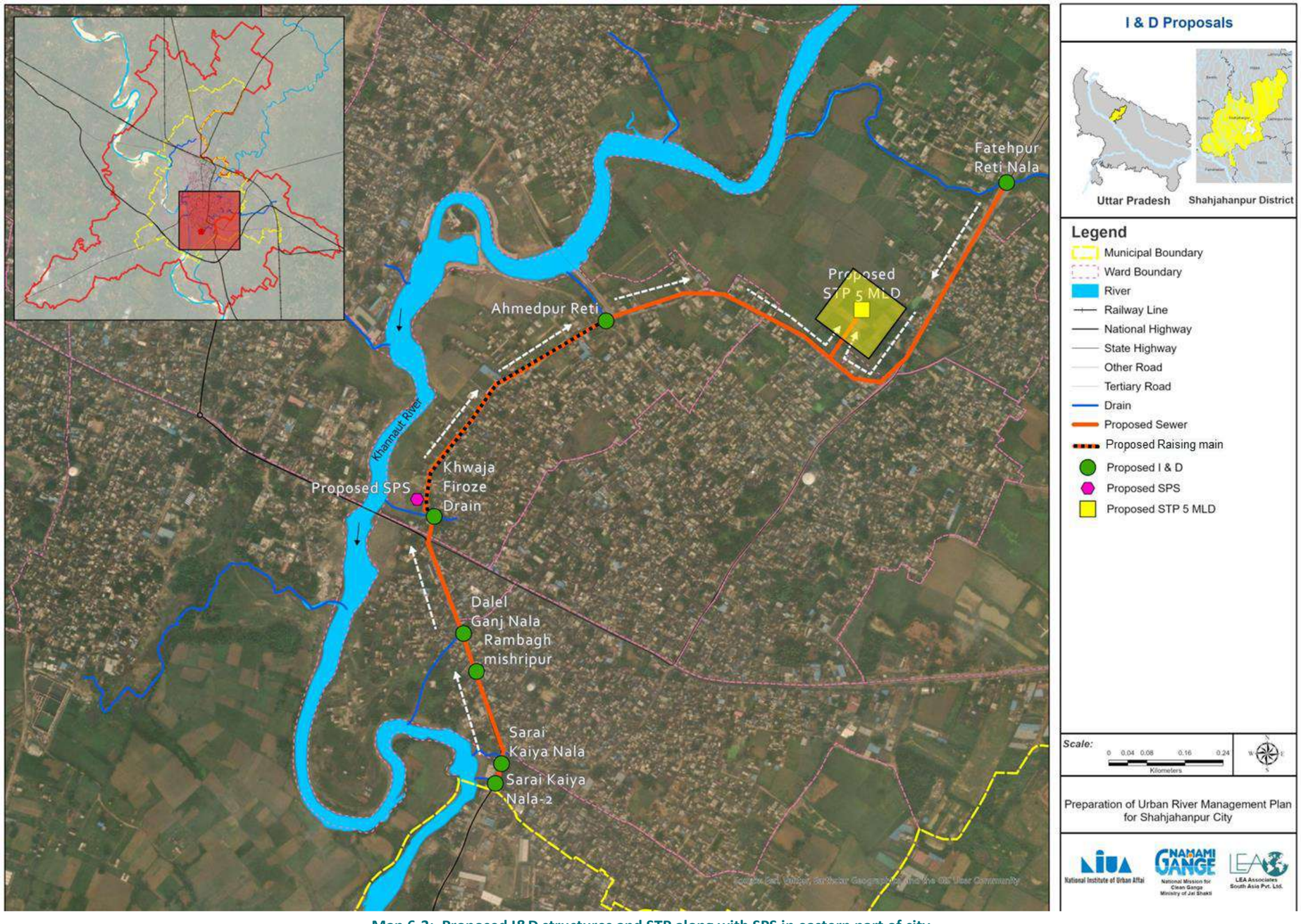
A 10 MLD Sewage Pumping Station (SPS) is proposed at Pakka Pul to lift sewage from the downstream catchment into the pumping system and convey it to the proposed treatment facility. The SPS will require an area of approximately 30 × 30 m with tentative locations identified. The final siting will be determined during the DPR stage and implemented based on land availability and SPS design criteria.

A 10 MLD Sewage Treatment Plant (STP) is proposed at New Basti Reti, Hanumant Dham Road. The STP will be designed using Sequential Batch Reactor (SBR) technology, ensuring high-quality effluent, operational flexibility, and compliance with discharge standards. The plant will treat intercepted flows from the seven untapped drains and will be integrated with SCADA-based monitoring for real-time performance tracking. The STP will require a minimum land area of approximately 1.5ha, subject to

final site selection and layout optimization during the DPR stage.

These proposed interventions (A and B) are illustrated in Map 6-3. The I&D structures will be constructed within available municipal land, typically requiring an area of approximately 15 × 15 m. The STP will require an area of approximately 50 × 50 m, subject to final site selection during the DPR stage. The alignment of interceptor sewers and location of treatment infrastructure will be finalized based on hydraulic feasibility, land availability and integration with existing and planned sewer networks.

Refer Figure 6-1 for the flow arrangement of proposed I&D structure, refer Figure 6-2 for the conceptual arrangement and Figure 6-3 for the conceptual arrangement of SPS.



Map 6-3: Proposed I&D structures and STP along with SPS in eastern part of city

Implementation Framework:

Responsible agency: Pey Jal Nigam (Urban)	**Estimated budget:** ₹47.5 Cr
Timeline: Short term 1-2 years	**Funding sources:** Namami Gange

6.3.3 Intervention 4: Nature-based treatment for unserved area of Lodhipur.

As outlined in Section 4.2.2, several low-lying and encroached settlements in Shahjahanpur—particularly in the Lodhipur area lack formal sewerage infrastructure. Despite the presence of interception and diversion (I&D) structures in certain locations, elevation differences and fragmented drainage networks result in untreated greywater and sewage being discharged directly into the Khannaut River. Satellite imagery and field observations confirm continuous discharge from minor drains and localized ponding in the floodplain, contributing to pollution loads and public health risks. Major critical gaps are listed below:

a) **Lodhipur (Post-Interception):** Several households remain connected downstream of the Lodhipur drain interception point. Additionally, a minor drain joins the Lodhipur drain from the opposite bank, contributing approximately 0.3 MLD of untreated sewage directly into the Khannaut River (refer Image 6-1).

b) **Lodhipur (Minor Drains):** Three minor drains in the Lodhipur area collectively convey about 0.2 MLD of untreated Used water, which is discharged into the Khannaut River (refer Image 6-2).

Image 6-1: Sewage outflow along with minor drain after intercepting the Lodhipur drain

Image 6-2: Sewage outflow along with minor drain after intercepting the Lodhipur drain

Proposed Intervention

a. **Unified Conveyance Channel (Lodhipur – Western Bank):** The minor drain and its adjoining tributary are proposed to be intercepted and merged into a single conveyance channel. This consolidated flow will be directed to a constructed wetland of ~2000 sqm, strategically located on the western riverbed of the Khannaut. The site remains largely dry except during high flood events, making it suitable for year-round treatment interventions (refer Map 6-4).

b. **Constructed Wetland (Lodhipur – Eastern Bank):** The three minor drains in Lodhipur will be intercepted and diverted downstream into a constructed wetland of ~1500 sqm, strategically located on the eastern riverbed of the Khannaut (refer Map 6-4).

To prevent issues of mosquito breeding next to the settlement, subsurface horizontal flow constructed wetlands have been proposed (refer Figure 6-4). Robust emergent plants like Common Reed (Phragmites australis), Cattails (Typha species like T. latifolia, T. angustifolia), and Bulrushes (Scirpus species), along with ornamental options like Canna indica have been proposed in the gravel substrate. These native species are very effective with regards to Used water treatment, nutrient uptake and aeration.

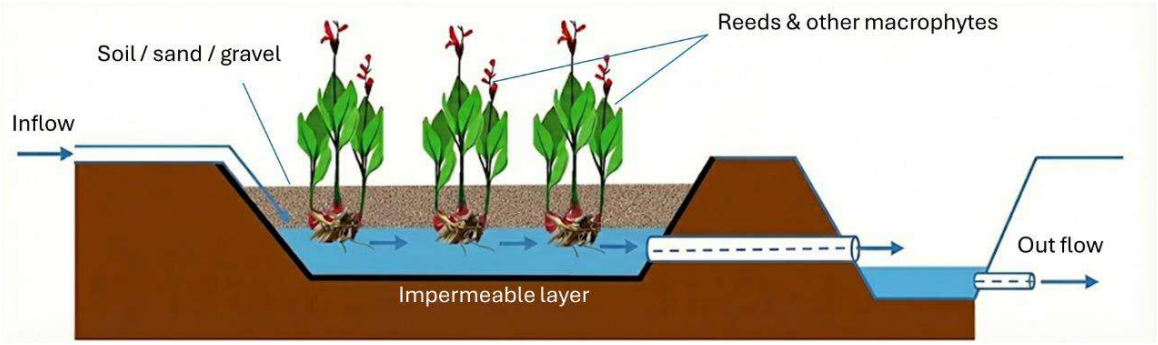
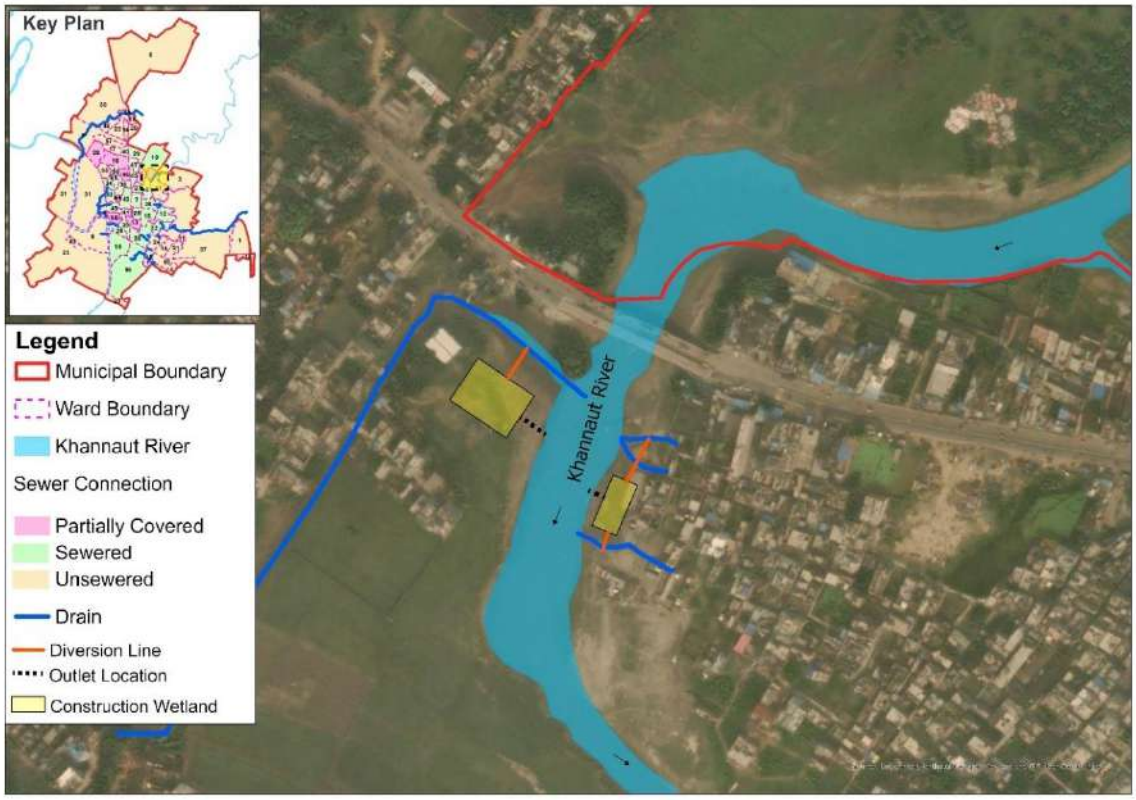


Figure 6-4: Schematic diagram of subsurface horizontal flow constructed wetland



Map 6-4: Proposed constructed wetland for unserved area of Lodhipur

Implementation framework:

Responsible agency: Peyjal Nigam	**Estimated budget:** ₹3 Cr
Timeline: Short Term 1-2 years	**Funding sources:** Jal Jeevan Urban and CSRs

6.3.4 Intervention 5: Resilient Infrastructure Proposal for 32KLD FSTP

The 32 KLD Faecal Sludge Treatment Plant (FSTP) at Kakra is located just 45–50 metres from the Garra riverbed, making it highly vulnerable to flooding. The plant sustained damage during the 2024 floods and in earlier events, highlighting its repeated exposure to flood risks. With electrical panels, MCC/PLC systems and solar arrays positioned at ground level, the facility experiences frequent downtime, safety hazards and costly repairs whenever floodwaters inundate the site. As a result, the FSTP is not functioning properly, leading to untreated waste discharge and environmental pollution.

Proposal Intervention:

a) Elevation of Electrical & Mechanical Systems:

- Relocate electrical panels, MCC/PLC systems, and other critical equipment to the first floor of the control room.
- Route cabling through waterproof conduits and raised trays to prevent water ingress.

b) Relocation of Solar Panels:

- Install solar panels on the roof of the control room building to keep them above flood levels.
- Secure mounting structures with wind-resistant design and elevated inverter enclosures.

c) Flood-Resilient Construction Materials

- Use corrosion-resistant and waterproof materials for fixtures, junction boxes and structural elements.
- Seal wall and floor penetrations to block floodwater entry.

d) Green Buffer & Site Management

- Maintain vegetative buffer zones around the site to absorb excess water and reduce erosion.
- Ensure proper drainage channels to divert floodwater away from the plant.

e) Operational Preparedness

- Update Standard Operating Procedures (SOPs) for emergency shutdown and restart during flood alerts.
- Train staff on safe access to elevated equipment and rooftop solar systems.

Image 6-3: Elevated FSTP infrastructure for flood resilience and uninterrupted sanitation services

Implementation framework:

Responsible agency: Nagar Nigam Shahjahanpur	**Estimated budget:** ₹8 - 10 Lakhs
Timeline: Short Term 2-4 Months	**Funding sources:** AMRUT 2.0/ Disaster Resilience Grants

6.3.5 Intervention 6: Strengthening Faecal Sludge Treatment Capacity

As outlined in the section 4.2, In Shahjahanpur, 66% of households depend on OSS systems, generating about 90 KLD of faecal sludge daily. The 32 KLD FSTP at Kakra is inadequate, and with desludging vehicles making limited trips within a 5–6 km radius, much of the sludge remains untreated, causing gaps in safe management. As a result, faecal sludge collected from distant locations is often discharged into Nallahs and agricultural lands to reduce travel distance and costs. Such unsafe disposal practices lead to untreated waste entering the environment, causing pollution, health risks and undermining the city's sanitation goals. Strengthening treatment capacity and improving collection efficiency are therefore critical for sustainable faecal sludge management.

Proposed Intervention

To address the above challenges a combined intervention is proposed:

A. **Construction of 32 KLD Co-Treatment Plant within the existing 40 MLD STP**
B. **Procurement of Mobile Septage Treatment Unit.**

Intervention A: Construction of 32 KLD Co Treatment Plant within the existing 40 MLD STP

A 32 KLD Co-Treatment Plant will be constructed within the premises of the existing 40 MLD STP, utilizing the earmarked 0.37 hectares of available land. At present, the STP receives only about 18 MLD of sewage inflow. However, once Intervention 4 and 5 are implemented, the inflow is expected to increase to approximately 28 MLD. This enhanced inflow will provide sufficient hydraulic and biological capacity to accommodate faecal sludge co-treatment without compromising STP performance.

Vacuum trucks will discharge faecal sludge into the co-treatment unit, beginning with a Screen Chamber for removal of coarse solids. The sludge will then pass into a Homogenization Tank to ensure uniform consistency before separation. Solids will be directed to a Dewatering Unit and then to Sludge Drying Beds for safe disposal or reuse. Liquids and filtrate will be routed to the STP's Inlet Chamber for biological treatment alongside sewage. This structured flow ensures controlled integration, prevents shock loading and maintains treatment efficiency (refer Figure 6-5).

The proposed 32 KLD Co-Treatment Plant is based on proven operational models implemented in other Indian cities, ensuring feasibility and adaptability for Shahjahanpur. By leveraging existing STP infrastructure, the intervention minimizes land and capital requirements while expanding treatment capacity. This approach provides a sustainable solution to manage the city's 90 KLD faecal sludge load, reduce unsafe disposal, and strengthen long-term sanitation resilience.

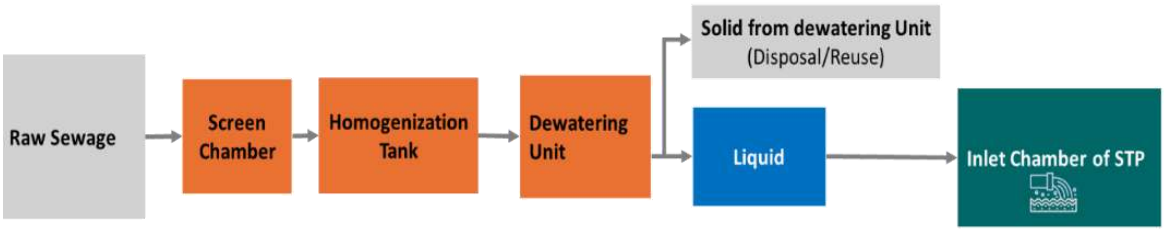


Figure 6-5: Process flow diagram of co-treatment units

Intervention B: Procurement of Mobile Septage Treatment Unit

A Mobile Septage Treatment Unit will provide additional onsite treatment capacity (refer Image 6-4)

Vacuum trucks will discharge sludge into this unit, where solids and liquids are separated and treated effluent is released in a controlled manner. The Mobile Septage Treatment Unit with a 10 KL (10,000-litre) capacity, is based on the operational model successfully implemented in Gorakhpur city, ensuring proven feasibility and adaptability for Shahjahanpur city. Mounted on a truck chassis, it will be equipped with mechanical separation, dewatering, and safe effluent discharge systems for flexible use especially for the wards on north of railway crossing.

