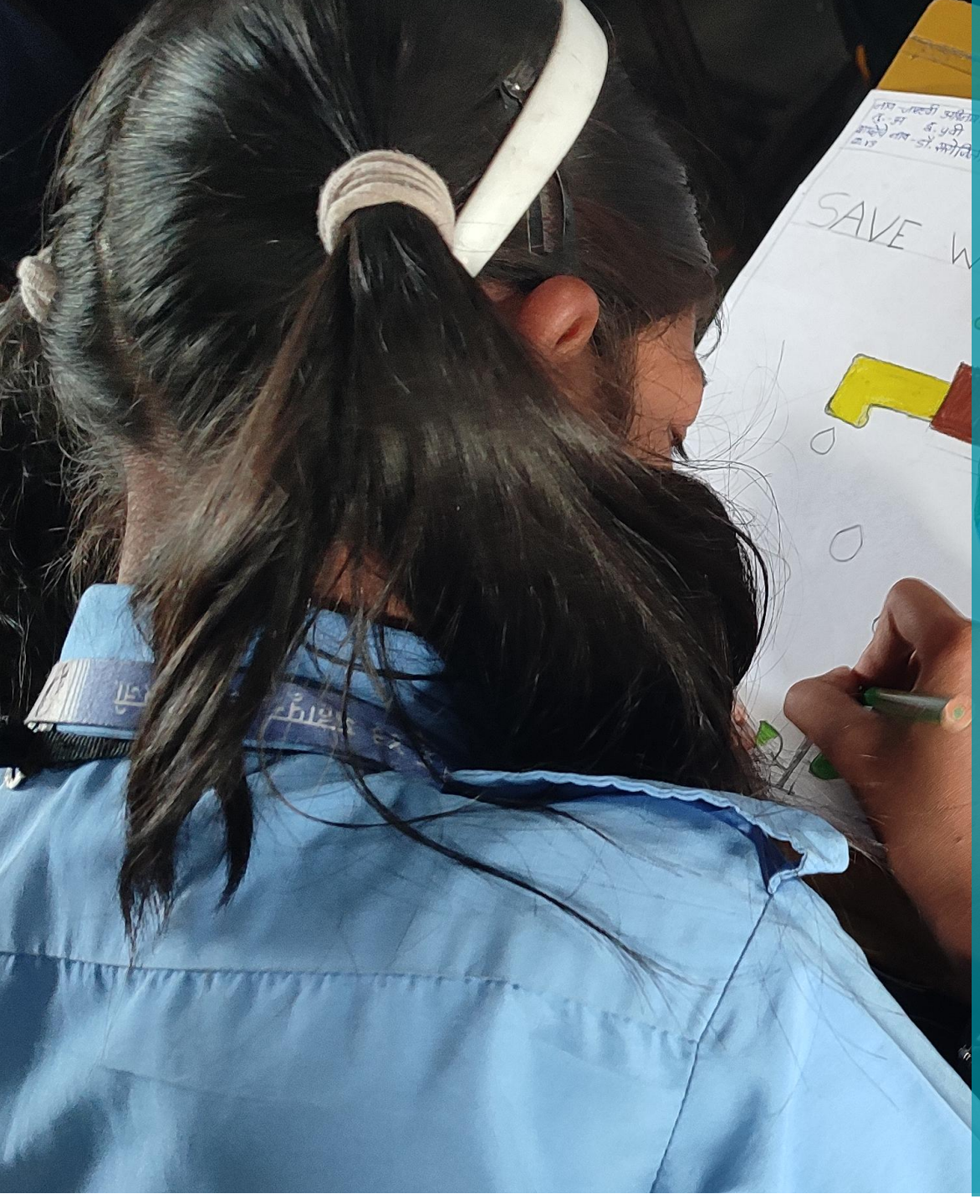


Climate Resilient WASH in Ichalkaranji - Nature-based Solutions (NbS) and Community Engagement

Ichalkaranji, Maharashtra

June 2026

CWAS CENTER FOR WATER AND SANITATION | CRDF CEPT RESEARCH AND DEVELOPMENT FOUNDATION | CEPT UNIVERSITY

City Profile: Ichalkaranji is located on the east of Kolhapur district in Maharashtra