Image 6-4: Mobile Septage Treatment Unit

Implementation Framework

Responsible agency: Nagar Nigam Shahjahanpur	**Estimated budget:** ₹3.5 Cr
Timeline: 3-6 months	**Funding sources:** AMRUT 2.0 SUDA

6.3.6 Intervention 7: Preparation of Faecal and Septage Management Plan

As mentioned in Section 4.2, In Shahjahanpur, the majority of households (66%) rely on onsite sanitation systems (OSS), such as septic tanks and pits. This reliance produces approximately 90 KLD of faecal sludge each day, necessitating safe and efficient management to safeguard public health and the environment.

To address this challenge, the city has already initiated interventions:

- **32 KLD Co-treatment facility at the existing STP** – leveraging existing infrastructure to expand treatment capacity.
- **Procurement of a Mobile Septage Treatment Unit (MSTU)** – providing flexible, decentralized treatment options for hard-to-reach areas.
- **Resilient infrastructure for an existing 32 KLD FSTP** – ensuring long-term sustainability and flood-proof operations.

These interventions represent significant progress toward strengthening Shahjahanpur's faecal sludge management system. However, to maximize their impact, they must be integrated into a

comprehensive city-wide Faecal Sludge and Septage Management (FSSM) Plan.

Proposal Intervention:

The city 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. It must align with the *Faecal Sludge and Septage Management in Urban Areas of India – Standard Operating Procedures (SOPs)*. The interventions below combine Shahjahanpur's baseline findings with SOP-mandated best practices to ensure technical compliance, environmental safety, and institutional accountability.

Interventions in Detail

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: Shahjahanpur should immediately initiate retrofitting and create a centralized geo-tagged database of all OSS systems to ensure safe containment and monitoring.

2. Scheduled and Regulated Desludging

- Establish bylaws mandating desludging cycles every 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: Desludging operations are currently reactive, with trucks typically making a single trip within a 5–6 km radius. Implementing a regulated desludging schedule will enable the safe management of the 90 KLD of faecal sludge generated daily and help prevent unsafe disposal into nallah and agricultural lands.

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: In Shahjahanpur, desludging trucks currently discharge faecal sludge into drains (nallahs) and agricultural lands, primarily to avoid travel expenses. Introducing GPS-based tracking will

curb illegal dumping and ensure that sludge is transported to designated treatment facilities for safe disposal.

4. Treatment Infrastructure

- Faecal Sludge Treatment Plants (FSTPs) should be established at strategic locations to improve accessibility and reduce travel time, thereby ensuring safe treatment and preventing environmental contamination.
- Integrate faecal sludge into existing sewage treatment plants through co-treatment, with controlled inlet dosing to prevent shock loading and maintain stable performance.

City Application: Shahjahanpur has already incorporated the above interventions. Given Kakra FSTP's proximity (45–50 m) to the Garra riverbed and its repeated exposure to flood damage, resilient retrofitting with elevated design has been proposed. In addition, co-treatment of faecal sludge is facilitated at the 40 MLD STP, while deployment of a mobile septage treatment unit is recommended to serve households located at greater distances

5. Reuse and Resource Recovery

- Convert treated sludge into compost, compliant with Fertilizer Control Order (FCO) standards.
- Establish MoUs with farmers associations, 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: Shahjahanpur currently discharges sludge untreated, losing potential recovery of 15–20 tons/month of compostable material. Resource recovery will reduce waste, generate revenue, and support circular economy practices.

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: Shahjahanpur's Kakra FSTP, vulnerable to floods near the Garra riverbed, will be secured through elevation of critical infrastructure, supported by ring-fenced O&M budgets, trained operators, and preventive maintenance to ensure reliable, resilient operations.

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: Shahjahanpur currently operates without enforceable bylaws, leading to informal desludging and uncontrolled disposal into Nallahs and agricultural lands. Adoption of bylaws regulating 3–5-year desludging cycles, licensing of private desludging vehicles, and penalties for illegal dumping will institutionalize accountability and align with national SOPs.

By proposing interventions such as co-treatment at the existing STP, procurement of a mobile septage treatment unit, and resilient FSTP infrastructure. To maximize the impact of these measures, the city must integrate them into a comprehensive Faecal Sludge and Septage Management (FSSM) Plan anchored in municipal bylaws, ring-fenced O&M funding, and institutional accountability. This structured approach will ensure the safe management of faecal sludge across all wards, safeguard the Garra and Khannaut rivers from pollution, and build long-term resilience against future flood risks.

Draft Scope of Work for Faecal Sludge and Septage Management (FSSM) is presented in Annexure 1.

Implementation Framework

Responsible agency:
Shahjahanpur Nagar Nigam

Estimated budget:
₹50 L

Timeline:
Short term
6-9 months

Funding sources:
State Urban Development Department (SUDA)
Swachh Bharat Mission (Urban) – FSSM component
Convergence with AMRUT 2.0 or National River Conservation Plan (NRCP)

6.3.7 Intervention 8: Real-time River water quality monitoring units with dashboard integration and public display

As outlined in Section 4.2.2, water quality in Shahjahanpur is currently assessed manually and periodically by the State Pollution Control Board (SPCB). The sampling results from July 2025 indicate significant levels of organic pollution and clearly point to sewage contamination. These findings

confirm that untreated or partially treated domestic Used water is imposing considerable ecological stress on both rivers.

Proposal Intervention:

To address these issues, it is proposed to install four real-time water quality monitoring units at strategic upstream and downstream locations, integrated with both the SPCB and municipal dashboards, and supported by a public display board at Hanuman Dham.

Technology and Process

The intervention involves installing automatic multi-parameter water quality monitoring units that continuously measure pH, dissolved oxygen, turbidity, conductivity, temperature, faecal coliform (biosensor), and BOD/COD (optical sensors). Each unit will be equipped with self-cleaning probes, solar-powered operation, and GSM/IoT-enabled communication modules.

The monitoring process will function as follows:

- Sensors continuously collect water quality data at each location.
- Data is transmitted in real time via GSM/IoT to both the SPCB and municipal dashboards.
- Dashboards analyze trends, generate alerts when thresholds are exceeded, and prepare compliance reports.
- A public LED information board installed at Hanuman Dham will display simplified water quality indicators (Green = Safe, Yellow = Moderate, Red = Unsafe) to raise citizen awareness.

Monitoring Locations

Four monitoring units will be installed at strategic upstream and downstream points to capture both baseline and cumulative urban impacts:

- Garra River (Upstream – Shubas Nagar area)
- Khannaut River (Upstream – SP Bangla)
- Garra River (Downstream – NH-30, Rausar)
- Khannaut River (Downstream – NH-30, Rausar)

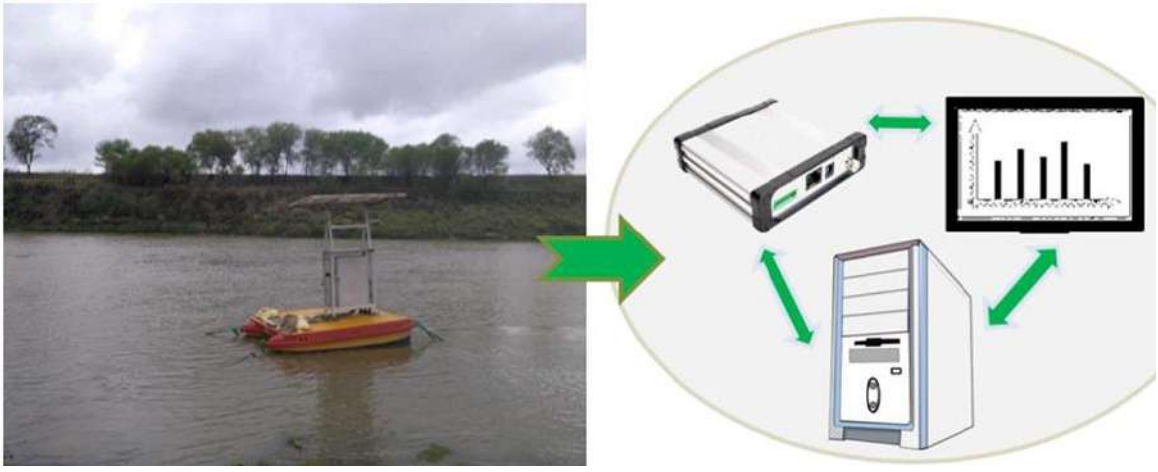


Figure 6-6: Real time water quality monitoring unit

Implementation Framework

Responsible agency: Pollution Control Board and Nagar Nigam Shahjahanpur	**Estimated budget:** ₹40-50 Lakhs
Timeline: Short term 3-6 months	**Funding sources:** AMRUT 2.0 SUDA SPCB

6.3.8 Intervention 9: Legacy waste clearance and prevention measures for drain and riverbed pollution control

As outlined in Section 4.4, Solid waste dumping along nallah and riverbeds has become a major environmental challenge in Shahjahanpur. The Khannaut River is more polluted than the Garra River, largely due to indiscriminate disposal of plastics, debris, and mixed municipal waste. Accumulated waste clogs drain, reduces their capacity, and worsens flooding during monsoon events. These unmanaged deposits degrade river ecology, create foul odour, and pose public health risks. Field surveys have already identified eight major hotspots (refer Map 3-4), with more likely to emerge upon further mapping. These concentrated zones of waste require systematic clearance, remediation, and preventive measures to restore ecological health and urban resilience.

Image 6-5: Solid waste hotspot at pakka pul along the drain

Image 6-6: Solid waste hotspot at banka ghat along the drain and Khannaut riverbed

Proposal Intervention:

1. **Identification and Mapping**
    - Sanitation Supervisors will conduct routine surveys to identify and geo-tag solid waste hotspots along drains and riverbeds.

- Initial surveys have already identified eight major hotspots, with provision for adding more as mapping expands.

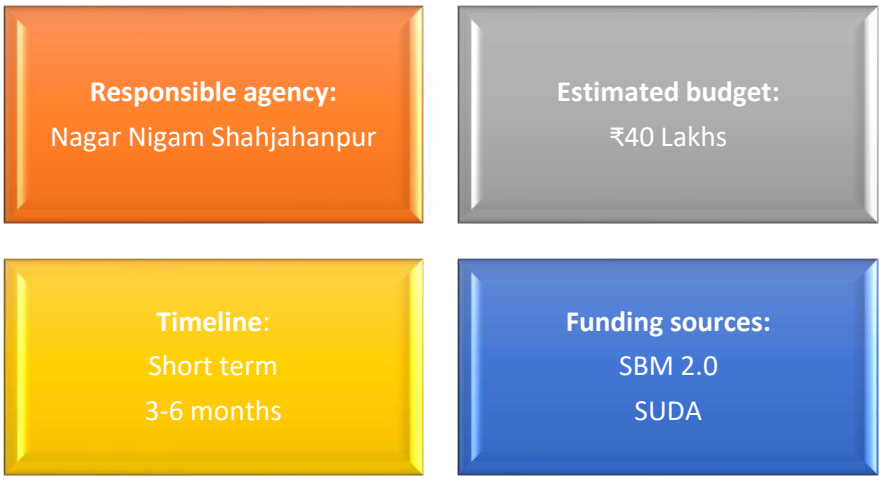
2. **Remediation Strategy**
   - Mechanical removal of legacy waste from identified hotspots using loaders and trucks.
   - Waste will be sent to existing treatment facilities (recycling units, composting plants, etc.).
   - Clearance will be documented and linked to the municipal dashboard for transparency.
3. **Prevention Measures**
   - To ensure hotspots do not re-emerge, the following preventive interventions are proposed:

Option A – Eco-Engineering + Smart Monitoring

- **Bamboo fencing with vertical gardens at bridges:** Aesthetically pleasing bamboo fencing with vertical gardens along inner face are proposed at the bridge locations to prevent disposal of garbage from bridges into streams.
- **CCTV cameras** installed at cleared hotspots, connected to the municipal dashboard for real-time monitoring.

Option B – Community Stewardship

- Launch an "Adopt-a-Spot" program where schools, RWAs, and NGOs maintain cleared sites.
- Install QR-coded signboards for citizens to report illegal dumping directly to the municipal system.



Implementation Framework

6.3.9 Intervention 10: Construction of Enhancer type Trash Trap System at major drains

As mentioned in the section 4.3.1, the solid waste carried by drains and surface runoff often accumulates in river stretches, obstructing flow and degrading ecological health. Plastics, packaging materials and floating debris are particularly problematic as they spread downstream, creating

pollution hotspots and affecting water quality. In addition, solid waste frequently chokes sewage flows at the Interception and Diversion (I&D) structures, reducing their operational efficiency and leading to bypassing of untreated Used water into the rivers. This dual impact waste accumulation in river stretches and obstruction at I&D points, intensifies pollution loads and undermines the effectiveness of existing Used water management systems.

An enhanced trash trap system offers a practical solution to intercept waste before it disperses further into the river system, while also reducing the risk of solid waste clogging at interception and diversion (I&D) structures.

Image 6-7: Solid waste blocking flow at Yunus Khel drain

Image 6-8: Solid waste blocking flow at Roshan Ganj drain I&D

Proposal Interventions:

Implementation of enhanced trash trap systems at four major drains Roshan Ganj, Yunus Khel, Chhota Kakre drains and Fatehpur Reti before I&D structures to intercept plastics and floating debris, ensuring systematic collection and transfer to existing municipal treatment facilities, thereby reducing the risk of solid waste clogging at I&D structures.

1. **Installation of Enhancer Trash Trap System.**
    - **Floating Trash Barrier:** Deploy barriers before the I&D structure in drain.
    - Barriers will be designed to trap plastics, bottles, and floating debris without obstructing water flow.
    - **Collection Cage:** Integrate a cage structure with the barrier to collect intercepted waste for safe removal.
2. **Waste Removal Mechanism**
    - Sanitation workers will remove accumulated waste from the collection cage through crane at scheduled intervals.
    - Collected waste will be transported to existing municipal treatment facilities for processing and disposal.
3. **Monitoring and Maintenance**

- **CCTV Surveillance:** Install cameras at I&D Structures to monitor illegal dumping and waste accumulation in real time.
- **Challan System:** Integrate CCTV footage with a municipal challan mechanism to penalize violators, ensuring accountability and deterrence.
- Regular Cleaning Schedule: Sanitation teams will carry out routine removal of intercepted waste (daily/weekly depending on load), supported by supervisors for quality checks.

Implementation Framework

Responsible agency: Nagar Nigam Shahjahanpur	**Estimated budget:** ₹1.8 Cr
Timeline: Long term	**Funding sources:** Municial budget

6.3.10 Intervention 11: Implementation of integrated dairy waste management for bio-gas recovery

As highlighted in Section 4.4.3, dairy dung waste in Shahjahanpur is a major source of pollution affecting the Khannaut and Garra rivers. Unmanaged disposal of dung contributes significantly to solid waste loads and exacerbates urban sanitation challenges. Small dairies and individual cattle owners often discharge dung and Used water directly into drains and streets, which reduces the efficiency of sewage treatment plants and results in improper waste management. This issue is most prevalent among small-scale dairies and individual cattle owners. In contrast, larger dairies generate dung in sufficient quantities to be sold, typically for manure or biogas production, but this resource remains underutilized, leaving considerable potential untapped.

Image 6-9: Dung waste discharge into drains and narrow streets for managing dung waste

Proposal Intervention:

To establish a municipal-scale waste-to-energy facility that converts cattle dung into bio-CNG and

compost. By integrating anaerobic digestion, gas upgrading, and compression technologies, the initiative will reduce methane emissions, generate clean fuel, and support sustainable agriculture. The project is designed under a DBFO (Design–Build–Finance–Operate) concession model with government and private sector collaboration.

1. **Dung generation:** Based on the stakeholder's consultation, Shahjahanpur has 10,500 bovines (cows and buffaloes), as per CPCB (Guidelines for Environmental Management of Dairy Farms and Gaushalas) each animal produces approximately 15 kg dung/day and the total dung generated approximately 157.5 tons per day.
2. **Collection System:** Dung collection will follow a zonal strategy for efficiency:
   - Core wards: Handcarts, e-rickshaws, and community bins at junctions for narrow, dense areas.
   - Peri-urban wards: Mini-tractors and motorized trolleys for mixed-density zones.
   - Outer wards: Bulk tractors with hydraulic trailers for large dairy clusters.

   Covered community bins (500–1000 litres) will be placed at junctions and farms, emptied twice daily. Partnerships with gaushalas and dairy farms will provide on-site tanks, compost return, and farmer incentives. GPS tracking, mobile app logging and ward-level dashboards will ensure accountability and efficiency.
3. **Transfer station:** The collected dung will be aggregated at transfer stations before treatment. The area requirement is estimated at 30 square meters per ton per day, which means that for 157.5 TPD, approximately 4,725 square meters will be required. This can be achieved through the three recommended station types mentioned below:

Table 6-2: Types of transfer stations

Station Type	Capacity (TPD)	Area Required
Small	3–5	400–600 sqm
Medium	10–20	1000–2000 sqm
Large	>50	1–2 hectares

4. **Treatment Facility:** The treatment infrastructure will consist of anaerobic digestion using CSTR technology, gas upgradation through pressure swing adsorption and compression and bottling at 200–250 bar in compliance with PESO norms. The land requirement for processing 157.5 TPD is estimated at 12.5 to 15 hectares.
5. **Resource Recovery & Revenue:** Resource recovery will generate significant revenue streams. Bio-CNG production is expected to yield between 5,460 and 9,050 kilograms per day, which, at a price of 50–55 per kilogram under the SATAT scheme, will generate annual revenue of 27–45 crore. Compost production will result in approximately 85–100 tons per day of digestate, valued at 3–4.5 crore annually. Carbon credits are expected to contribute an additional ₹15–20 lakh per year. Together, the total estimated annual recovery will range between ₹30.15 crore and ₹49.7 crore.

The project framework will follow a concession/DBFO model. Government support will be provided through the schemes and programmes. The private partner will be responsible for building, operating, and maintaining the plant, managing logistics, and earning revenue from product sales.

Implementation framework:

Responsible agency: Nagar Nigam Shahjahanpur	**Estimated budget:** ₹75 Cr
Timeline: Long term	**Funding sources:** UP NEDA, SATAT Scheme and MNRE Waste-to-Energy Programme

6.4 Objective 3: Interventions to Rejuvenate Waterbodies and Wetlands in Shahjahanpur

As mentioned in Section 3.2, Shahjahanpur Municipal Corporation encompasses 19 waterbodies, of which 10 exceeds 1 acre in size, 8 waterbodies and one wetland having a size less than one acre. While these assets are crucial for stormwater drainage, groundwater recharge, flood moderation and ecological balance; their condition has deteriorated due to encroachment, siltation, untreated used water inflows and solid waste dumping. This has led to declining water quality, reduced storage capacity and weakened ecological services. To address these challenges, enhanced safeguards, targeted pollution mitigation and systematic integration of waterbodies into the city's water management framework are essential to reinstate their ecological and functional roles.

6.4.1 Intervention 12: To create water body Database at city level

While Shahjahanpur's waterbodies are recognized for their ecological and hydrological importance, the absence of a comprehensive, city-wide inventory and monitoring framework has constrained the ULB's capacity to safeguard, manage, and rejuvenate these assets. Fragmented datasets, overlapping jurisdictions, encroachments and uncontrolled inflows of sewage and solid waste have progressively diminished both water quality and the storage potential of several assets.

Proposed Intervention

The initiative seeks to establish a city-level comprehensive waterbody database for Shahjahanpur, functioning as a centralized digital repository of all waterbodies within municipal jurisdiction. This database will enable real-time monitoring, integrated planning and enforcement coordination across relevant agencies, thereby strengthening institutional capacity for waterbody management.

The design and implementation of the Shahjahanpur Waterbody Database will be guided by the Urban Water Body Diagnostic Tool (UWBDT)[1] developed by the National Institute of Urban Affairs (NIUA). The UWBDT provides a standardized assessment framework encompassing critical parameters such as physical condition, hydrological connectivity, water quality, ecological health, governance structures and risk exposure. Adoption of this framework will ensure systematic evaluation, evidence-based decision-making and long-term rejuvenation strategies for Shahjahanpur's urban waterbodies.

[1] https://uwdtool.in/ ; https://nmcg.nic.in/writereaddata/fileupload/56_Urban-Water-Body-Diagnostic-Tool-Manual.pdf

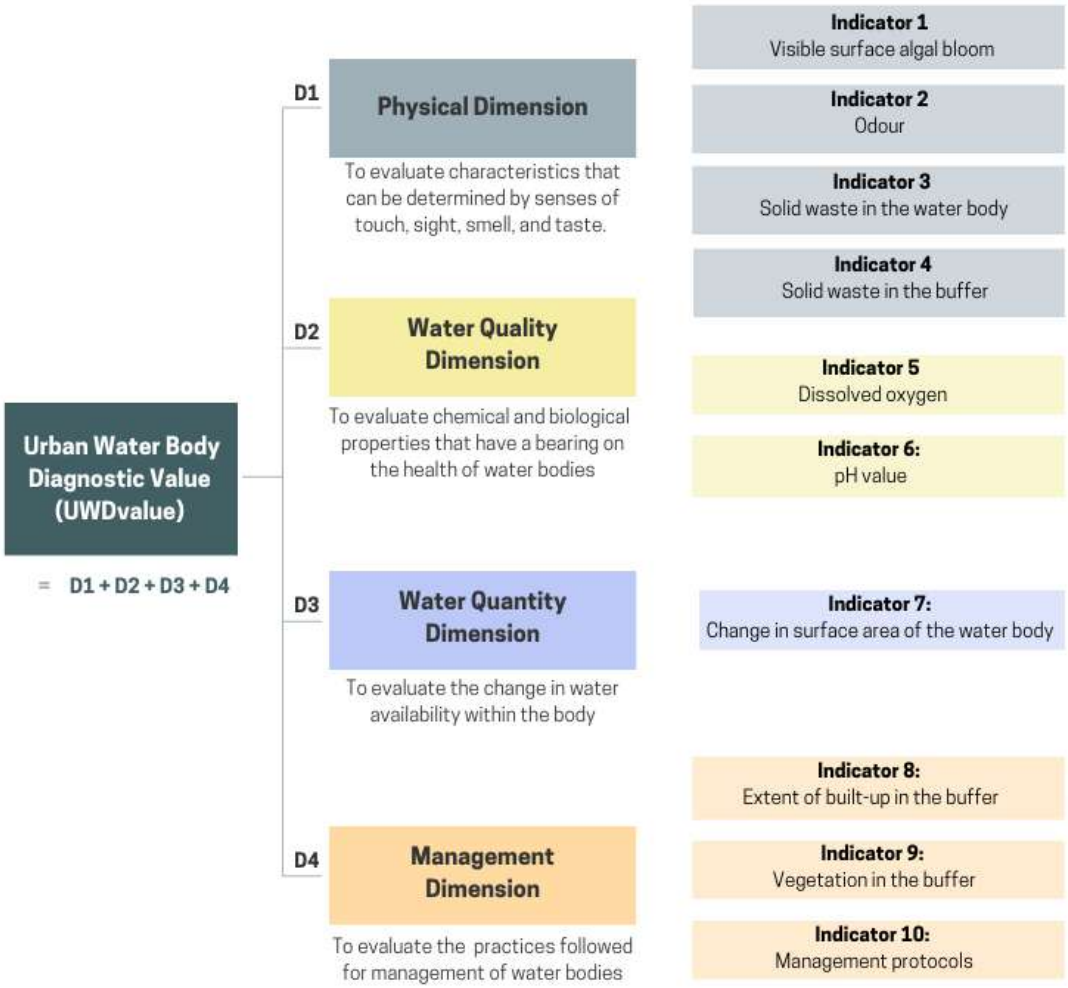


Image 6-10: Urban Waterbody Diagnostic Key Parameters

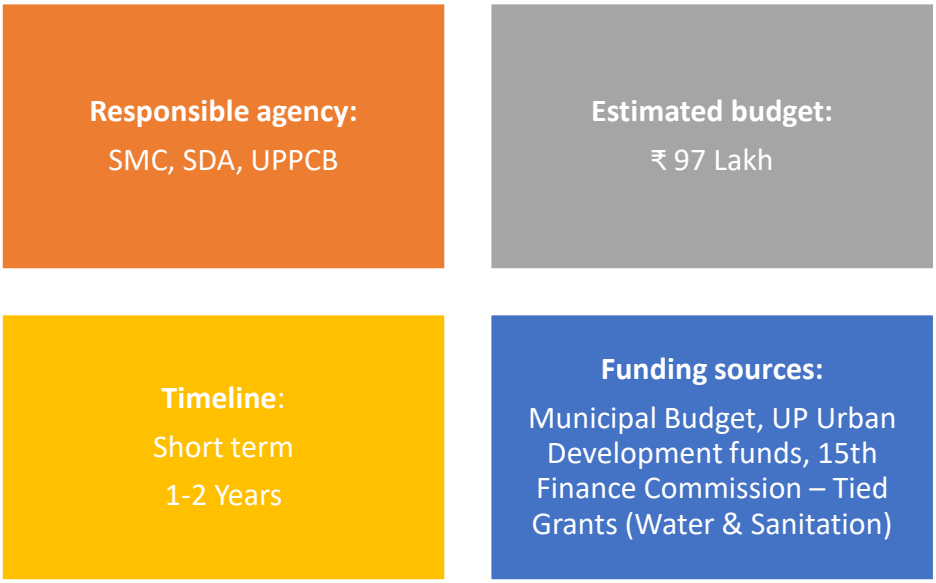
The following are the key components essential for creating the database of waterbodies.

Stages	Actions to be taken
Data Collection	• Geo-referenced mapping of all waterbodies (area, boundary, catchment) • Ownership and administrative details • Current land-use and encroachment status • Hydrological connectivity with drains, rivers, and floodplains • Water quality parameters and pollution sources • Economic Potential (Boating, Fishing, Recreational) • Flooding and waterlogging history • Rejuvenation status and maintenance records
Database Integration	All collected data is consolidated into a dynamic, spatially enabled digital repository. The database is structured using the Urban Water Body Diagnostic Tool (UWBDT) developed by NIUA, which provides a standardized framework for assessment. Key features include: • Centralized access for municipal departments • Real-time updates and monitoring tools • Structured evaluation across ecological, hydrological, and governance dimensions
Application & Outcomes	• **Monitoring:** Enables regular surveys, hydrological assessments, and pollution tracking

Stages	Actions to be taken
	• **Planning:** Informs integrated land-use strategies and conservation measures • **Enforcement:** Facilitates encroachment removal, pollution control, and compliance with buffer zone regulations

Implementation Framework

The implementation framework outlines the institutional responsibilities, funding sources, budget allocation, and project timeline required to operationalize the proposed initiative as mentioned below. For detailed costing and financial breakdown, refer Annexure 2.



6.4.2 Intervention 13: Strategy for Urban Water Body Rejuvenation

Shahjahanpur's dependence on groundwater, coupled with declining recharge trends between 2014–2019, has heightened vulnerability to water scarcity and deteriorating quality. Encroachment, loss of protective buffer zones, inflows of untreated used water, solid waste dumping, siltation and proliferation of invasive species such as water hyacinth have progressively degraded urban ponds and wetland. Critically low dissolved oxygen levels further endanger aquatic biodiversity, undermining both ecological integrity and socio-economic value.

Historically, these ponds functioned as natural recharge basins sustaining aquifers and community needs. Their degradation has weakened resilience and water security, making systematic rejuvenation essential for long-term sustainability.

Proposal Intervention:

Given limited municipal budgets and widespread degradation, a data-driven Prioritization Matrix has been developed to rank waterbodies by hydrological importance, ecological health, and feasibility. This ensures resources are allocated strategically and interventions are phased.

Based on the NIUA Urban Water Body Diagnostic Tool, all the ten ponds having above one acre area within municipal limits were assessed across three dimensions:

- Physical parameters (encroachment, buffer condition, bed type)

- Water quality and hydrology (Used water inflows, solid waste, dissolved oxygen)
- Socio-economic context (accessibility, cultural significance, surrounding land use)

The detailed methodology outlining how each parameter was scored and how composite values were derived is provided in Annexure 3 and the detailed pond-wise scoring is in Annexure 4 Based on composite scores, ponds have been categorized into priorities as presented in Table 6-3. As per the table above, strategic categorization of Shahjahanpur ponds places those with critical sanitation issues under Priority A (Drainage Interventions), ensuring Used water diversion and treatment before any beautification. Once sanitation is stabilized, ponds with natural pervious beds and strong physical scores are classified as Priority B (Recharge Zones) to enhance groundwater recharge. Finally, ponds that are clean, accessible, and socially viable are designated as Priority C (Recreation) for landscaping, aeration, and public use.

Table 6-3: Prioritization of Ponds

Priority	Focus	Number of Ponds	Key Issues Addressed
Priority A	Drainage & Sanitation-first	6	Raw sewage inflows, solid waste, low DO
Priority B	Recharge-focused	4	Natural beds, moderate pollution, limited accessibility
Priority C	Recreation & Amenity Upgrades	0	None currently qualify; potential post-sanitation

Implementation Measures by Priority

Priority A – Drainage & Sanitation

Ponds under Priority A are severely degraded due to raw sewage inflows, solid waste dumping and critically low dissolved oxygen levels. The immediate objective is to stabilize water quality and eliminate pollution sources before recharge or recreational use is considered.

Implementation Measures:

- Construct Interception & Diversion (I&D) drains with stone pitching and bamboo culverts to redirect untreated Used water.
- Establish decentralized Used water treatment units (Phytorid wetlands or DEWATS) using gravel beds, vetiver grass, and native reeds.
- Implement solid waste management through bamboo fencing, recycled signage, and community led clean up drives.
- Undertake aquatic weed management with manual removal and floating wetlands of native plants.
- Introduce solar powered water quality monitoring sensors for DO, BOD, and COD.
- Develop a mandatory 9-meter vegetated buffer zone with vetiver, neem, and bamboo to prevent encroachment and filter runoff.

Priority B – Recharge-Focused Interventions

Ponds under Priority B retain natural soil beds and moderate pollution levels, making them suitable

for groundwater recharge. The focus is on restoring infiltration capacity and protecting aquifer pathways.

Implementation Measures:

- Conduct desilting operations to restore depth (2–3 m) and reopen aquifer pathways, reusing silt for landscaping.
- Construct sedimentation basins at inlets using stone bunds and vegetated traps to settle solids before water enters.
- Install recharge shafts and percolation pits (brick lined, gravel filters) aligned with natural flow directions.
- Establish vegetative buffer zones with vetiver, bamboo, and neem to reduce runoff contamination.
- Preserve natural soil beds by avoiding concrete lining and maintaining ≥90% perviousness.
- Ensure a 9-meter green belt around pond peripheries for ecological protection.

Priority C – Recreation & Amenity Upgrades (Future Phase)

No pond currently qualifies for Priority C. However, once sanitation and recharge measures are successfully implemented, select ponds may transition to this category. The focus will be on enhancing community value while retaining ecological buffers.

Implementation Measures:

- Develop landscaped ghats and walking paths (≥1.5 m wide) using stone and bamboo decking.
- Install solar powered aeration fountains to improve dissolved oxygen and aesthetics.
- Provide solar lighting and recycled signage for safety and awareness.
- Designate cultural activity zones (10–15% of periphery) with bamboo platforms and shaded seating.
- Enhance the green belt with flowering and shade trees such as gulmohar, neem, and amaltas.

Implementation framework:

Responsible agency: Shahjahanpur Municipal Corporation (SMC)	Estimated budget: ₹ 0.58 Crs (for 1 Waterbody as per DPR & feasibility)
Timeline: Short Term 1 - 2 Years	Funding sources: AMRUT 2.0 and SUD Grants

6.4.3 Intervention 14: Phased Restoration of Lal Kothi Pakka Talab

Lal Kothi Pakka Talab (1.22 acres) has been selected as a pilot site to demonstrate the phased restoration framework. Its location, size (1.22 acres) and current degraded condition make it representative of the challenges faced by many water bodies in the city. By piloting interventions here, the project aims to establish a replicable model that integrates sanitation, recharge and recreation for all the identified ponds. The key concerns of the site are:

- Solid waste dumping along three sides of the periphery.
- Dried bed conditions with reduced water holding capacity.
- Minor drain inflows contributing untreated Used water.
- Absence of boundary fencing, leading to encroachment and re-dumping.
- Lack of infrastructure amenities, limiting community use and stewardship.

Proposal Intervention:

To address the above listed concerns, a phased restoration strategy has been designed for Lal Kothi Pakka Talab. The proposal emphasizes a step-by-step approach in which sanitation and pollution control measures are implemented first, followed by recharge and ecological restoration, and finally community-oriented recreational amenities. This sequencing ensures ecological stability before introducing social and cultural functions, thereby making the site a replicable model for other urban ponds.

Given that the pond is presently in a dried condition, the intervention strategy also incorporates measures to restore water availability through stormwater diversion, rainwater harvesting and treated inflows supported by recharge structures. These measures will ensure a sustained water regime, providing the ecological foundation required for long-term restoration and community use.

Image 6-11: Solid waste accumulation and minor drains inflow into Lal Kothi Pakka Talab

Priority A – Drainage and Sanitation-First Interventions (1st Phase)

The first priority is to stabilize water quality and eliminate pollution sources.

- **Solid Waste Removal and Fencing:** All accumulated solid waste will be cleared, and eco-friendly bamboo fencing with recycled signage will be installed along at least 80% of the

pond's periphery. This will secure 5–10% of the edge area, preventing re-dumping and encroachment.

- **Decentralized Used water Treatment:** Minor drain inflows will be treated using a Phytorid wetland system designed to handle 10–15% of inflow volume. Occupying 0.1–0.2 acres per acre of pond area, the system will be constructed with gravel beds, vetiver grass and native reeds to naturally filter pollutants and enhance dissolved oxygen levels.

Priority B – Recharge-Focused Interventions (2nd Phase)

Before initiating recharge measures it is essential to restore water inflow into the pond. Stormwater from surrounding catchments will be diverted through inlet channels, while minor drain inflows will be treated prior to entry. Rainwater harvesting structures will further supplement recharge, ensuring perennial water presence and effective aquifer restoration. Once inflow is restored, the following measures shall be undertaken to enhance recharge and ecological function:

- **Desilting:** Restore Pond depth to 2–3 meters by removing approx. 80% of accumulated silt across 15–20% of the bed. Excavated material will be reused for landscaping.
- **Recharge Shafts and Percolation Pits:** Construct 1–2 shafts per acre (3–5 m deep) along with percolation pits (0.02–0.05 acres per acre), brick-lined with gravel and geotextile mats to improve infiltration.
- **Sedimentation Basin:** Create inlet basins sized to 5–10% of inflow volume (0.05–0.1 acres per acre) using stone bunds and vegetated traps to settle solids.
- **Vegetative Buffer Zone:** Establish a 9-meter green belt, with at least 25% of the periphery planted with vetiver, neem, and bamboo to filter runoff and protect pond edges.
- **Preservation of Natural Soil Bed:** Maintaining ≥90% perviousness by keeping the bed unlined, safeguarding natural recharge pathways.