Ichalkaranji Municipal Corporation

29.92 Sq.Km
Area

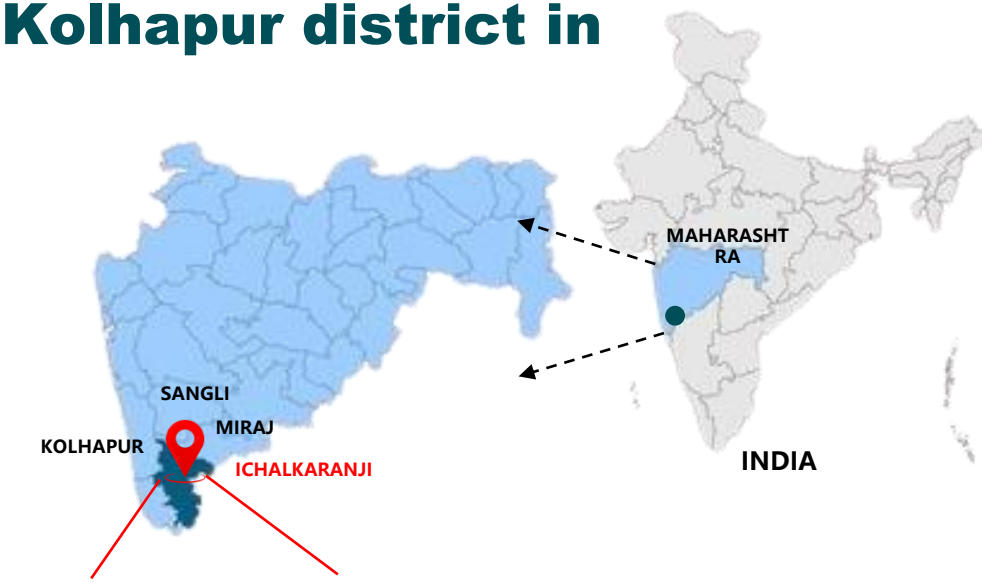
32
Wards

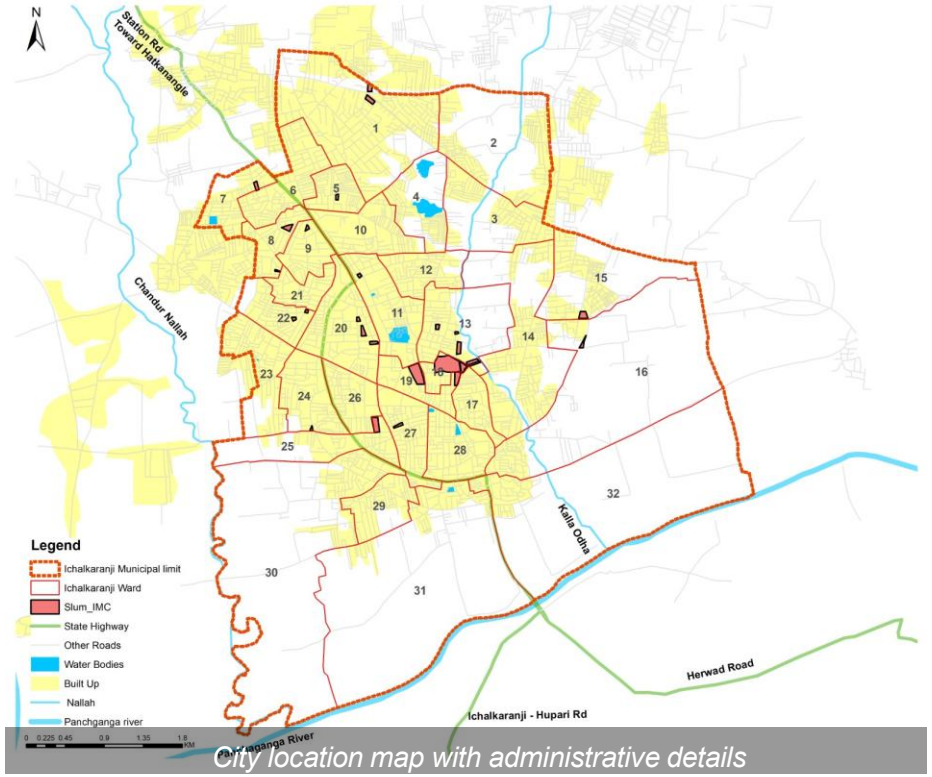
3,68,916
Population
Slum: **28,171**

49345
Households
Slum: **4,047**

8% of total population

- Ichhalkaraji is a newly formed **municipal corporation.**
- The **climate** is generally **dry** except during south west monsoon season.
- The city receives **annual rainfall 600 – 700 mm** from June to September and **faces frequent flooding and water logging.**
- Ichalkaranji is a rapidly **growing industrial centre** driven by **textile industry** and is known as the Manchester of Maharashtra.





City location map with administrative details

Source: Data as on 2022 . Information from IMC, https://cgwb.gov.in/sites/default/files/2022-10/kolhapur.pdf

Climatic Risks for Ichalkaranji city

Ichalkaranji belongs to the Western Maharashtra region, mainly includes Sangli, Kolhapur and Satara district. The region experiences varying risks depending on their geography, socioeconomic factors, and governance.

Natural Climatic Risks

Erratic Rainfall patterns

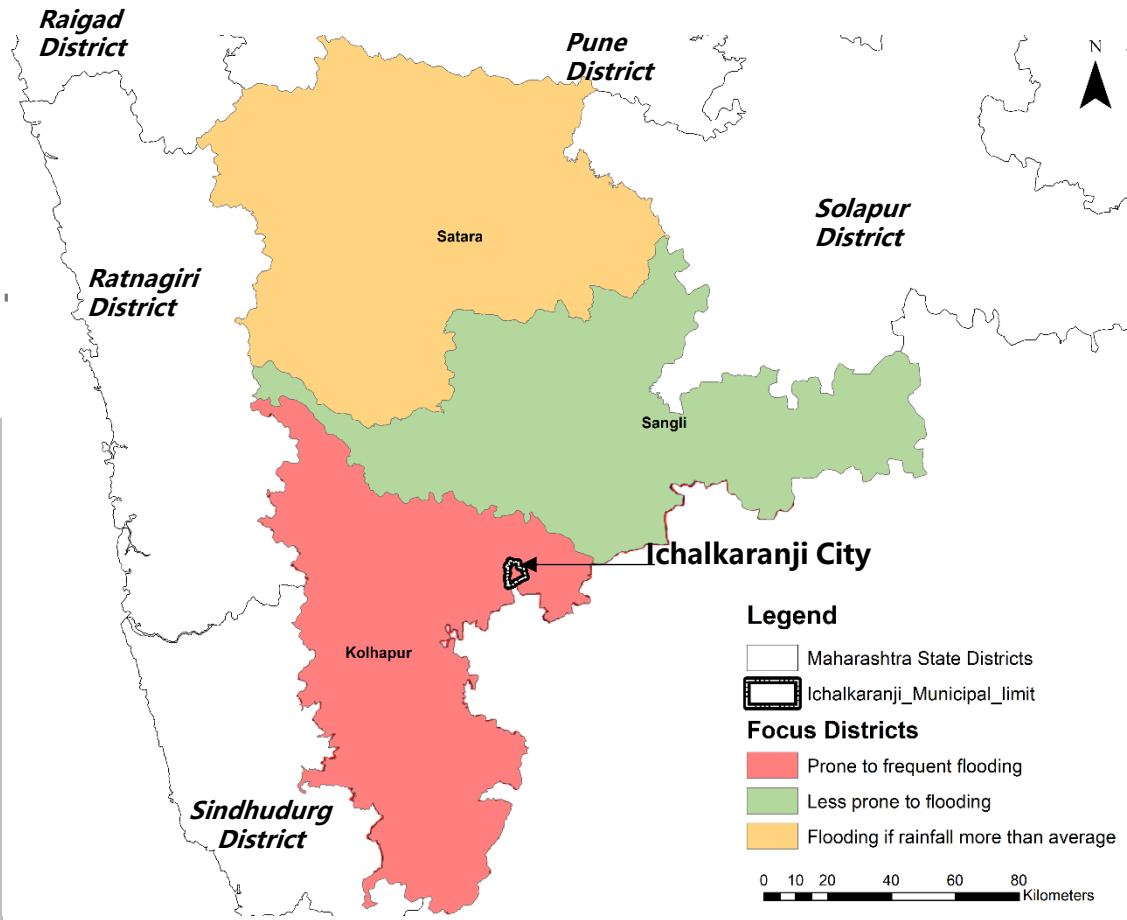
The region has an **erratic rainfall pattern** throughout the monsoon season.

Higher urban flooding

Kolhapur district is prone to floods due to the presence of Panchganga and Krishna rivers

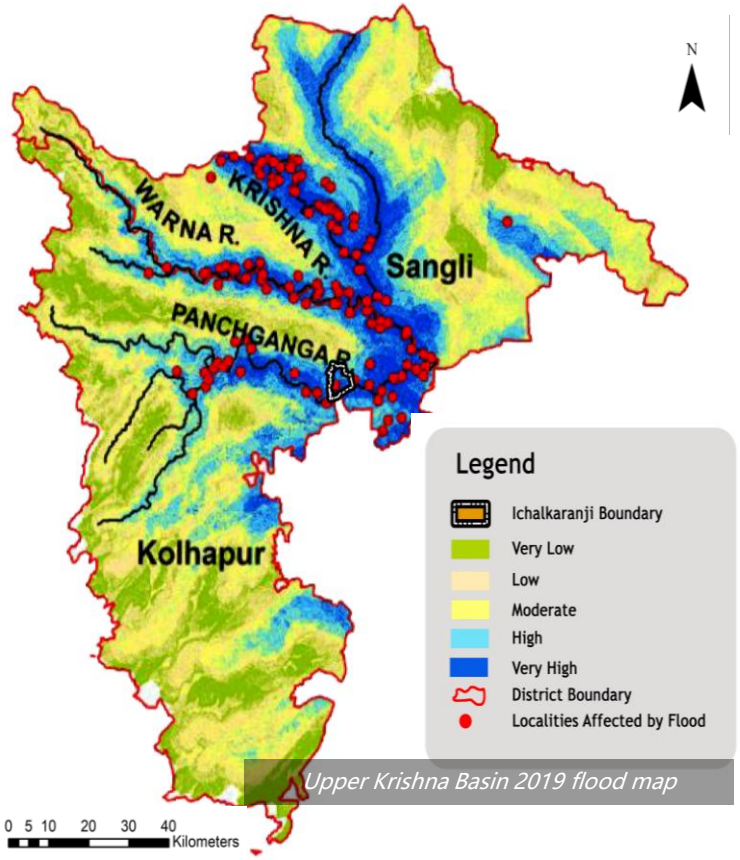
Human-Driven Changes and impact

Activities		Impacts
Uncontrolled water extraction from borewells	*Leading to*	Fluctuations and depletion in ground water due to irregular and insuffient water supply
Unregulated discharge from industrial units	*Leading to*	Ground water contamination
Excessive impervious surfaces and encroachment of water bodies	*Leading to*	Urban flooding due to rapid development blocking natural drains

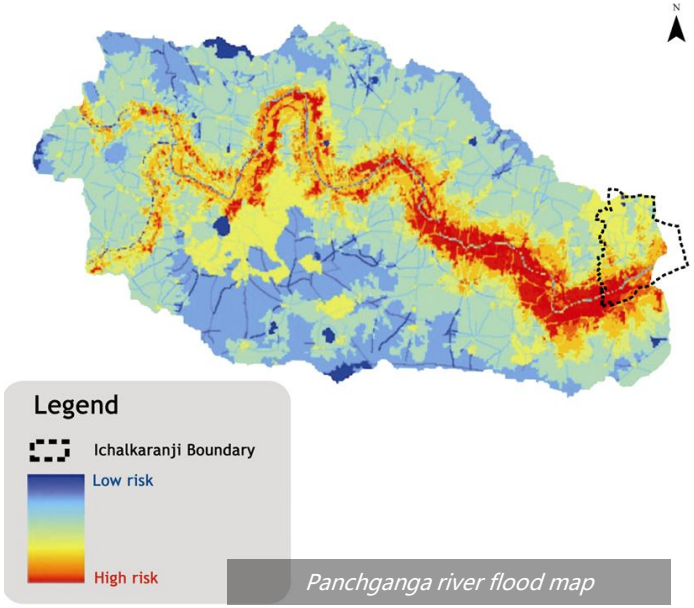


Natural Climatic Risks : Due to heavy rainfall in western region of Maharashtra Ichalkaranji and Kolhapur faces frequent flooding

- Ichalakranji city has experienced floods in the years 2005, 2019 and 2021, where rainfall was ranging from **2000 to 3000 mm** during the rainy season.
- The **2019** floods were particularly devastating, with Ichalkaranji receiving rainfall of more than **1058 mm**, causing widespread disruption to daily life and infrastructure.