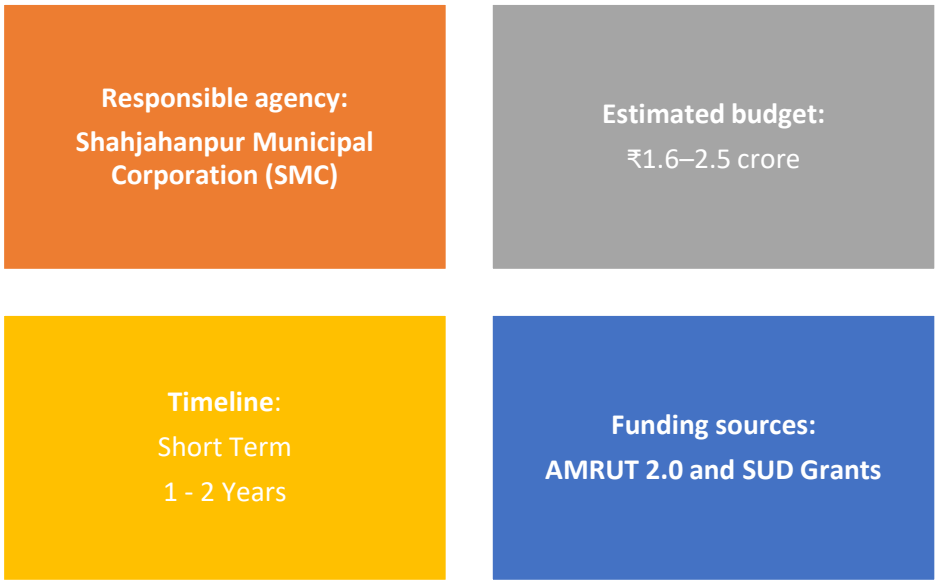
Priority C – Recreation and Amenity Upgrades (3rd Phase)

After sanitation and recharge measures successfully implemented, the pond can be developed for community use. The focus will be on enhancing accessibility, aesthetics, and cultural value while maintaining ecological buffers.

- **Landscaped Ghats and Paths:** Develop ghats along 15–20% of the periphery with walking paths at least 1.5 meters wide. Covering 0.1–0.2 acres per acre, these will use stone and bamboo decking.
- **Aeration Fountain:** Install at least one solar-powered fountain per acre (0.02 acres per acre) to improve dissolved oxygen and aesthetics.
- **Lighting and Signage:** Provide solar lights every 20–30 meters with recycled safety signage at entry points (0.05 acres per acre).
- **Cultural Activity Zone:** Designate 10–15% of the periphery for events, requiring, equipped with bamboo platforms and shaded seating (0.1–0.15 acres per acre).
- **Enhanced Green Belt:** Establish a landscaped 9-meter buffer with flowering and shade trees such as gulmohar, neem, and amaltas, covering 20–25% of the periphery.

This phased approach ensures ecological stability and recreational development. This intervention integrates eco-friendly materials, nature-based solutions and Master Plan 2031 directives, transforming Lal Kothi Pakka Talab into a resilient ecological and community asset.

Implementation framework:



6.4.4 Recommendation 1: Strengthening of water bodies below one acre

In addition to the ten major ponds, smaller water bodies below one acre also require systematic attention to strengthen city-wide resilience. These sites, though limited in size, play a critical role in local recharge, pollution control, and ecological balance. Their management must therefore be integrated into the broader Urban River Management Plan (URMP).

Implementation Measures:

- **Mapping and Monitoring:** All sub-acre ponds will be mapped and regularly monitored to detect encroachment, solid waste dumping, and pollution sources. This ensures early intervention and prevents irreversible degradation.
- **Integration into Recharge Networks:** Smaller ponds will be connected to city recharge systems through percolation pits and infiltration structures, enabling them to contribute to aquifer replenishment despite their limited size.
- **Nature-Based Solutions:** Rain gardens, bioswales, and micro-wetlands will be developed around these ponds to filter runoff, enhance biodiversity, and improve water quality using low-cost, eco-friendly methods.
- **Policy Inclusion:** These water bodies will be formally incorporated into future URMP updates, ensuring that they are not overlooked in planning frameworks and receive sustained attention in monitoring and funding cycles.

6.5 Objective 4 Interventions to enhance riparian buffer along riverbank

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.

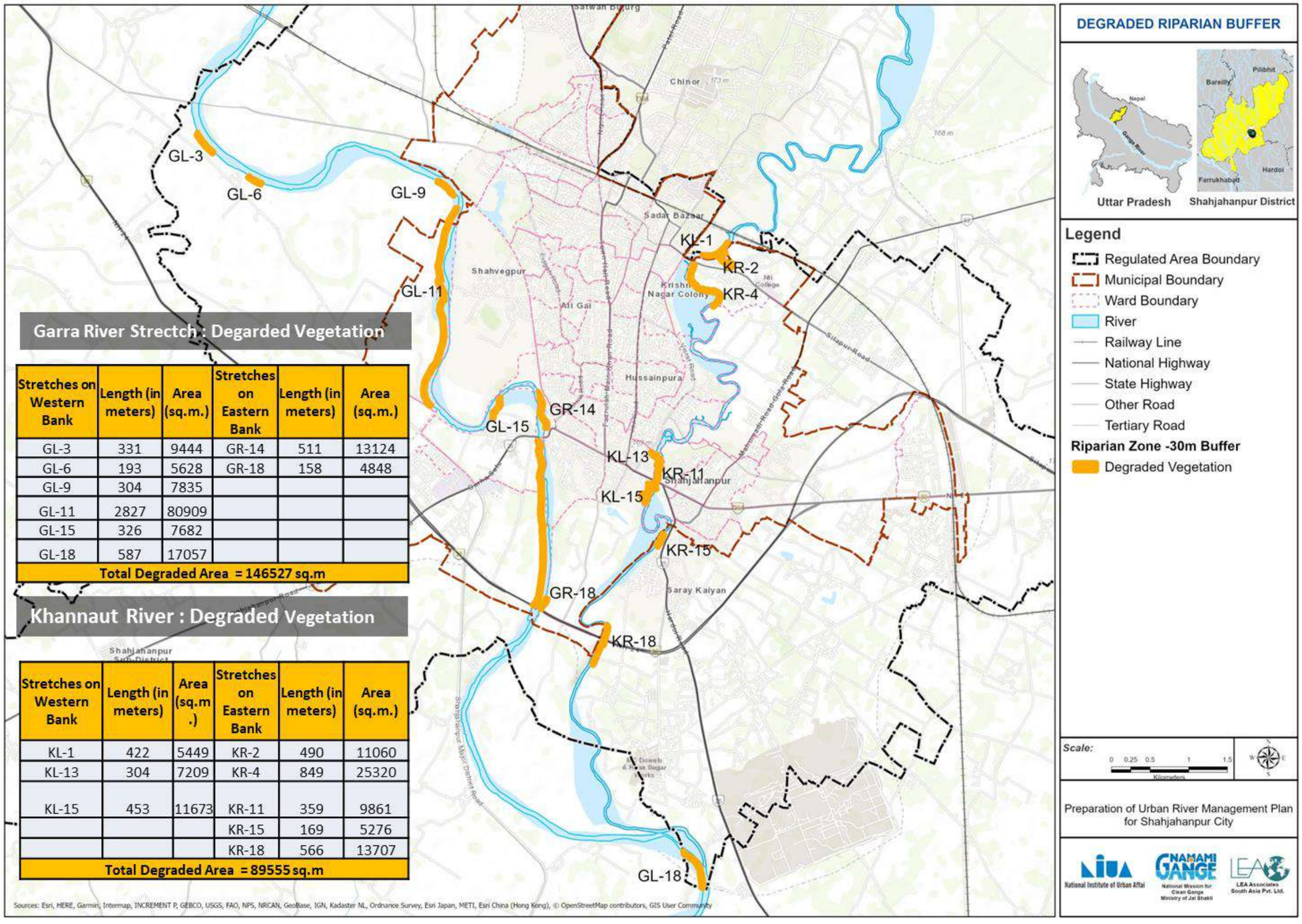
The riparian stretches on both banks of Garra and Khannaut rivers was analyzed and differentiated between degraded and healthy stretches. Interventions have been proposed for restoration of degraded stretches whereas conservation and preservation recommendations have been proposed for the relatively healthy stretches in the following paragraphs.

Image 6-12: Degraded Riparian stretches along Khannaut river

Image 6-13: Degraded Riparian stretches along Garra river

6.5.1 Intervention 15: Restoration of degraded riparian stretches

To address the localized degradation, bank erosion and declining structural stability were observed along the Garra and Khannaut river as shown in Map 6-5. A Three-Zone Riparian Buffer Restoration Strategy is proposed on both banks 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.



Stretches on Western Bank	Length (in meters)	Area (sq.m.)	Stretches on Eastern Bank	Length (in meters)	Area (sq.m.)
GL-3	331	9444	GR-14	511	13124
GL-6	193	5628	GR-18	158	4848
GL-9	304	7835			
GL-11	2827	80909			
GL-15	326	7682			
GL-18	587	17057			
Total Degraded Area = 146527 sq.m					

Stretches on Western Bank	Length (in meters)	Area (sq.m.)	Stretches on Eastern Bank	Length (in meters)	Area (sq.m.)
KL-1	422	5449	KR-2	490	11060
KL-13	304	7209	KR-4	849	25320
KL-15	453	11673	KR-11	359	9861
			KR-15	169	5276
			KR-18	566	13707
Total Degraded Area = 89555 sq.m					

Map 6-5: Degraded Riparian Buffer along Garra and Khannaut river

Proposed key actions for restoration

The proposed riparian restoration interventions on the Garra and Khannaut Rivers focus on bio-engineering based riverbank stabilization, establishment of a multi-zone riparian buffer, and enhancement of native vegetation to improve ecological integrity and flood resilience. Measures such as vetiver and grass plantations, bamboo clumps, and live staking are proposed to stabilize eroding banks while avoiding hard engineering wherever feasible.

Components	Key Actions/ Species	Expected Outcome
1. Stabilize Eroding Riverbanks (Bio-engineering)	Vetiver, kans grass, bamboo clumps, live staking, brushwood check structures; avoid concrete where not required	• Reduced erosion, bank stability, safer flood margins
2. Establish Three-Zone Riparian Buffer	Zone-1 grasses & sedges, Zone-2 shrubs/small trees, Zone-3 native trees	• Reduced nutrient runoff, pesticide interception, flood energy dissipation • Biodiversity enhancement, long-term riparian stability
3. Pollution Source Management (Agro & Domestic)	Vegetated filter strips, compost pits, controlled fertilizer use awareness	• Reduced nutrient & pesticide loading
5. Replacement of invasive species by Native Species Integration	**Recommended native species (site-suitable):** • Anisomeles indica (Lamiaceae) • Leucas aspera • Achyranthes aspera • Saccharum spontaneum **Implementation notes:** • Gradual removal of invasive plants to avoid exposed bare soil • Sequential planting during pre-monsoon/monsoon • Periodic weed control and survival monitoring	• Restoration of native riparian habitat and biodiversity. • Gradual suppression of invasive species through healthy native cover. • Lower maintenance requirement over time due to self-sustaining native vegetation.

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 Figure 6-7.

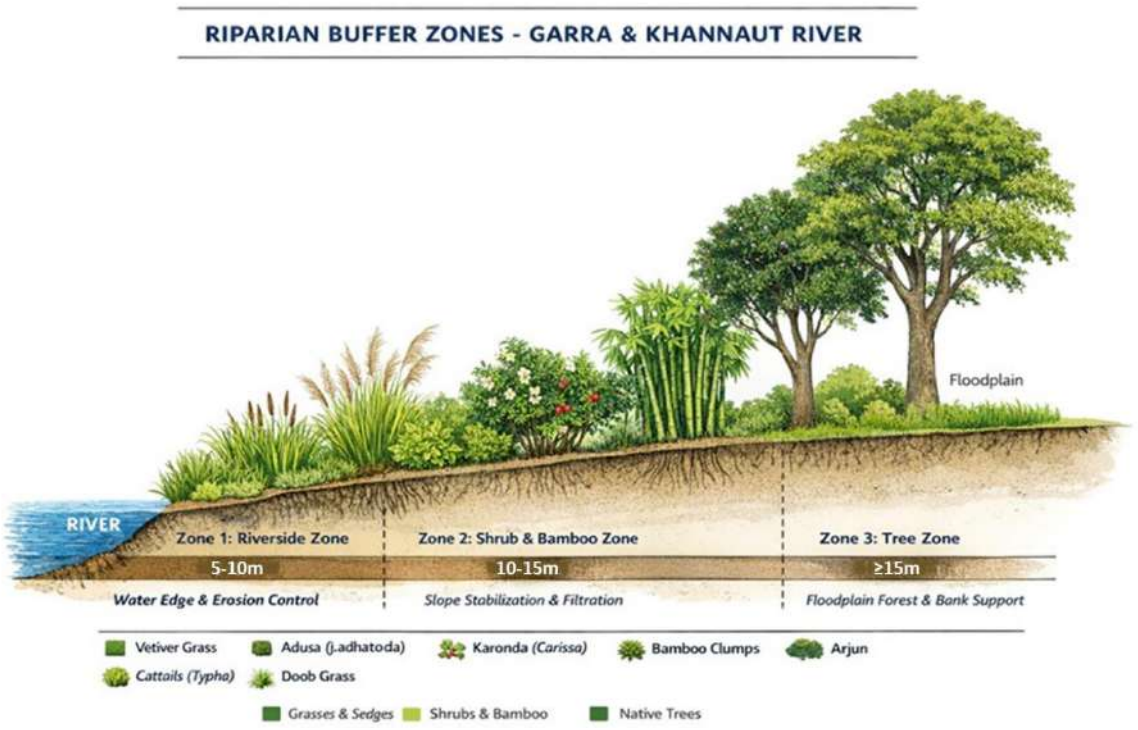


Figure 6-7: Section of the Proposed riparian stretch along eastern and western bank of the river

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 native plant species recommended for each riparian zone are summarized in the table below.

Zone	Width	Vegetation Type	Proposed Species with Ecological Benefits
Inner Zone Closest to water (stream edge)	5–10 m	Dense grasses & sedges (soil binding, scour resistance)	1. **Vetiveria zizanoides (Vetiver):** Extremely strong root network (3–4 m deep), excellent erosion control, traps sediments, absorbs nitrates & phosphates, tolerates flooding and pollutants 2. **Saccharum spontaneum (Kans):** Binds loose alluvial soils, stabilizes sand bars, reduces bank erosion, provides habitat for birds and insects 3. **Cynodon dactylon (Doob grass):** Dense mat, reduces erosion, absorbs nitrogen & phosphates
Middle Zone Mid-slope bank	10–15 m	Shrubs (stability + habitat)	1. **Vitex negundo (Nirgundi):** Soil binding, medicinal, mosquito deterrent. 2. **Clerodendrum infortunatum (Karonda):** Pollinator support, erosion control. 3. **Dodonaea viscosa (Vilayati mehndi):** Windbreak, stabilizes slopes. 4. **Cassia fistula (scattered):** Nectar for pollinators, ornamental
Outer Zone Higher bank / upland	≥ 15 m	Deep-rooted native trees (long-term stability)	• **Terminalia arjuna (arjun):** Classic river-bank tree, strong roots, micro-climate cooling • **Ficus religiosa (peepal**): Keystone species, supports birds & bats

Zone	Width	Vegetation Type	Proposed Species with Ecological Benefits
			• **Dalbergia sissoo (Shisham)**: Nitrogen enrichment, bank stabilization • **Azadirachta indica (neem)**: Pest deterrent, shade, air quality

Expected Outcome:

After implementing the proposed zonal riparian intervention, the degraded stretches of both rivers 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.