Upper Krishna Basin 2019 flood map



Panchganga river flood map

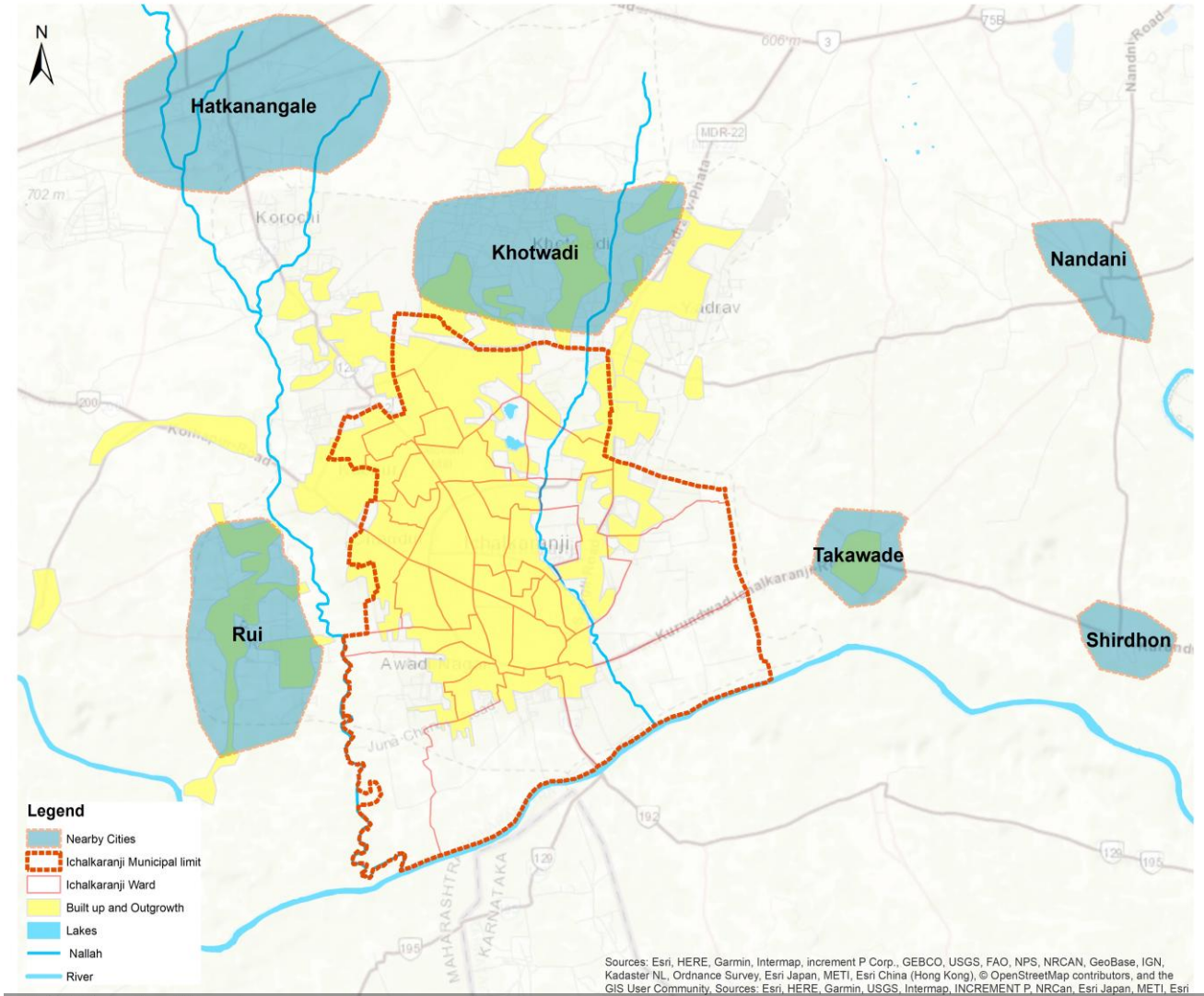
Flood in Ihalkaranji

New articles on floods

Human-Driven Changes and impact: The growing development activities considering the industrial growth impact the natural drains (nallas) carrying capacity

- The **development** of **handloom and power loom industries** at have resulted into urbanization of the town.
- The other handloom services industries are concentrated on the **northern side of town,** boost in industrial sector has led to **strong road network connectivity** within the town.
- Due to two town planning schemes implemented in the town, a **planned development** is observed.

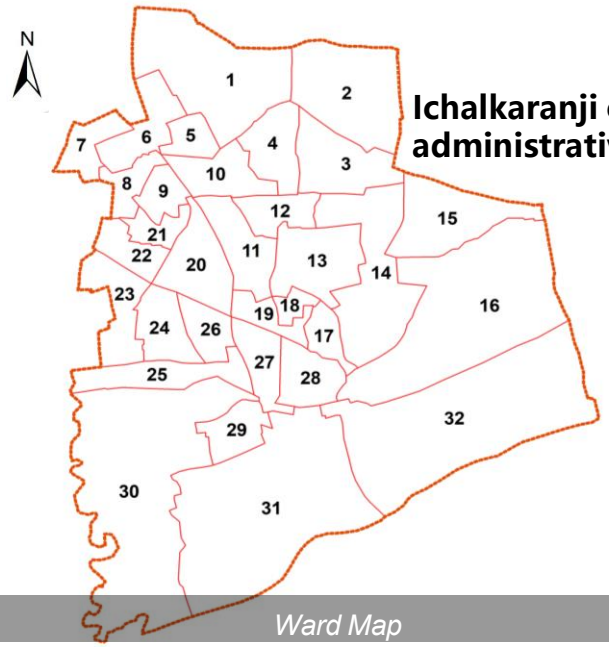
Some glimpses of the city with commercial as well as outskirt areas, good road network



Outgrowth areas near Ichalkaranji based on industrial growth

Source: Information from DRP report by Rachana Kansagra, Maharashtra State Adaptation Action Plan on Climate Change-MSAAP

Human-Driven Changes and impact: Increased impervious surfaces and alteration of natural water flow due to rapid industrialization