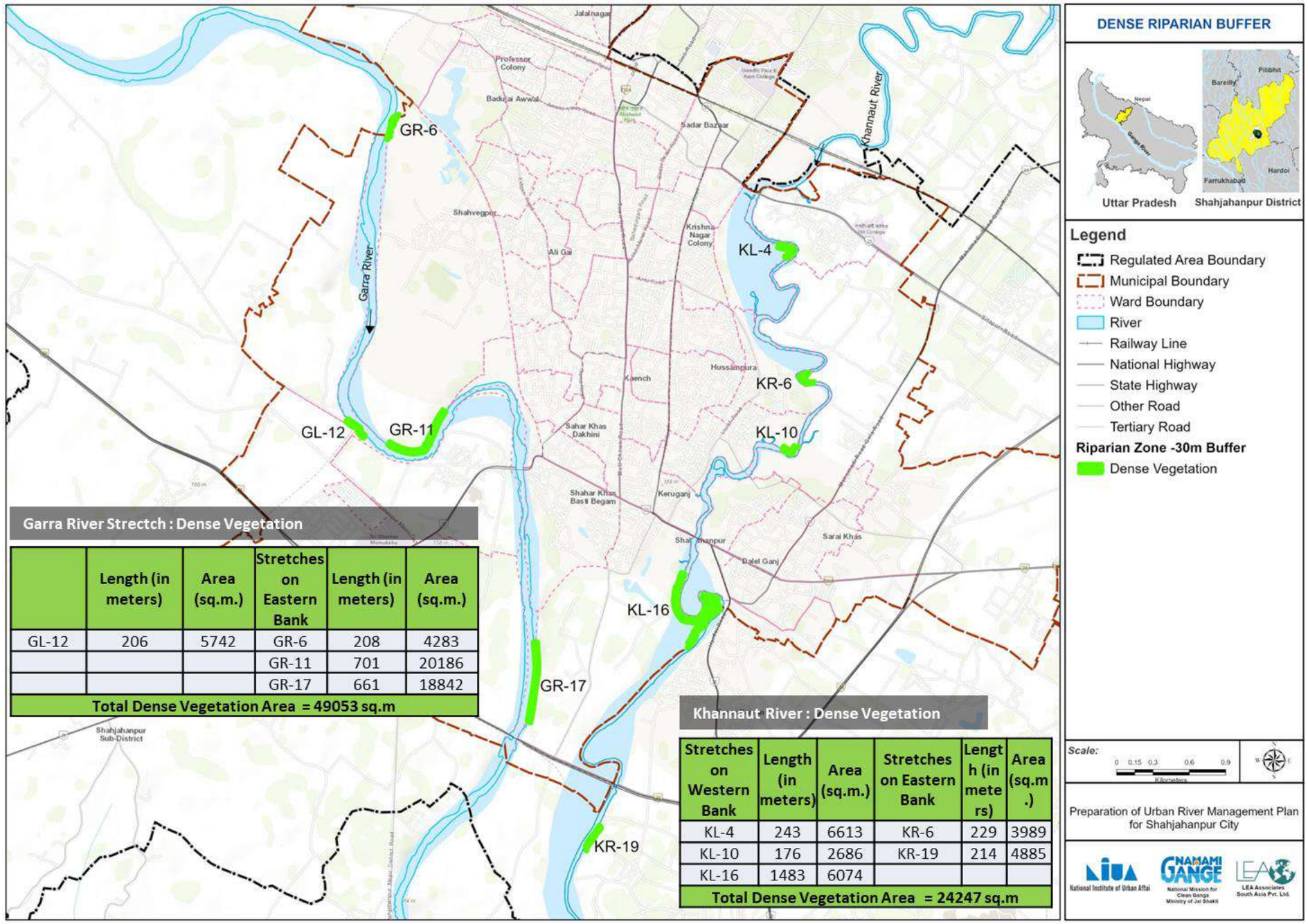
Figure 6-8: Illustration of proposed riparian stretch on Khannaut river

6.5.2 Recommendation 2: Conservation and Preservation of Natural dense riparian buffer

Strict conservation measures are recommended for the ecologically intact stretches of the Garra and Khannaut River corridor, where riparian vegetation remains largely undisturbed. These priority conservation zones are illustrated in the accompanying Map 6-6. 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.

Image 6-14: Dense Riparian stretches along Khannaut river

Image 6-15: Dense Riparian stretches along Garra river



Garra River Strectch : Dense Vegetation

	Length (in meters)	Area (sq.m.)	Stretches on Eastern Bank	Length (in meters)	Area (sq.m.)
GL-12	206	5742	GR-6	208	4283
			GR-11	701	20186
			GR-17	661	18842
Total Dense Vegetation Area = 49053 sq.m					

Khannaut River : Dense Vegetation

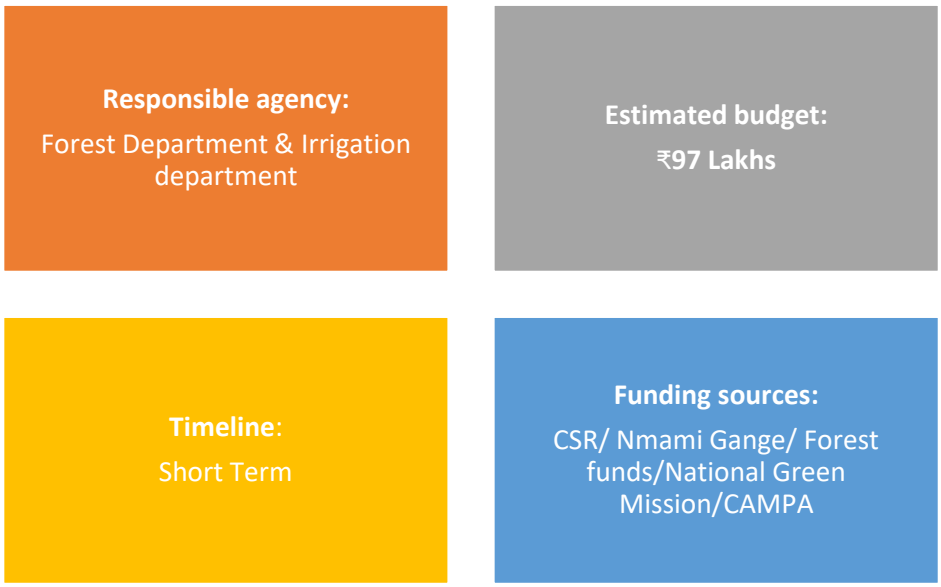
Stretches on Western Bank	Length (in meters)	Area (sq.m.)	Stretches on Eastern Bank	Length (in meters)	Area (sq.m.)
KL-4	243	6613	KR-6	229	3989
KL-10	176	2686	KR-19	214	4885
KL-16	1483	6074			
Total Dense Vegetation Area = 24247 sq.m					

Map 6-6: Existing natural dense Riparian buffer stretches

The table below presents the key management actions proposed for the existing riparian buffer along the Garra and Khannaut 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 Framework



The implementation of the riparian buffer restoration along the Garra and Khannaut 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 Garra and Khannaut rivers in Shahjahanpur. It defines roles, timelines, costs and funding arrangements to support efficient and sustainable implementation, while ensuring that restoration measures are aligned with local flood conditions, riverbank stability needs and overall river management and environmental objectives.

6.6 Objective 5: Intervention strategy to reuse treated used water

Based on the details of the 40 MLD Sewage Treatment Plant (STP) mentioned in section 4.2 above, the treated used water meets NGT standards (Order dated 30 April 2019) with BOD <10 mg/L, making it suitable for diverse non-potable uses including irrigation, landscaping, industrial cooling and construction. A pre-feasibility study by Uttarakhand Pay Jal Nigam proposes major components including a pumping station, 12 km DI rising main, and a 40 MLD tertiary treatment plant (UF + RO units), with an estimated cost of ₹22,434.85 lakh and five-year O&M provision. The project will supply treated Used water for industrial use, conserving Sharda Canal water for irrigation and drinking. Thus, until industrial-scale utilization is fully realized, interim reuse measures are recommended to achieve the mandated 20% reuse target under AMRUT and to ensure productive application of the available treated water.

6.6.1 Recommendation 3: Scaling up irrigation reuse of treated water

The current reuse volume of treated used water is only 1.5 MLD, which is well below the mandated threshold under AMRUT 2.0. In the long term, supplying treated water to Roza Thermal Power Plant, achievable by augmenting inflows to approx. 28 MLD through seven untapped drains.

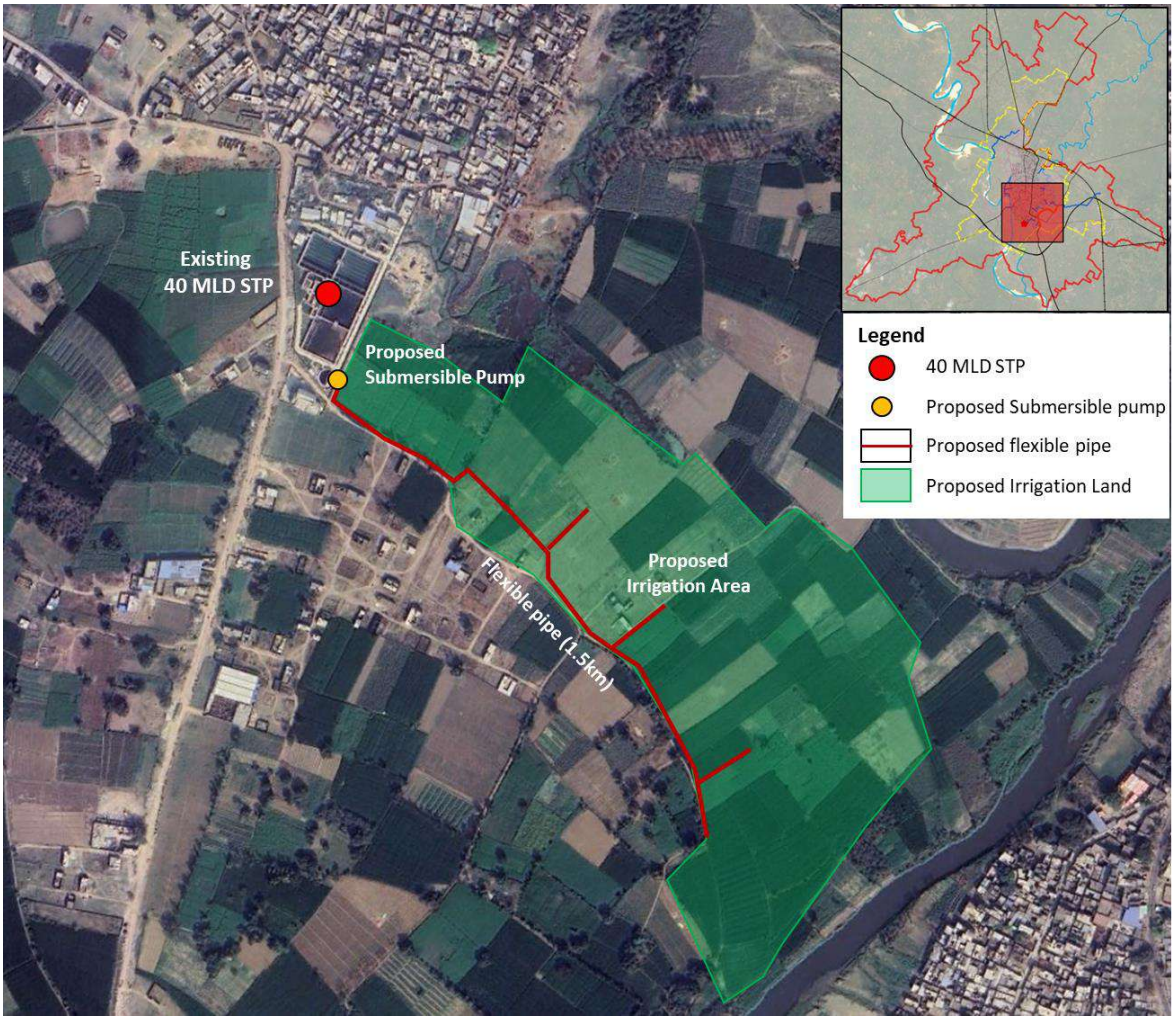
However, due to the current volume of treated water, industrial supply is not yet feasible.

Treated Used water shall be allocated for irrigation and develop the infrastructure to support supply to industry. This dual approach ensures immediate alignment with AMRUT 2.0, prevents underutilization of effluent, and establishes a foundation for long term industrial integration. Thus, the following actions shall be undertaken:

- **Interim Irrigation Reuse:** Allocate 5 MLD of treated used water for irrigation of 10 hectares of land adjacent to the STP, exceeding the mandated 20% reuse requirement.
- **Conveyance System:** Install a submersible pump at the treated water outlet to ensure reliable lifting of effluent. Convey treated water through a flexible HDPE pipeline (300mm diameter, approx. 1.5 km length) connecting the STP to the irrigation site.
- **Distribution Network:** Develop a distribution system designed to provide uniform irrigation coverage across the 10-hectare command area, ensuring efficient utilization of the allocated supply.

The command area, pipeline alignment and distribution network prepared in line with current site conditions are illustrated in the Map 6-7. Values and layouts reflect prevailing ground assessments and may be refined during implementation.

This intervention secures immediate compliance with AMRUT 2.0 through interim irrigation reuse, while strategically positioning Shahjahanpur for future industrial utilization. By addressing the current gap and aligning with long term potential, the city achieves both environmental safeguards and economic benefits from treated Used water management.



Map 6-7:Proposed treated Used water reuse system with STP, pipeline and irrigation area

Implementation Framework

Responsible agencies: Nagar Nigam Shahjahanpur and Agriculture Department	Estimated budget: ₹10-12lakh
Timeline: Short term 1-2 months	Funding sources: AMRUT 2.0 and Nagar Nigam Shahjahanpur

6.7 Objective 6: Intervention for good quality return flow

Shahjahanpur City is entirely dependent on groundwater for domestic, commercial, and institutional needs, making aquifer sustainability critical for long-term urban resilience. A long-term analysis of groundwater levels between 2014 and 2019 shows a steady decline, with the Central Ground Water Board (CGWB, 2019) attributing this depletion to excessive abstraction and the spread of paved surfaces that restrict natural infiltration. The imbalance between extraction and recharge has created structural stress on aquifers, heightening the risk of water scarcity and deterioration in quality due to contaminant concentration.

6.7.1 Intervention 16: Sponge Park Retrofits with Integrated Open Well Recharge

The declining groundwater levels and the city's dependence on aquifers make it imperative to introduce recharge-sensitive interventions that ensure good quality return flow. While Shahjahanpur has green areas, sub-acre ponds, and legacy open wells, these assets are underutilized due to the absence of structured recharge systems. Parks are often paved beyond permissible limits, wells lack filtration safeguards, and ponds are silted or disconnected from runoff flows. Without intervention, the imbalance between extraction and recharge will continue to worsen. The baseline assessment analysis highlighted the key issues and gaps includes:

- Absence of filtration systems in existing open wells, risking aquifer contamination.
- Limited infiltration due to paved surfaces and lack of detention zones in parks.
- Underutilization of sub-acre water bodies and green spaces for recharge.
- No standardized recharge infrastructure across municipal wards.
- Lack of community-level awareness and maintenance protocols.

Proposal Intervention

The intervention proposes retrofitting selected parks and green spaces into sponge parks equipped with bioswales, rain gardens, permeable surfaces, and recharge wells. At the same time, traditional open wells and ponds will be upgraded with filtration-linked recharge systems. Together, these measures will capture stormwater runoff, filter out contaminants, and infiltrate clean water into aquifers, ensuring sustainable groundwater recharge.

The initiative will be implemented across existing and proposed green spaces (413.13 hectares) in the Master Plan 2031 (Refer Map 6-8). By targeting these zones, it enhances infiltration, reduces runoff, and safeguards groundwater quality, ensuring policy compliance, hydrological relevance, and scalability as a replicable model for urban resilience. The intervention components are detailed in the description that follows.

Sponge Park: The sponge park retrofits will be implemented in municipal parks and open spaces, particularly those located along the central ridge line and north–south drainage corridors where runoff naturally flows towards the Khannaut and Garra rivers. Within these parks, impermeable paths will be replaced with permeable pavers laid over graded aggregate and geotextile separators, enabling infiltration in compliance with IRC SP guidelines.

Table 6-4: Specifications and reference of Sponge Park

Element	Specification (Short & Clear)	Reference
Permeable Paths	Pavers 60–80 mm thick over 150–300 mm graded aggregate with geotextile separation	IRC SP guidelines
Rain Gardens	Cover 5–10% of catchment; depth 0.3–0.6 m; engineered soil 300–600 mm; infiltration 25–75 mm/h	NIUA manuals; CGWB norms
Vegetated Bioswales	Bottom width 0.6–1.2 m; depth 0.4–0.7 m; slope 1–3%; check dams every 15–25 m	CPHEEO drainage manual
Curb Cuts & Silt Traps	Openings 0.3–0.6 m wide; silt trap sumps 0.2–0.3 m deep at intervals	

Open Wells: Existing open wells within parks and dense mohallas will be retrofitted as recharge units. Each well will be fitted with a compact filtration train comprising a first-flush diverter to discard the initial runoff, a silt trap basket, and layered media including coarse aggregate, fine sand, and activated carbon.

Table 6-5: Specifications and reference of open wells

Element	Specification (Short & Clear)	Reference
First-flush diverter	Discards 1–2 mm rainfall equivalent to remove initial contaminants	CGWB Guidelines (2019)
Filtration media	Coarse aggregate (200–300 mm), fine sand (300–500 mm), activated carbon (100–150 mm)	BIS IS 15797
Protective measures	Perforated lids; geotextile-wrapped perforated pipe sleeves inside shaft	CGWB Guidelines
Setbacks	15 m from septic tanks; 10 m from sewer lines	BIS IS 15797

Recharge Shafts: Where open wells are absent or unsuitable, recharge shafts will be constructed.

Table 6-6: Specifications and reference of recharge shafts

Element	Specification (Short & Clear)	Reference
Diameter & depth	300–600 mm diameter; 6–12 m depth to pervious strata	CGWB recharge standards
Casing & gravel pack	Slotted PVC/HDPE casing; gravel pack 2–6 mm, 150–300 mm annulus	CPHEEO Manual
Pretreatment	Mandatory sand-charcoal filter box or modular canister before recharge	CPHEEO Manual

Below acre ponds will be upgraded with forebay cells, planted shelves, and edge recharge shafts.

Table 6-7: Specifications and reference of urban pond

Element	Specification (Short & Clear)	Reference
Forebay cells	5–10% of pond area; depth 0.8–1.2 m for sediment settlement	NIUA waterbody rejuvenation guidelines
Planted shelves	2–4 m wide marginal shelves with native macrophytes for nutrient uptake	NIUA ecological landscaping standards
Edge recharge shafts	2–6 shafts per pond; spaced 30–50 m apart; fitted with pretreatment filters	CGWB recharge norms

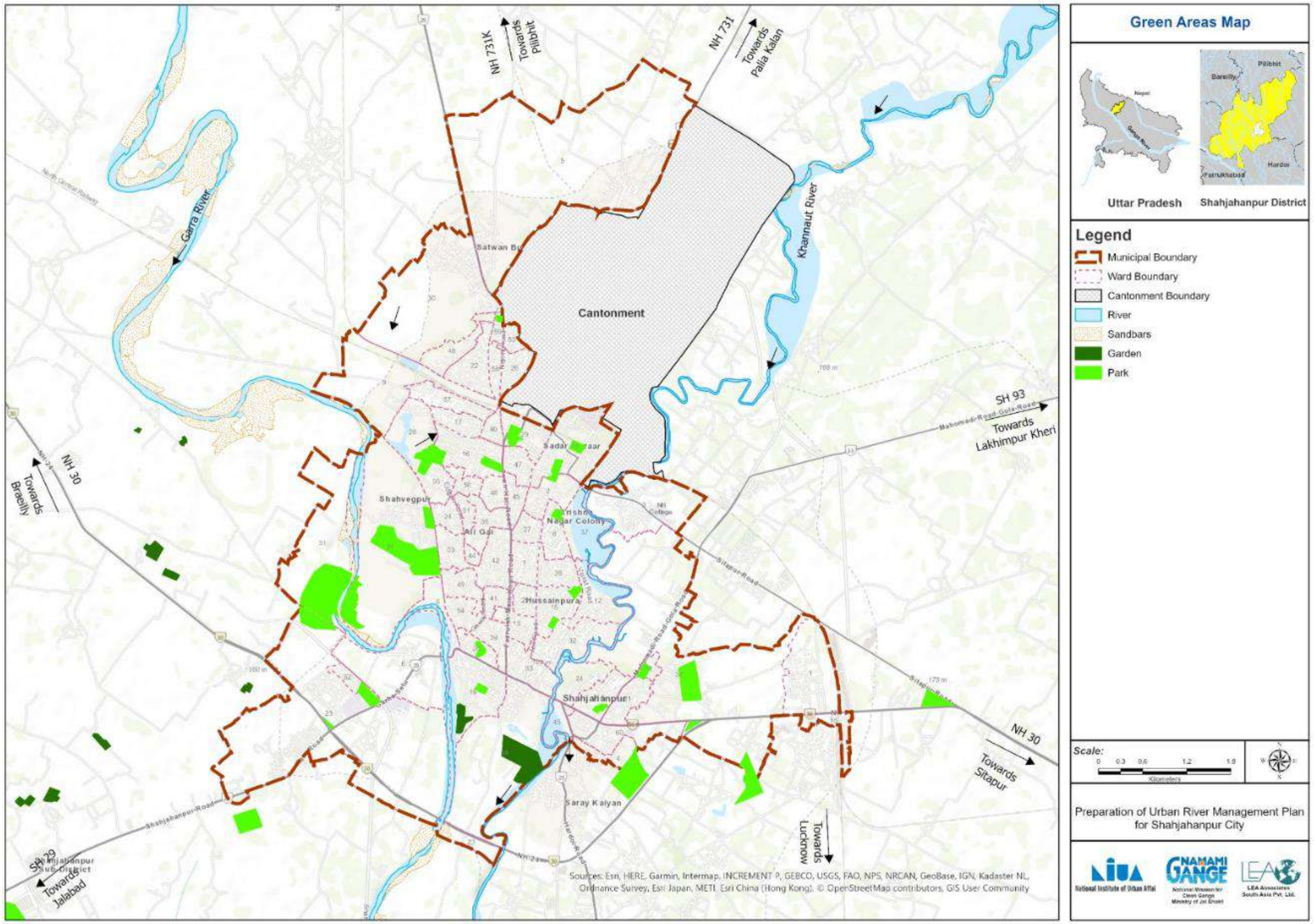
Implementation Framework

Responsible agencies:
Nagar Nigam Shahjahanpur

Estimated budget:
₹0.5-1.5cr (per park/ward depending on scale and site conditions)

Timeline:
Short Term
4-6 months

Funding sources:
AMRUT 2.0, Jal Shakti Abhiyan, Municipal budget, CSR, RWAs



Map 6-8: Green areas in the proposed Master Plan 2031

Objective 7: Interventions to develop eco-friendly riverfront projects and economic potential

As mentioned in the section 2.7, Development of riverfront at Shahjahanpur is focussed on the Khannaut River rather than the Garra River due to issues related to engineering feasibility, flood risk and tourism potential. The Garra is prone to severe, high-volume flooding which is likely to damage riverfront interventions. It flows slightly more to the periphery of the old core in the west. While the city has expanded towards it, the banks are often associated with sandy floodplains or agricultural stretches rather than a dense urban edge suitable for a promenade.

The Khannaut by contrast, is a tributary and has a lower discharge volume compared to Garra and passes through the heart of the established city such as Civil Lines, Cantonment, Lodhipur, etc. and a riverfront here serves the daily recreational needs of the dense urban population in its vicinity. Two interventions for establishing eco-friendly riverfronts have been proposed based on discussion with city authorities on the Khannaut River:

1. Development of riverfront development at Pukka Pul as extension of Hanumant Dham
2. Development of Chhath Ghat at Lodhipur

6.7.2 Intervention 17: Development of riverfront at Pakka pul

The Khannaut River at Shahjahanpur is home to the iconic Hanumant Dham, a notable tourist spot located at the Bisrat Ghat. It features a towering 104-foot statue of Lord Hanuman, which is believed to be the largest. The site attracts 50–100 daily visitors, with numbers swelling to 5,000 during festivals like Chhath Puja and Kartik Purnima.

The Irrigation Department is extending the pathway along the river for a stretch of 780 meters. About 600m to the south of this site lies a 3-acre open area adjacent to the river to the north of Pukka Pul. It is intended to develop the site for recreational purposes (Image 6-16)

Image 6-16: Proposed riverfront development site at Pukka Pul

Presently the irrigation department is constructing a retaining wall along the eastern bank of Khannaut river up to the Pukka Pul site for supporting the riverfront pathway from Hanumant Dham (Image 6-17).

Image 6-17: Ongoing construction of retaining wall for pathway

Width of the site varies from 15m in the narrowest part in the north to 75m to the south next to the Pukka Pul. The elevation difference between the riverbank and the site is 2 to 2.5m. The entire site lies within the highest flood line delineated in the Master Plan (shown in red in Image 6-18). A medium drain from Dalelganj passes along the southern edge of the site and joins the river.

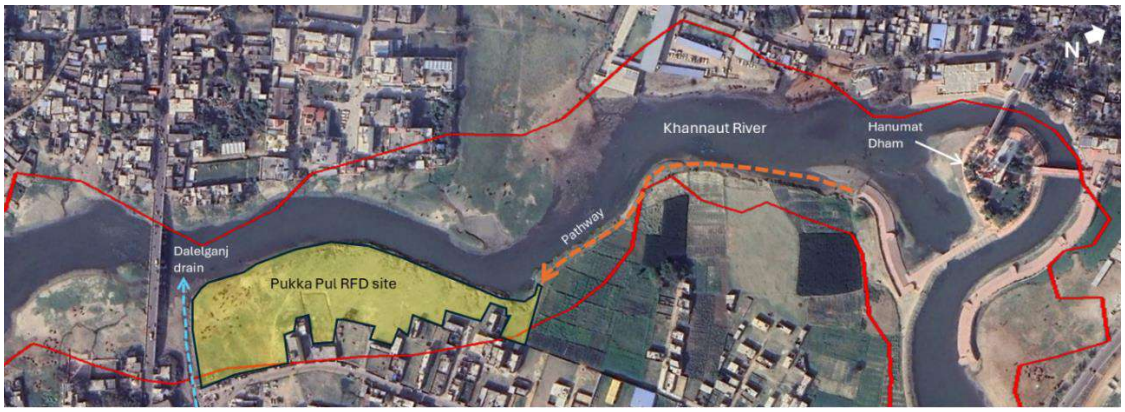


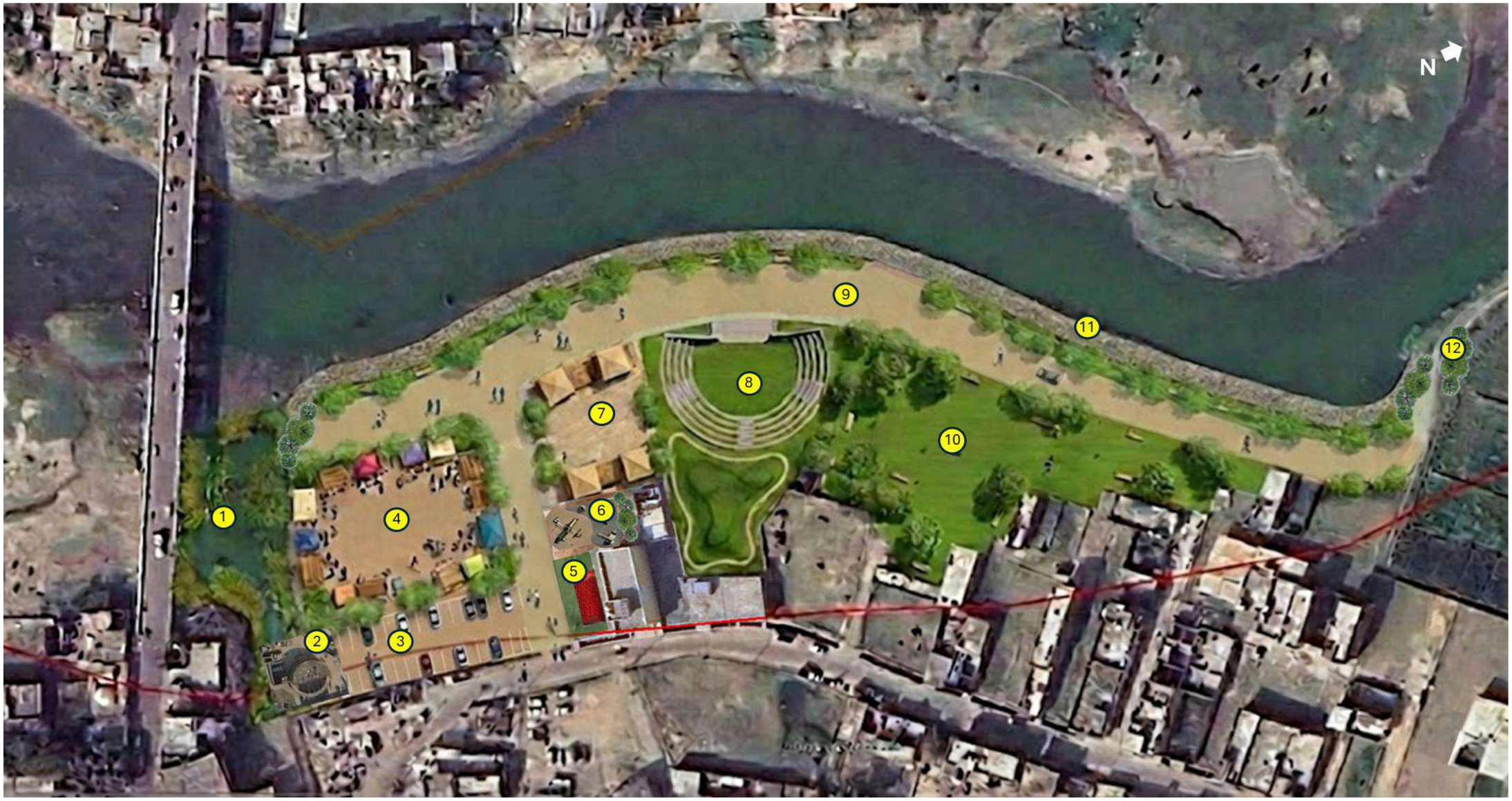
Image 6-18: Plan of Pukka Pul riverfront as extension of Hanumant Dham

The site is planned in just two levels as follows:

Zone A: Riverbank level: Gabion mattress protection to the retaining wall pathway being constructed by the irrigation department is proposed at the toe on the river bank.

Zone B: Ghat promenade level: The following key components are proposed at the promenade level which is approximately 2m above the riverbank.

1. Provision for Sewage Pumping Station for interception and diversion of the Dalelganj drain. A small stretch of constructed wetland is proposed on the riverbank to reduce pollution load from the drain till the SPS is constructed.
2. Entry to the site comprises an entrance building that houses the toilets and the parking area.
3. Kranti Shilp Haat and Khannaut Kinare food court comprising temporary kiosks have been provided for making the place lively and act as a counter magnet to the Hanumant Dham. Children's play area has also been proposed at this location.
4. An Open-Air Amphitheater has been proposed where cultural activities can be held, including those related to Hanumant Dham.
5. A small picnic grove has been attached to the amphitheater where families may enjoy the river view.



1. Constructed wetland for treating Used water from adjacent residentail area till SPS is constructed
2. Sewage Pumping Station for nallah
3. Parking area of permeable paver blocks
4. Kranti Shilp Haat
5. Entrance building and toilets
6. Children's Play Area
7. Khannaut Kinare food court
8. Open Air Ampitheatre
9. River side Promenade
10. Picnic grove
11. Gabion apron below existing concrete edge
12. Way to Hanumant Dham

Map 6-9: Proposed components at Pucca Pul riverfront development

Implementation Framework:

Responsible agency: Irrigation department, NPP, Tourism Department	**Broad Estimated budget:** ₹12-13Cr
Timeline: Long term 12 - 18 months	**Funding sources** Nmami Gange, CSRs, Municipal funds

6.7.3 Intervention 18: Develop an Eco-friendly ghat at Lodhipur (Chhat ghat)

A stretch of approximately 240 meters extending on either side of the Lodhipur Pul on the eastern bank of Khannaut River has been identified by the Irrigation department for development of Chhat Ghat. Presently the 1-acre site is used for undertaking rituals during Chhat puja by the residents.

Image 6-19: Chhat ghat at Lodhipur showing temporary chhat festival arrangements

The width of the site is merely 25 to 30 meters from the river edge with elevation difference of only 1 to 2 meters from the bank. The entire site lies within the highest flood line delineated in the Master Plan (shown in red in Image 6-20). Three drains from the nearby colony passes through the southern part of the site and joins the river.

Image 6-20: Plan of Chhat ghat site at Lodhipur

The site is planned in three levels as follows:

Zone A Riverbank level: Gabion protection to the ghat stretch has been provided at the bank level at either end of the ghat stretch. In the central stretch rough granite blocks has been provided within water for devotees to stand and offer prayers. A concrete toe wall and rip-rap apron has been provided below the granite stones to provide stability against river current.

Zone B Ghat promenade level: The promenade level comprising permeable paver blocks is the middle level of the ghat at approximately 1.5m above the riverbank. Steps from this level go down to the bank level as well to the water kund for devotees who do not wish to enter the river. Constructed wetland has been proposed in southern part of the ghat to clean the water in the drains that flow into the river. A toilet block has been proposed for the convenience of the devotees.

Zone C Road level: Due to paucity of space, vehicle parking is proposed along the roads leading up to the ghat. Stairs as well as a ramp have been provided from this level down to the promenade level of the ghat.

1. Gabion bank protection
2. Constructed wetland for treating Used water from adjacent residentail area
3. Promenade level comprising permeable paver block pathway
4. Water kund for devotees
5. Rough Granite block in water over concrete toe wall
6. Toilet block
7. Steps to the chhat ghat from road
8. Ramp to the chhat ghat from road

Map 6-10: Proposed components of Chhat Ghat at Lodhipur

Implementation Framework:

Responsible agency: Irrigation Department, NPP, Tourism Department	**Estimated budget:** ₹4.5-5 Cr
Timeline: Long term 12 - 18 months	**Funding sources:** Nmami Gange, CSRs, Municipal funds:

6.8 Objective 8: Interventions to Leverage the Economic Potential of River

6.8.1 Recommendation 4: Riverfront Tourism & Recreation

Leverage the proposed Pakka Pul riverfront development provides a structured, resilient public realm that can be leveraged for tourism and local economic growth. Suggested activities include:

1. Pilgrimage-Linked Tourism Services

- Hanumant Dham already attracts thousands of visitors during festivals. The Pakka Pul promenade can host temporary stalls and service kiosks offering prasad, souvenirs, and refreshments, creating spill over economic benefits for local vendors.

2. Cultural Performances & Evening Aarti

- The walkway and shaded seating areas can be used for open-air devotional music, evening aarti, and cultural shows**,** enhancing visitor experience while generating income for local performers and organizers.

3. Handicraft & Food Kiosks

- The modular kiosks in Zone 3 can be designated for local crafts (woodwork, pottery, textiles) and regional foods**,** turning the riverfront into a "Shahjahanpur Haat" that attracts both pilgrims and tourists.

4.Family Recreation Economy

- The children's play area and shaded promenade encourage family visits, supporting small businesses like toy vendors, snack stalls, and ice-cream carts.

6.9 Objective 9: Intervention to inculcate river-sensitive behavior among citizens

The interventions under Objective 9 are designed to embed ecological awareness and cultural pride into everyday practices, ensuring citizens adopt river-sensitive behaviours. From awareness campaigns and eco-clubs to storytelling corners, smart signages and annual river festivals, these measures collectively strengthen emotional, cultural and behavioural ties with the Garra and Khannaut rivers. The detailed interventions are listed in the sections below.