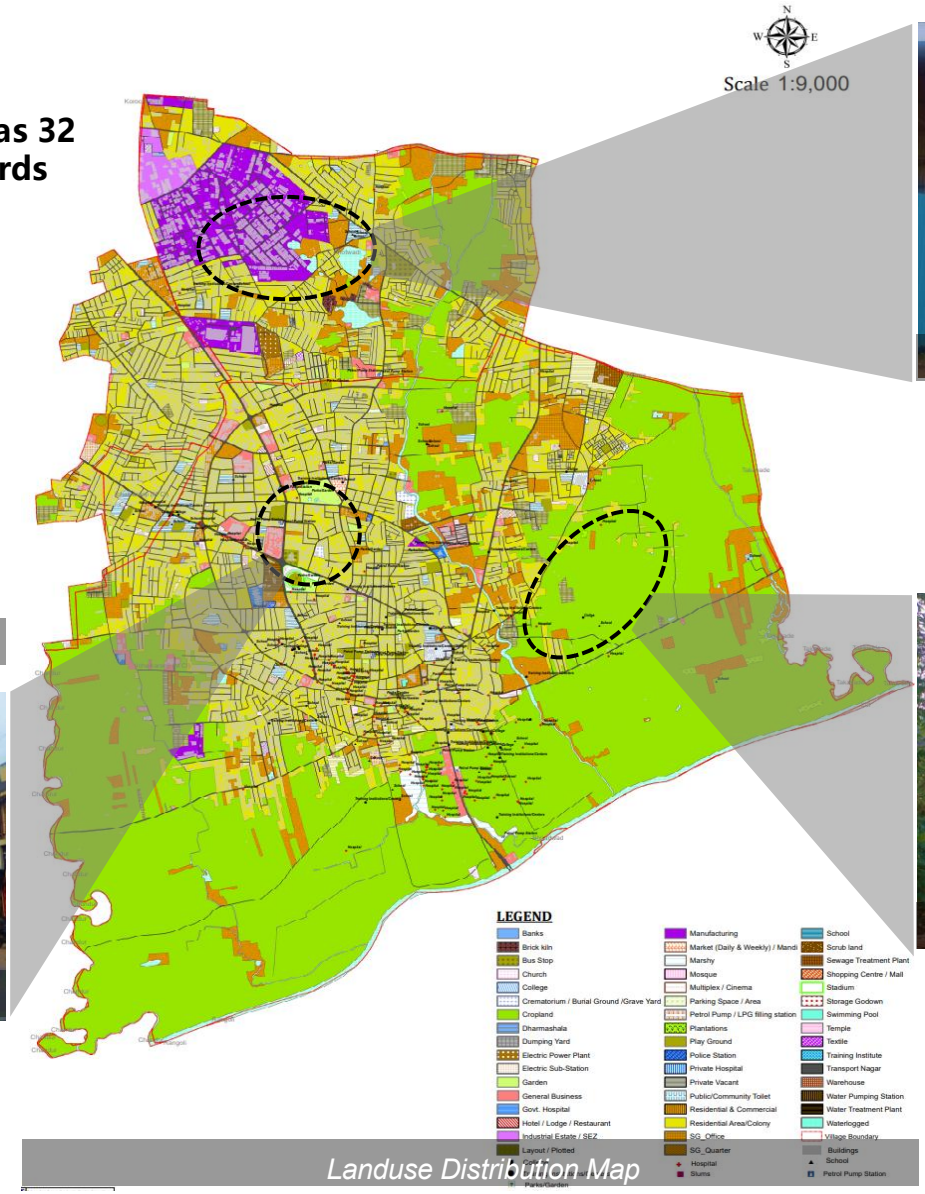


Ichalkaranji city has 32 administrative wards

Ward Map

CBD area for Ichalkaranji

Core city is **densely populated** with **mix** of residential commercial **areas**. There are trees for green cover



Landuse Distribution Map

Indsutrial areas (textile, power loom, etc)

The **textile**, handloom and power loom **industry**, has led to **strong road network** connectivity leading to urbanization.

Agricultural development on the southern side

Important place in urban development of **western Maharashtra**. The fertile soil makes **rice** and **sugarcane** as major crops. The agricultural area is developed is towards Panchganga river in the south.

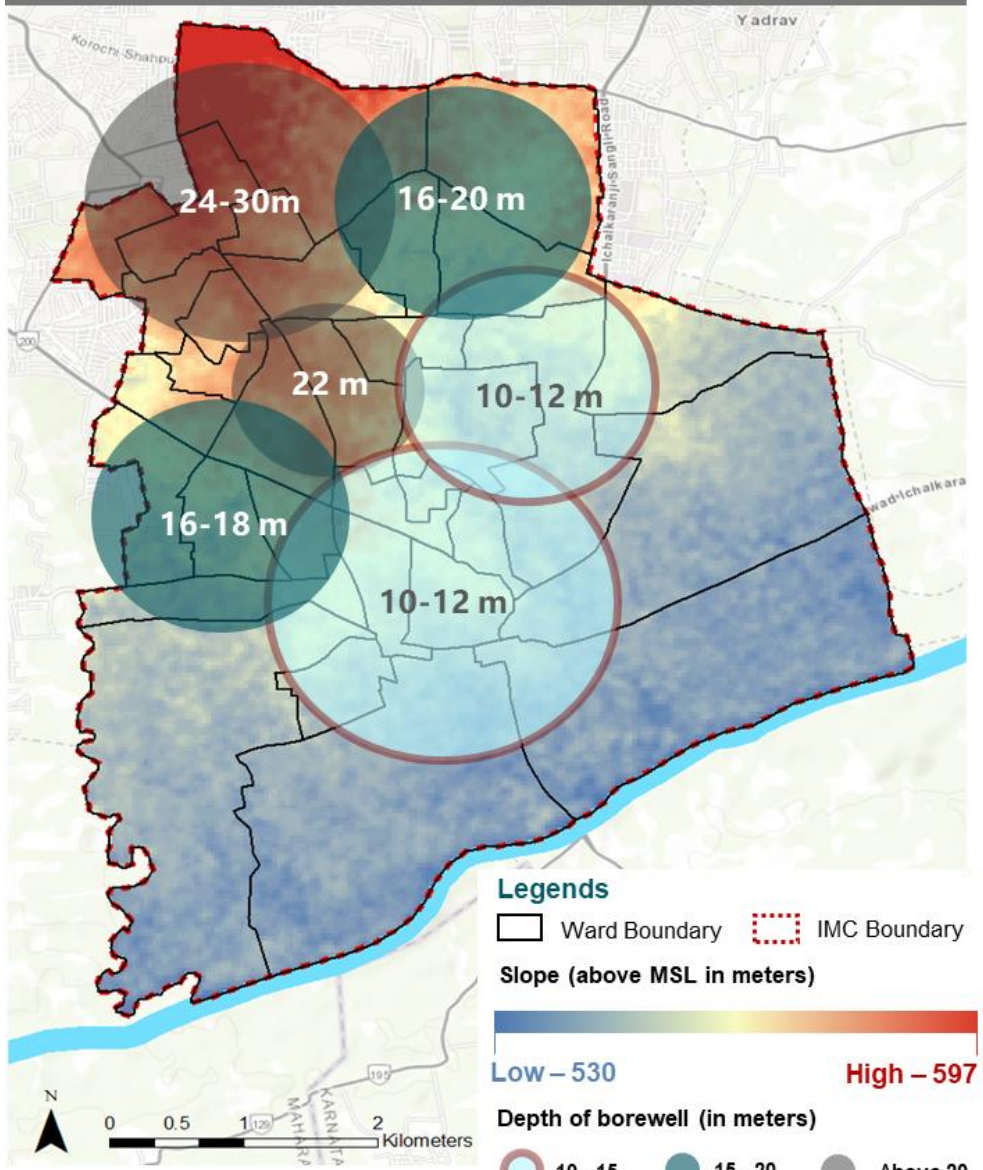
Source: IMC and primary survey

Human-Driven Changes and impact: Ground water depletion due to increasing number of borewell and groundwater extraction in the city

- There are more than **800 borewells** within the city, out of which **381** are equipped with **online operating systems** and meters for remote monitoring **by IMC** staff.
- **Ground water table levels** vary from **10m to 30m.**
- Pollutants from textile industries into the nallahs and river has lead to increased ground water contamination.
- **Currently there are no permission or restrictions** on **setting** up of private **borewells**.