Figure 6-9: River-sensitive practices and cultural awareness

6.9.1 Intervention 19: River Awareness Campaign – "Meri Nadi, Mera Shahar"

The rivers of Shahjahanpur (Garra and Khannaut) are not yet fully integrated into the daily consciousness of citizens. Current IEC initiatives primarily focus on general cleanliness under the Swachh Bharat Mission, with minimal focus on river-specific awareness. As a result, several critical gaps have been identified:

a. Lack of dedicated river-centric IEC infrastructure such as murals, interpretive signage, kiosks and digital platforms.

b. Weak visibility of river heritage and biodiversity in awareness campaigns.

c. Minimal citizen engagement beyond rallies and one-off events, leaving stewardship opportunities untapped.

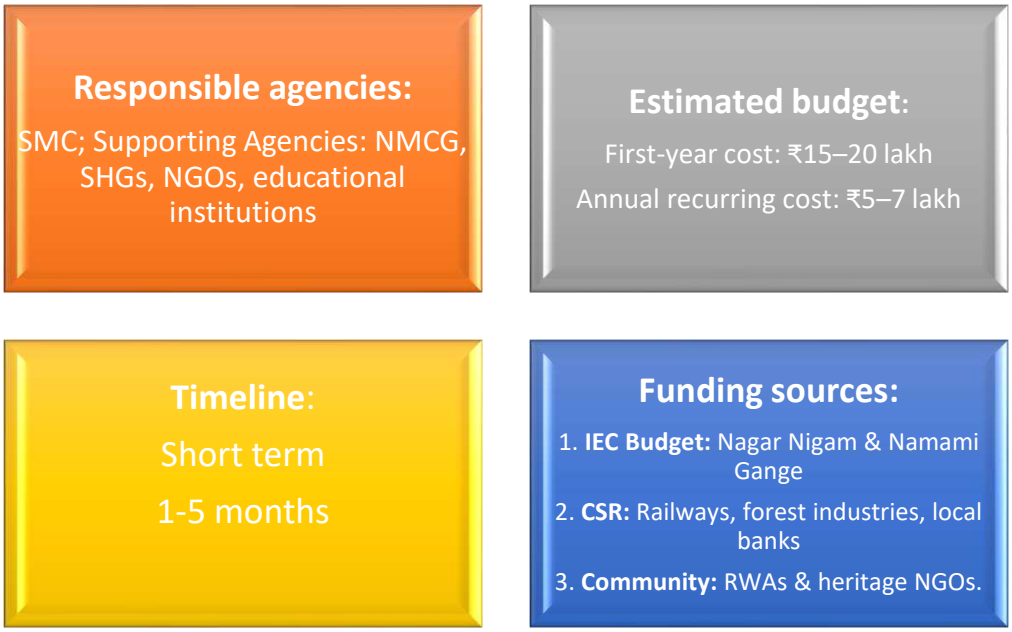
Proposed Intervention:

- **Radio Jingles:** Develop catchy, multilingual jingles in Hindi and Urdu to broadcast river conservation messages across local FM channels.

- **Street Plays:** Organize nukkad nataks in markets, colonies and public spaces dramatizing issues like plastic pollution, waste dumping and river health at junctions in sadar bazar, Rahi tourist bungalow area and Hanumant dham.
- **Wall Art Murals**: Commission murals at ghats, bridges and busy public walls depicting river heritage, biodiversity, and conservation slogans.
- **Digital Outreach:** Create WhatsApp broadcast groups to share short videos, event updates, and citizen pledge campaigns.
- **Community Engagement**: RWAs, shopkeepers and NGOs will be mobilized to co-host events, ensuring broad participation.
- **Monitoring:** Campaign reach will be tracked through participation counts, social media engagement, and feedback surveys.

Frequency: The campaign will be conducted on a quarterly basis, ensuring regular outreach and sustained engagement throughout the year.

Implementation Framework:



6.9.2 Intervention 20: Distribution of Biodegradable Offering Kits at Sacred Sites in Shahjahanpur city

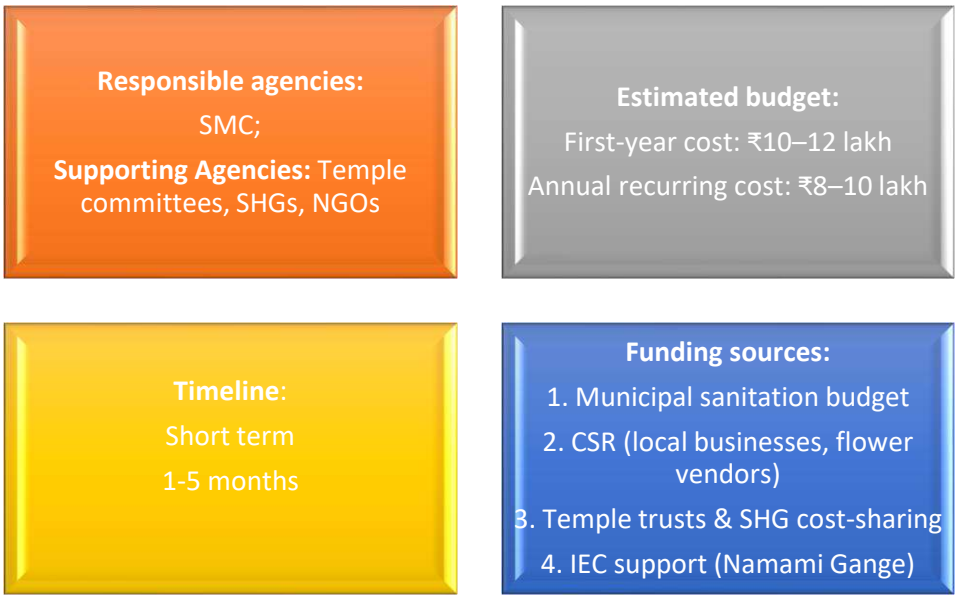
Ritual practices along the Garra and Khannaut rivers in Shahjahanpur including flower offerings during Aarti under the Namami Gange program and various forms of pooja performed at the chhat ghat, birasat ghat and Garra ghat have become a significant source of water quality degradation, particularly during the lean flow period when the rivers carry less water. While these practices hold deep cultural and spiritual value, they often involve the immersion of materials such as plastic wrappings, synthetic fabrics, thermocol items and non-biodegradable packaging, which accumulate along the riverbanks and within the water itself. Over time, this leads to visible waste deposits, foul odors, and

deterioration of aquatic ecosystems.

Proposed Intervention:

- **Biodegradable Ritual Kits**: Introduce kits comprising dried flowers, tulsi leaves, and compostable containers as sustainable alternatives to plastic-based offerings majorly at birasat ghat, garra ghat and sacred places along the rivers.
- **Distribution Channels:** Ensure availability through temples, Self-Help Group (SHG) kiosks, municipal counters, ghats and in major festival congregation points.
- **IEC Activities:** Promote ecological values embedded in religious practices through targeted Information, Education, and Communication (IEC) campaigns, with slogans prominently displayed at distribution points.
- **Awareness and Advocacy:** Conduct awareness drives in collaboration with priests and temple committees to encourage adoption among devotees.
- **Community Participation:** Train SHGs to prepare and package kits, thereby fostering livelihood opportunities and strengthening community ownership.
- **Monitoring and Evaluation:** Municipal staff will monitor kit usage during festivals to assess reductions in plastic waste and track behavioral change.

Implementation Framework:



6.9.3 Intervention 21: River Storytelling Corners for community-led narratives and cultural connection

Cultural and heritage connections to rivers in Shahjahanpur remain underutilized in IEC activities. Current campaigns emphasize cleanliness but neglect emotional and historical ties. As a result, several critical gaps have been identified:

a. Lack of platforms for cultural and biodiversity storytelling to highlight river heritage.

b. Absence of interactive community spaces (story circles, heritage boards) at ghats.

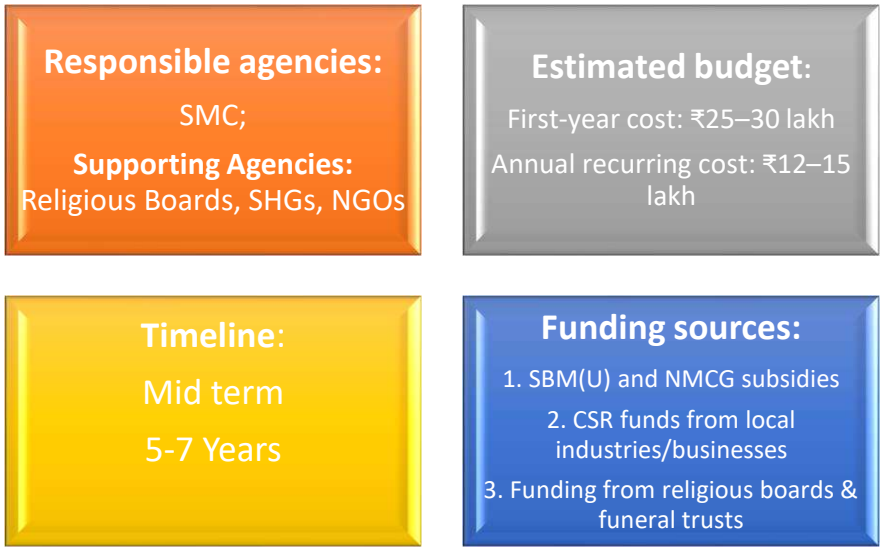
c. Minimal involvement of elders, students and cultural groups in river awareness, limiting intergenerational learning.

Proposed Intervention:

- **Story Circles & river heritage board:** Host weekly storytelling sessions at ghats and parks led by historians, elders and other community people at bisarat ghat and garra ghat majorly and in major temples. Install illustrated panels at ghats narrating myths, local histories, biodiversity facts and folk tales.
- **Cultural Performances:** Collaborate with local groups to perform traditional songs, poems, and folk narratives about rivers at hanumant dham during evenings were high flow of visitors.
- **Digital story walls:** Install QR codes boards linking to audio/video recordings at storytelling corners with heritage stories, biodiversity facts, and legends accessible via mobile devices.
- **Digital Archiving:** Record and preserve stories in audio/video format for wider dissemination.
- **Community Engagement:** RWAs, schools and NGOs to be involved in curating and presenting stories.
- **River Story Festivals:** Organise annual events showcasing plays, folk dance and exhibition on river heritage.
- **Training Story Facilitators and Workshops for Teachers:** Train local youth and cultural groups to moderate storytelling circles. Equip educators with river heritage modules to integrate into school curricula.

Frequency: The storytelling sessions will be held bi-monthly, ensuring regular cultural engagement and continuity throughout the year.

Implementation Framework:



6.9.4 Intervention 22: Behavioral Nudges through Smart Signages at Sacred Sites in Shahjahanpur city

a. Despite repeated awareness campaigns, behavioral change in Shahjahanpur remains weak. Citizens often revert to old practices once events conclude. The key gaps identified include: Absence of river-focused signage or behavioural nudges at drains, ghats and solid waste dumping hotspots.

b. IEC awareness remains generic and lacks behavioural science-based cues to discourage pollution.

c. Limited monitoring and reinforcement mechanisms to sustain long-term behavioural change.

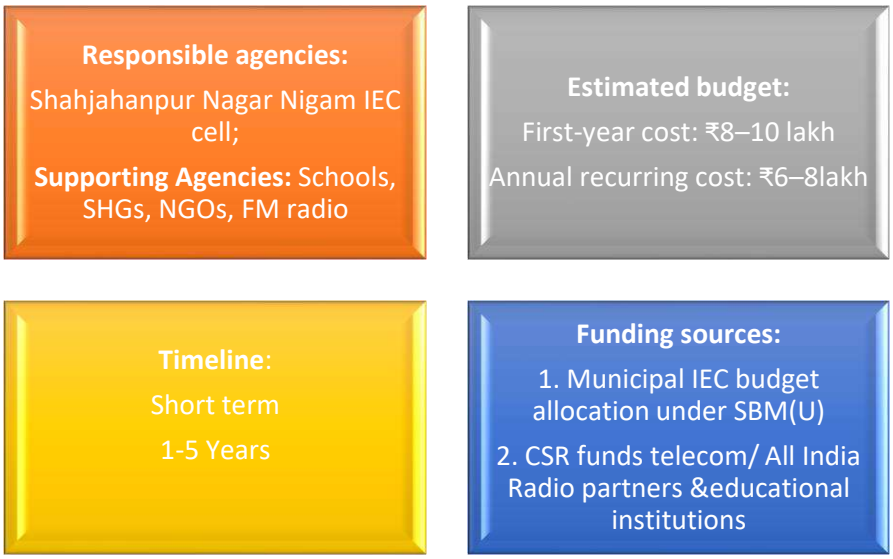
Proposed Intervention:

- **Creative Signboards:** Install durable, weather-resistant signages at drains, ghats, and solid waste dumping hotspots with impactful messages discouraging littering.
- **Behavioural Science Design and River ecology Awareness Boards**: Incorporate social norm cues ("Most citizens keep this ghat clean"), positive reinforcement and eye-catching visuals to influence behavior.
- **Targeted Messaging:** Customize signages for commuters, slum areas and market users with practical, context-specific call of action.
- **Community Involvement:** Engage RWAs and SHGs to identify priority locations and co-design culturally relevant messages.

Frequency: The signages will be installed as a one-time intervention with maintenance and review conducted quarterly to ensure their effectiveness and condition.

Image 6-21: A concept design of Behavioural Science Design and River ecology Awareness board

Implementation Framework:



6.9.5 Intervention 23: Faith-Based Engagement – Temple & Mosque Drives

Religious practices along the rivers in Shahjahanpur often contribute to pollution, particularly through the use of non-biodegradable materials. While priests and imams hold influence within their communities, their active involvement in river stewardship remains limited. The key gaps identified are:

a. Lack of eco-friendly rituals and environmental awareness during religious events.
b. Weak collaboration between religious leaders and municipal authorities.
c. Absence of clean-up drives aligned with festival seasons.
d. Limited use of digital tools for IEC dissemination and citizen engagement.

Proposed Intervention:

- Collaborate with priests, imams and religious leaders to promote eco-conscious rituals during festivals and riverbank ceremonies.
- Facilitate sermons and community talks focused on river cleanliness and the harmful impact of waste dumping.
- Encourage the use of biodegradable offerings and discourage plastic and hazardous waste near riverbanks.
- Coordinate clean-up drive activities before, during and after major religious festivals.
- Adapt successful initiatives such as Namami Gange's "Ghat Par Prarthana" to the local context.

Implementation Framework:

Responsible agencies:
River Sabha Committees;
Supporting Agencies: RWAs, SHGs and NGOs

Estimated budget:
Annual recurring cost: ₹12–15 lakh

Timeline:
Short term
1-2 years

Funding sources:
1. Municipal IEC budget allocation under SBM(U)
2. CSR funds
3. Community contributions (RWAs)

6.10 Objective 10: Intervention to engage citizens in river management activities

Objective 10 focuses on active citizen participation and structured stewardship of the rivers in Shahjahanpur. Through River Sabha Committees, creative competitions, street plays and clean-up drives, these interventions institutionalize community involvement, empower residents and youth and strengthen accountability in river governance.

6.10.1 Intervention 24: Formation of River Sabha Committees at City-Level

One of the most pressing environmental challenges in Shahjahanpur is the indiscriminate dumping of cow dung and solid waste into the city nallahs, which is degrading the water quality and also undermining the ecological health of the Garra and Khannaut rivers. Community participation in river governance remains fragmented, with limited platforms for collective decision-making. Existing structures such as RWAs and SHGs lack defined responsibilities, resulting in weak engagement and minimal accountability.

- No formal citizen-led body for river stewardship to coordinate community efforts or provide continuity in monitoring.
- Weak accountability and transparency in reporting violations such as dumping of solid waste in Nallahs and rivers.

Proposed Intervention:

Establish democratically selected River Sabha Committees at city and ward levels with defined roles and responsibilities.

- The committee shall comprise of SHGs, youth leaders, RWAs and ward officials to ensure diverse representation.
- Identify dumping hotspots, cattle bathing points, and drains discharging into rivers,
- Committees shall integrate reporting into SBM/URMP dashboards for transparency and accountability.
- Volunteers shall be trained as to conduct awareness drives, monitor violations and report issues.
- NSS/NCC units shall be mobilized for monthly riverbank clean-up campaigns, coordinated through the committees.
- Committees shall hold quarterly meetings to review progress, share updates with municipal authorities and recommend corrective actions.

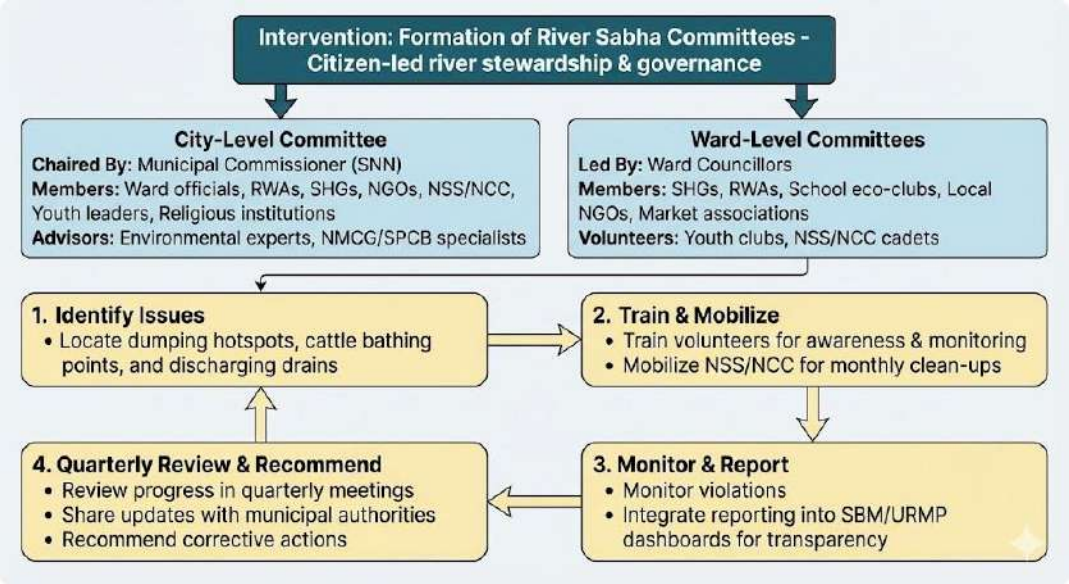


Figure 6-10: Composition of Committee and working model

Implementation Framework:

6.10.2 Intervention 25: River Festival – "Shahjahanpur Jal Mahotsav"

Although Shahjahanpur observes Environment Day and Ganga Utsav, there is no dedicated cultural anchor for river awareness. Citizen participation remains sporadic, with limited integration of schools, RWAs, and NGOs. The gaps identified are:

a. Absence of a structured "River Day" or annual festival to institutionalize river pride.

b. Citizen participation remains event-driven and irregular, with limited continuity.

c. Weak integration of schools, RWAs, and NGOs into cultural programmes, reducing visibility and ownership.