Borewells digging process and online borewell meters in the city

Map showing slope and depth of borewell within the IMC limit



Nature-Based Solutions (NbS) identified to address water security issues in the city

Rainwater Harversting

RWH at

- Household level
- Community level
- Public/ institutional level

01

Groundwater recharge

- Recharge structures at urban flooding spots
- Tubewells, percolation pits / wells that are revived/ recharged borewells revived/ recharged

02

Mini-piped water supply scheme

Last mile connectivity mini-piped water supply network with a major focus on setting up the community-level storage systems

03

Sponge park

A sponge park integrating rain gardens, bioswales, and retention ponds will be developed as multifunctional green infrastructure.

04

- **Assessments of WASH** in low-income areas including slums and assess the geo-hydrological features and Aquifers.
- Identify **suitable sites** for demonstration of pilots
- **Discussions with communities** and govt. stakeholders to identify and finalize locations
- **Community Handover** and Sustainability Plan for O&M

The solutions are backed by Community-Led Implementation and scale up approach

Financial Access Entrepreneurship Development for SHGs

1. **Assessments** around **Stakeholder Engagement** and **SHG Mobilization**

2. A **landscape assessment** to evaluate **financial products** from banks, MFIs, NBFCs) for credit to SHGs for NbS-related activities

3. **Training SHGs** on NbS orientation, Implementation and on operations and maintenance

Capacity building and Dissemination

1. **Tailored training** of city government officials, engineers and field staff on **execution and maintenance of NbS**

2. **Jal Sanraskhan Mela** (Water Conservation Fair) to **sensitize communities around NbS for Water conservation initiatives**.

3. **Preparation** of **technical manuals**, **standard operating procedures**, and monitoring guidelines

4. **Dissemination of demonstration** sites as live learning hubs, showcasing good practices through case studies and video and **facilitating peer learning**.

Scalability & Replication

1. **SOPs & technical manuals** for wider adoption

2. **Demonstration sites** as learning centers

3. **Convergence with government schemes** (SBM, AMRUT, NULM)

4. **Model** designed for adaptation in other cities

Baseline assessments conduced through Community engagements through WASH assessment and FGDs in vulnerable areas and slums

- WASH assessments **completed in all the 26 slums** of the city.
- This activity facilitated interaction with the **community to assess their understanding of water security** and their willingness to participate in related initiatives.
- The survey was conducted through **field visits, FGDs** with community members, youth groups, and SHG members.
- The assessments revealed **irregular water supply, long gaps between municipal water distribution cycles, dependence on shared or distant water sources, and non-functional sanitation infrastructure** in some settlements. Few cases of waterlogging during the monsoon was also observed.

Citywide Geotechnical study to access geohydrological features

- A citywide geotechnical study which would assess and analyse the **geohydrological features of the city** to formulate citywide strategies towards water security has been initiated.

- The study would include **aquifer mapping, ground water quality and quantity, recharge potential** and water balance etc.

- This would help to better understand the **groundwater conditions- its availability and sustainability , Aquifer characterization and for planning** and design of interventions pre and post monsoon was also observed.

- **Geotechnical feasibility assessments** for all **proposed RWH** and **GWR pilot sites** were **completed** before initiating the field work

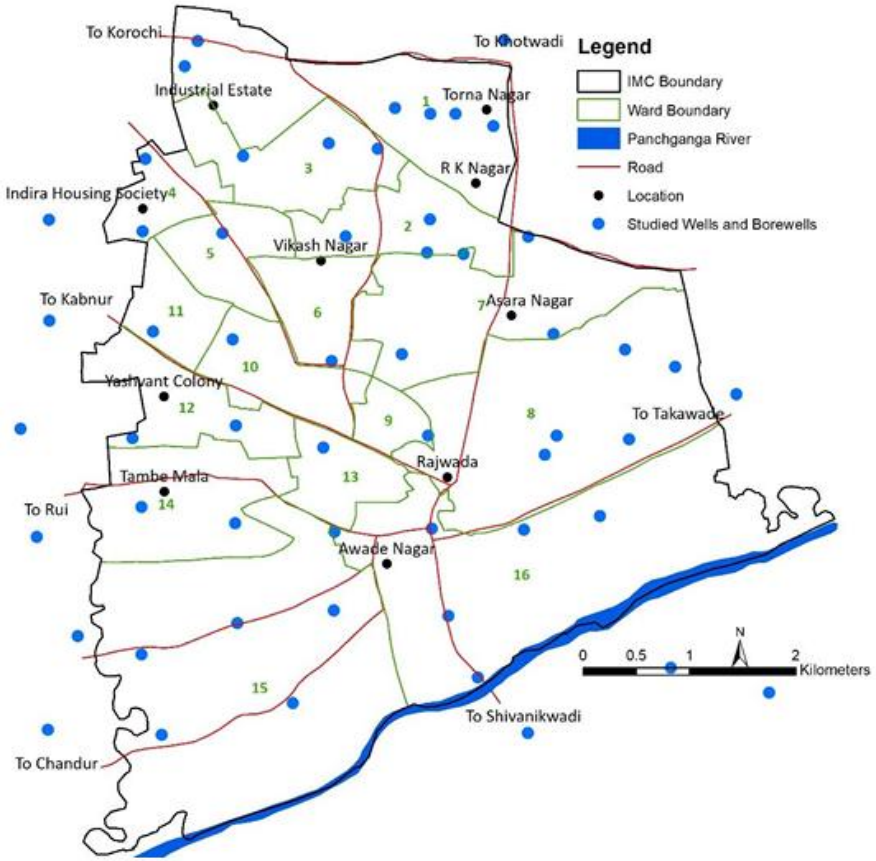
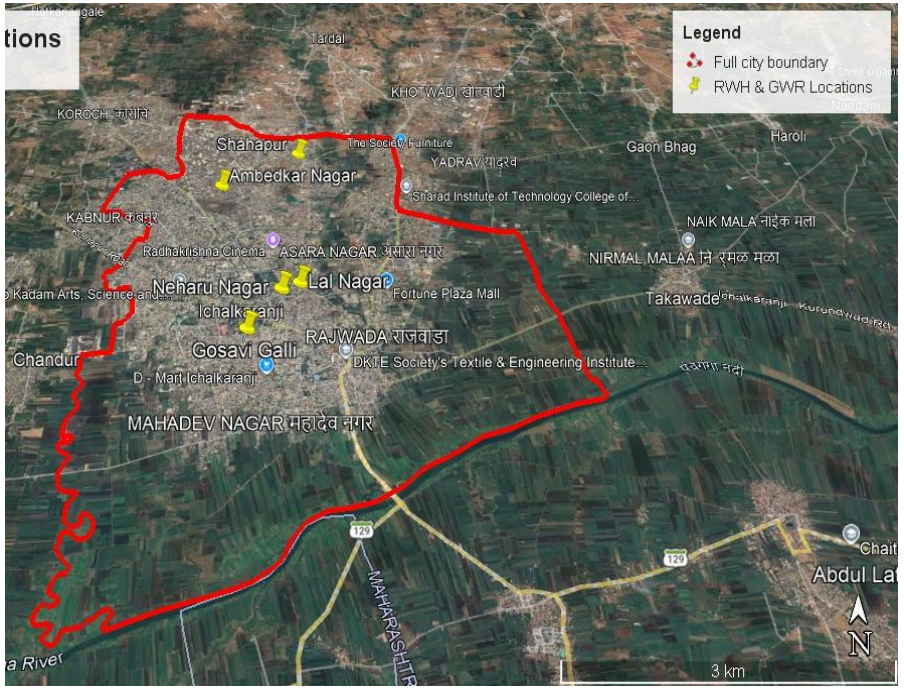


Fig. 5.2 Location of Studied Wells, Ichalkaranji City, Maharashtra

Pilot Demonstration of RWH-GWR structures in IMC schools and slum areas

- Based on the pilot site feasibility assessment, **RWH and GWR systems have been designed and implemented**.

- **Rainwater** from **rooftop** will be collected in the tanks and then would be **treated** through RO filters and through water dispensers it would be **available for consumption to vulnerable communities and IMC school children.**



Pilot site RWH – GWR demonstrations









Assessment for Sponge Park initiated

- **Sponge Park Planning:** After on field assessment of **all the 9 major IMC gardens** , a municipal garden named Bhagatsingh Garden has been finalized for the development of a sponge park to address **localized flooding and enhance groundwater recharge.**

- Multiple site visits were conducted with consultants, and the project concept, scope of work, and layout plans.

- Plan for exploring idea of a **rainwater theme park** which would have elements to showcase how a RWH structure works and what are the benefits etc

- **IMC's largest garden**, spread across 11.5 acres

- The **garden is maintained by a dedicated team of five full-time staff**, along with five additional staff members who visit daily for cleaning and routine maintenance.

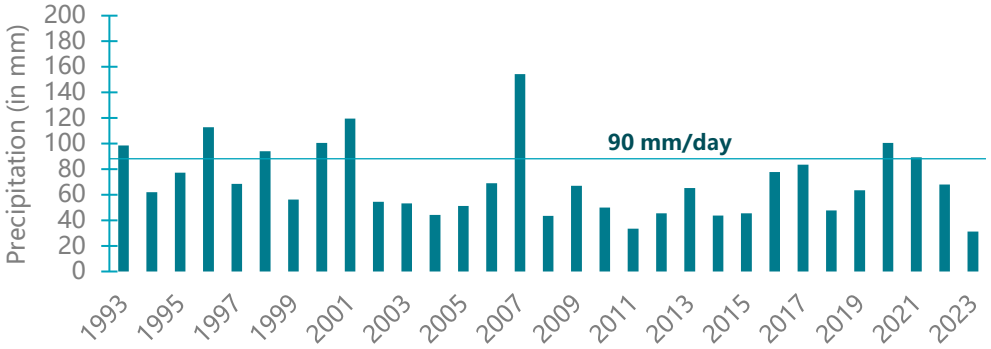
- The **garden** has **8 sheds for seating and children's play areas, along with 4 concrete structures** (Godown, Toilet & Washroom, Office, and Staff Quarters), together **covering an area of approximately 23,000 sq. ft.**

- **Daily Footfall:** about 1000 people

Modelling Rainfall and Flooding in Ichalkaranji for site feasibility

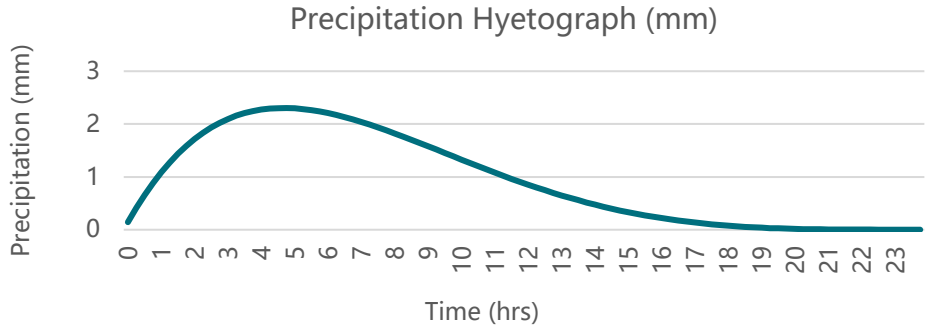
What amount of rain does the park need to handle?

Averaging the highest daily rainfall in the past – 90 mm/day



Modelling the 90mm rainfall into a 24 hour storm distribution

Assuming a SCS Type II storm distribution with 15 mins intervals. For this analysis we utilized a 5-year return period and used a point depth of 90mm. Using this data we modelled flooding on HEC-RAS as well as other inferences.