To institutionalize river awareness and pride through an annual cultural festival that blends ecology, heritage and community participation. The festival will serve as a flagship event to celebrate Shahjahanpur's rivers, promote eco-friendly practices, and strengthen citizen engagement.

Proposed Intervention:

- Host annual river festival featuring cultural programs, eco-product stalls and exhibitions.
- Organize school debates, poster-making and eco-art competitions on river themes.
- Promote sustainable crafts and goods by local artisans through eco-stalls.
- Conduct guided river walks, folk dances and storytelling sessions highlighting river heritage.
- Publish annual reports documenting participation, ecological pledges and cultural outcomes.
- Engage RWAs, schools, NGOs, and religious groups as co-hosts events to ensure inclusivity.

Frequency: The river festival to be celebrated annually highlighting on river conservation and cultural celebration.

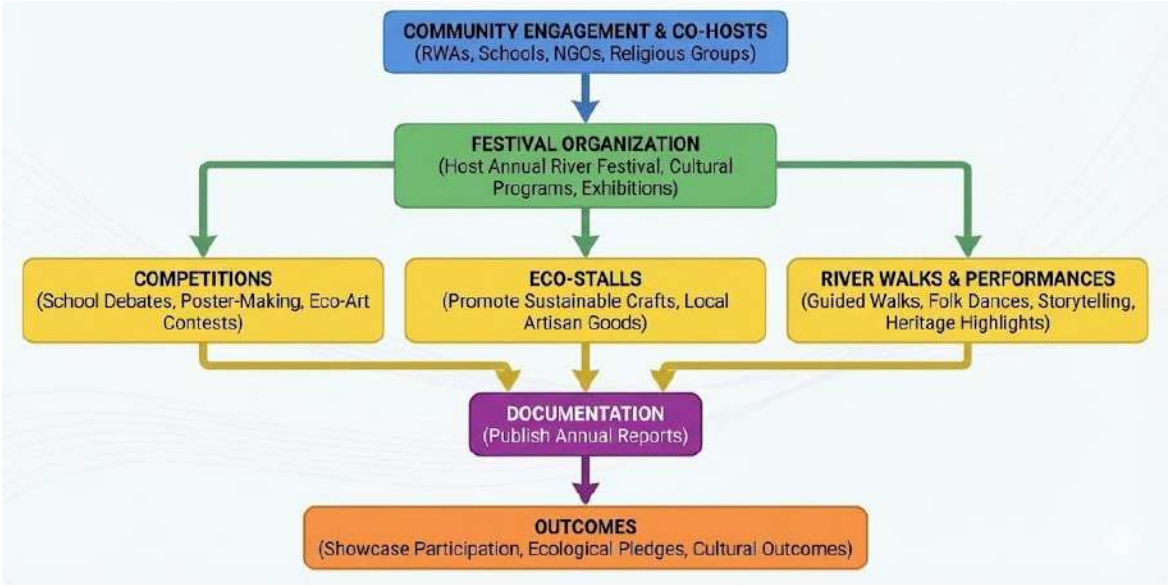


Figure 6-11: Annual River festival: organization and activity flow

Implementation Framework:

6.10.3 Intervention 26: Youth Internship Program – "River Warriors"

College students in Shahjahanpur have limited structured opportunities to engage in river management. While youth participation exists during events, it lacks continuity, skill-building and institutional recognition. The following gaps have been identified:

a. Absence of formal internship or volunteer programs dedicated to river stewardship and solid waste management

b. Limited integration of youth into IEC campaigns and field-based activities.

c. Low visibility and inadequate recognition of youth contributions to river health.

Proposed Intervention:

Launch the "River Warriors" Internship Program to provide hands-on experience engage college students in river management activities.

- Offer short-term internships involving IEC campaigns, surveys and awareness drives.
- Offer skill-building opportunities through field experience, data collection, and community engagement.
- Recognize contributions with certificates to enhance academic and career profiles.
- Partner with colleges and youth organizations for recruitment and outreach.

Frequency: Conduct internship program bi-annually, allowing two cohorts per year for sustained engagement and continuous contribution to river health initiatives.

Figure 6-12: Flow chart of Youth Internship Program

Implementation Framework:

Responsible agencies:
Education Department;
Supporting Agencies: Schools, Colleges and NGOs

Estimated budget:
Annual cost: ₹5–7 lakh

Timeline:
Short term
1-2 years

Funding sources:
Education Department, Municipal IEC Budget, CSR contributions from schools and coaching institutes and NGO.

6.10.4 Intervention 27: Community Composting & Waste Segregation Workshops

Waste segregation and composting practices in Shahjahanpur remain inconsistent. Households and community groups lack practical training and awareness, leading to informal disposal into drains and riverbanks. As a result, several critical gaps have been identified:

a. Limited hands-on training for composting and segregation at the source.

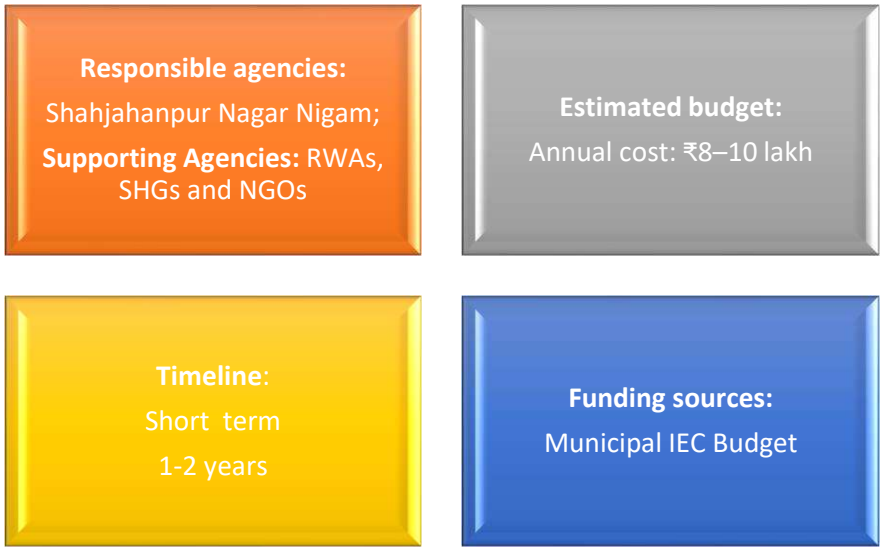
b. Weak engagement of SHGs and RWAs in sustainable waste practices.

c. Absence of community success stories to motivate wider adoption.

Proposed Intervention:

- Conduct hands-on workshops for households on composting organic waste and segregation at source.
- Conduct live training during RWA and SHG meetings.
- Train participants in various composting techniques suitable for home and community setups.
- Educate on reducing waste entering drains through effective segregation.
- Share success stories to motivate wider community adoption.

Implementation Framework:



6.10.5 Intervention 28: River Clean-Up Drives – "Nadi Mitra Abhiyan"

Riverbank clean-up activities in Shahjahanpur are currently irregular and largely event-driven. While some drives have been organized under Namami Gange and SBM, they lack continuity, structured citizen ownership, and systematic documentation. This has resulted in several critical gaps:

a. Absence of regular, institutionalized clean-up drives along riverbanks and ghats.

b. Limited integration of citizen contributions into municipal reporting systems.

c. Low visibility and recognition of community participation, reducing motivation for sustained involvement.

d. Lack of structured adoption of river stretches by RWAs, schools, or NGOs for long-term stewardship.

Proposed Intervention:

- Use banners, loudspeaker announcements, and social media outreach to mobilize citizens for monthly clean-up drives.
- Organize community-led clean-up drives focusing on removing waste from riverbanks, ghats, and adjacent areas.
- Engage students, RWAs, NGOs, and youth clubs as core volunteer groups driving the campaign.
- Encourage RWAs and schools to adopt specific stretches of the riverbank for continuous stewardship.
- Provide eco-leadership badges, certificates and public acknowledgment to active participants.
- Ensure proper segregation and disposal of collected waste through official municipal channels, linked to SBM/URMP dashboards.
- Record and document each drive with before-and-after photos and share results in community meetings to encourage pride and sustained participation.

Implementation Framework:

Responsible agencies:
River Sabha Committees;
Supporting Agencies: RWAs, SHGs and NGOs

Estimated budget:
Annual recurring cost: ₹12–15 lakh

Timeline:
Short term
1-2 years

Funding sources:
1. Municipal IEC budget allocation under SBM(U)
2. CSR funds
3. Community contributions (RWAs)

Annexure

Annexure 1: Draft scope of work for preparation of FSSM plan

The scope of work under this intervention covers the planning, institutionalization, and operationalization of a city-wide Faecal Sludge and Septage Management (FSSM) framework for Shahjahanpur. It builds upon the ongoing infrastructure interventions (co treatment facility, mobile septage treatment unit, and resilient FSTP retrofitting) and integrates them into a structured plan aligned with national SOPs.

Key Components of Scope

1. Safe Containment
    - Survey and geo tagging of all onsite sanitation systems (OSS).
    - Retrofitting septic tanks to watertight standards with baffles, venting, and inspection ports.
    - Development of a centralized household registry capturing tank size, desludging history, and effluent pathways.
2. Scheduled and Regulated Desludging
    - Drafting and notification of municipal bylaws mandating desludging cycles (3–5 years).
    - Licensing of service providers and deployment of GPS equipped desludging vehicles.
    - Transition from reactive desludging to a regulated, city-wide schedule.
3. Transport and Tracking
    - Implementation of a digital tracking system (GPS + mobile app) for all desludging vehicles.
    - Integration of trip logs into municipal dashboards.
    - Requirement of geo tagged proof of discharge at designated treatment points.
4. Treatment Infrastructure
    - Operationalization of the 32 KLD co treatment facility at the 40 MLD STP.
    - Deployment of the Mobile Septage Treatment Unit (MSTU) for decentralized treatment.
    - Flood resilient retrofitting of the Kakra FSTP, including elevation of electrical panels, MCC/PLC systems, and solar arrays.
    - Planning for additional decentralized FSTPs at strategic locations to reduce transport distances.
5. Reuse and Resource Recovery
    - Conversion of treated sludge into compost compliant with Fertilizer Control Order (FCO) standards.
    - Establishment of MoUs with farmers' associations, forestry, and municipal parks for offtake.
    - Promotion of circular economy practices to recover 15–20 tons/month of compostable material.

6. Operation & Maintenance (O&M)
    - Ring fencing of municipal budgets dedicated to FSSM operations.
    - Training of operators with quarterly refresher courses on SOPs, PPE use, and emergency response.
    - Service contracts with private operators tied to performance indicators.
    - Preventive maintenance schedules and independent audits for all treatment facilities.
7. Policy, Regulation & Institutional Framework
    - Drafting and enforcement of municipal bylaws regulating desludging frequencies, service standards, licensing, and penalties for illegal disposal.
    - Establishment of a dedicated FSSM Cell within the municipality to coordinate containment, desludging, transport, treatment, and reuse.
    - Launch of citizen dashboards for service requests, compliance monitoring, and grievance redressal

Annexure 2: Detailed Cost Estimates for creating water body database at city level

Total Waterbodies: 19 No.

Framework: NIUA – Urban Waterbody Diagnostic Tool (UWBDT)

Implementation Period: 12-18 months

Sl. No.	Component Category	Component / Description	Scope & Remarks	Unit	Quantity	Rate (₹)	Amount (₹ Cr)
1	Baseline Mapping	Geo-referenced mapping of all waterbodies	Boundary, area, catchment (GIS)	No.	19	1,20,000	22.80
2	Baseline Mapping	Ownership, land-use & encroachment survey	Revenue data + field validation	No.	19	70,000	13.30
3	Hydrological Assessment	Connectivity with drains, rivers & floodplains	Desk + limited field checks	LS	—	—	10.00
4	Water Quality Profiling	Compilation of available data	UPPCB / SMC / Fisheries (no new lab works)	LS	—	—	8.00
5	UWBDT Assessment	Diagnostic scoring of waterbodies	Physical, ecological, risk parameters	No.	19	40,000	7.60
6	Database Development	City-level GIS & MIS database	Spatial + attribute database	LS	—	—	15.00
7	Remote Sensing Support	Satellite imagery & change detection	Annual baseline + update	LS	—	—	10.00
8	Flood Risk Layer	Flood history & waterlogging	Link with IMD data	LS	—	—	9.00
	TOTAL PROJECT COST					**₹0.97Cr**	

Annexure 3: Prioritization methodology for urban water bodies

This annexure details the methodology used for scoring and prioritizing ponds in Shahjahanpur under the Urban River Management Plan. The framework is based on the NIUA Urban Water Body Diagnostic Tool, adapted to enforce a phased logic of **"**Sanitation First - Recharge Second - Recreation Last." The approach ensures that ecological stability and pollution control measures precede recharge interventions and recreational upgrades.

1. **Scoring Framework**

Each pond was assessed across three diagnostic dimensions, with indicators scored on a **1–5 scale** (5 = optimal condition, 1 = severe degradation). Composite scores were calculated for each dimension to guide prioritization.

Dimension 1: Physical Parameters (The Container)

- **Extent of Encroachment:** % of original area lost (1 = >50% encroached; 5 = 0% encroached).
- **Buffer Zone Condition:** Vegetation/open space around rim (1 = concrete edge; 5 = natural vegetation buffer ≥5m).
- **Nature of Bed:** Perviousness of pond bottom (1 = fully concrete lined; 5 = natural soil/sand).

Dimension 2: Water Quality & Hydrology (The Content)

- **Used water Inlets:** Number and type of drains (1 = multiple raw sewage inlets; 5 = no drains/treated inflows).
- **Solid Waste Dumping:** Garbage/plastic presence (1 = heavy dumping; 5 = clean surface and banks).
- **Dissolved Oxygen (DO):** DO level in mg/L (1 = <1 mg/L; 5 = >6 mg/L).

Dimension 3: Social & Economic Potential (The Value)

- **Accessibility:** Ease of public access (1 = landlocked/private; 5 = main road frontage).
- **Cultural Significance:** Association with temples/festivals (1 = none; 5 = active religious/historical use).
- **Surrounding Land Use:** Settlement type (1 = industrial/slum; 5 = residential/institutional).

2. **Gate Conditions for Prioritization**

To prevent misclassification, gate conditions were applied before assigning priorities:

Priority A – Drainage & Sanitation-First: A pond is placed in Priority A if it shows any critical sanitation concern — specifically, multiple raw sewage inlets, visible solid waste dumping, dissolved oxygen levels below 2 mg/L, or a total water quality score of 6 or less.

Priority B – Recharge-Focused: A pond qualifies for Priority B only after sanitation issues are resolved. It must have a natural or mostly natural bed (score ≥4), a physical score ≥10, a water quality score ≥8, and a social score ≥6.

Priority C – Recreation & Amenity Upgrades: A pond is eligible for Priority C only after sanitation is cleared. It must score ≥10 in physical, water quality, and social dimensions, with individual scores of at least 4 in accessibility, cultural significance, and surrounding land use.

Annexure 4: Water Body Prioritization list for Shahjahanpur City

Sl	Pond Name / Location	Physical Parameters			Water Quality & Hydrology			Social & Economic Potential			Total			Priority as per scoring
		Extent of Encroachment	Buffer Zone Condition	Nature of Bed (Bottom)	Used Water Inlets	Solid Waste Dumping	Dissolved Oxygen (DO)	Accessibility	Cultural Significance	Surrounding Land Use	Physical Parameters	Water Quality & Hydrology	Social & Economic Potential	
1	Atsalia Talab	5	4	4	3	5	2	3	1	3				**PRIORITY A**
2	Railway colony talab-1	5	4	4	4	5	5	2	1	5	13	14	8	**PRIORITY B**
3	Railway colony talab-2	5	4	4	5	5	4	2	1	1	13	14	4	**PRIORITY B**
4	South city extension Talab	5	2	5	5	5	2	2	1	5	12	12	8	**PRIORITY A**
5	Gaus Nagar (kakra)– 1	3	4	3	1	3	2	3	1	2	10	6	6	**PRIORITY A**
6	Gaus Nagar (kakra)– 2	2	3	3	2	1	3	2	1	1	8	6	4	**PRIORITY A**
7	Gaus Nagar (kakra)– 3	2	3	4	5	1	2	4	1	2	9	8	7	**PRIORITY A**
8	Subhash Nagar talab	5	4	4	5	5	4	3	1	5	13	14	9	**PRIORITY B**
9	Dub ghata talab	4	4	5	5	4	3	3	1	3	13	9	7	**PRIORITY B**
10	Lal Kothi pakka talab	5	1	5	5	1	1	4	1	5	11	7	10	**PRIORITY A**

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