Maximum Precipitation Rainfall Data

↓

Finding point depth for different return period using Gumbel's formula

↓

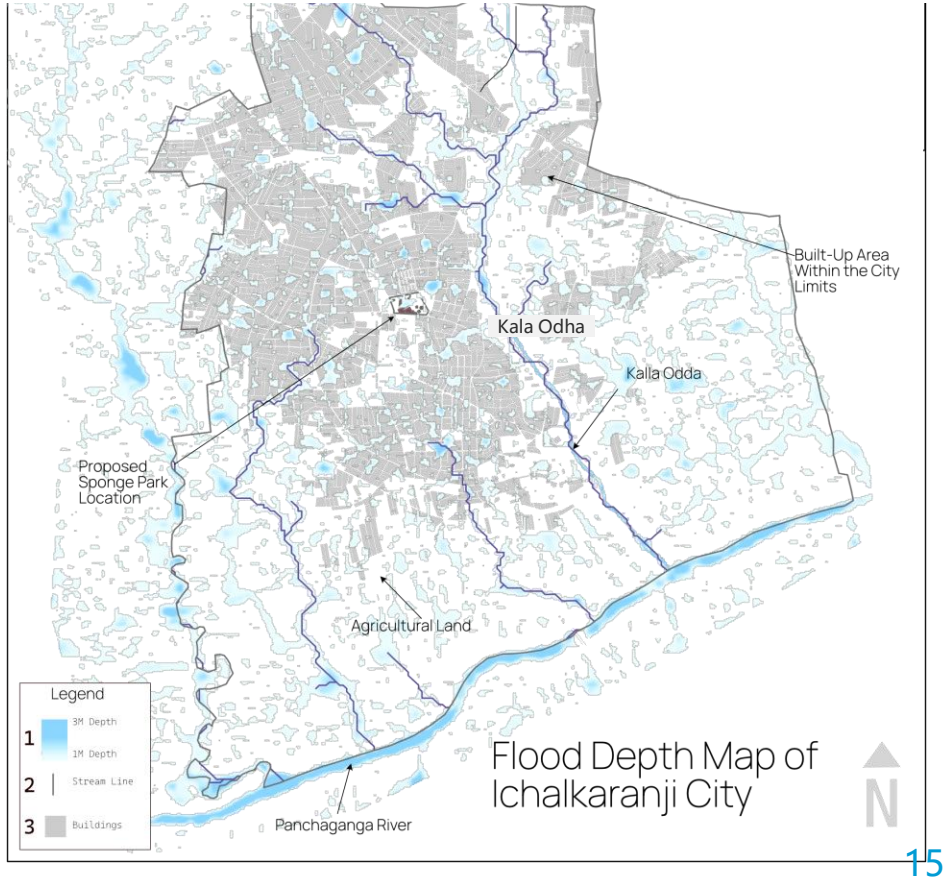
Modeling design storms based on point depth

↓

Building Rainfall Hyetograph through these models

Modelling flood depth based on max rainfall and storm distribution

Intensity of blue colour represents flood depth within the city for the scenario of a 5-year storm event which consists of a 90mm downpour within 24hrs. We can see **significant flooding besides the 'Kala Odha'.** We also notice significant flooding within low level agricultural zones of the city as well as small-scale water logging within the city.



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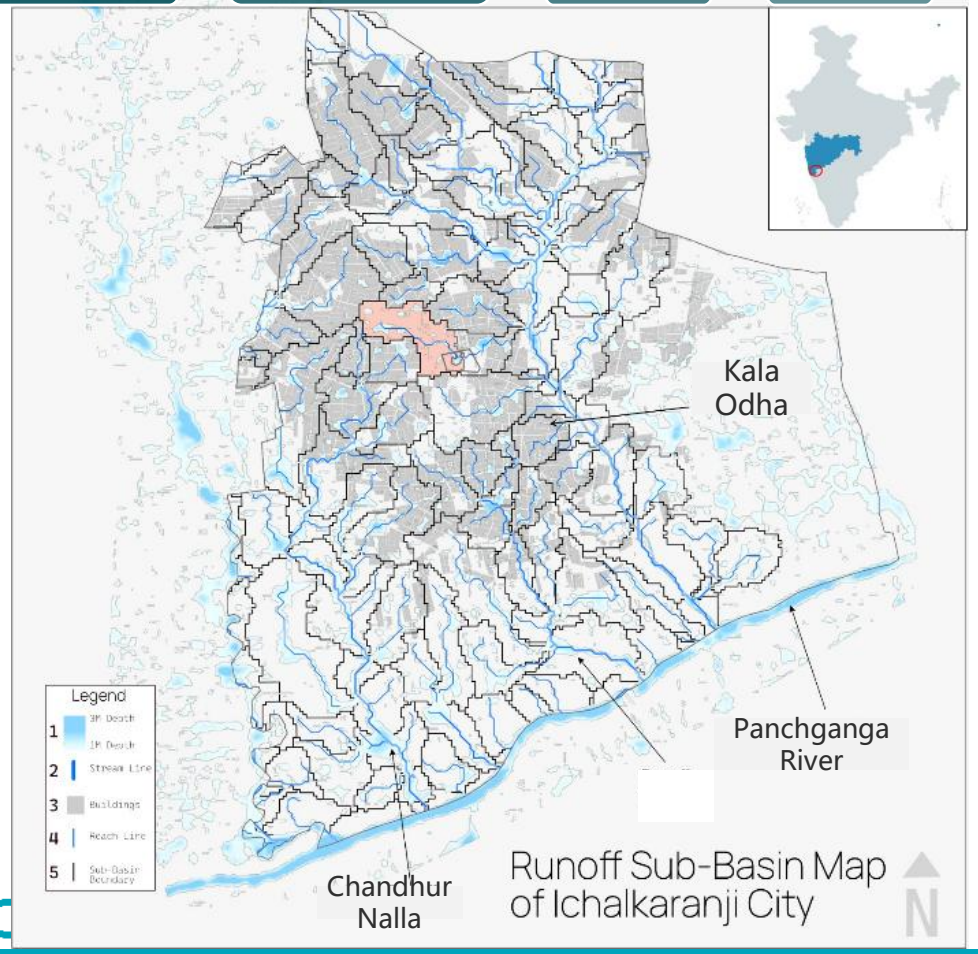
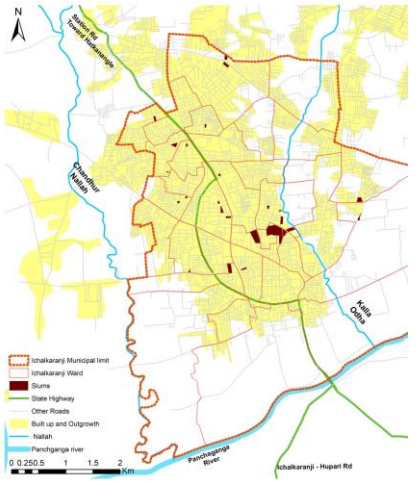
Local Catchment analysis for proposed sponge park site -Bhagatsingh Garden

Modelling natural runoff patterns

30 m Resolution CartoDEM import into HEC-HMS → Flow Direction, Flow Accumulation and stream Delineation Processed in HEC-HMS → Break point Insertion beyond city boundary → Processing Stream delineation on Flow accumulation



Stream modelling reflects the pattern observed on ground – noting the strong presence of **Kala Odha and Chandhur Nalla** as main feeders to Panchganga River

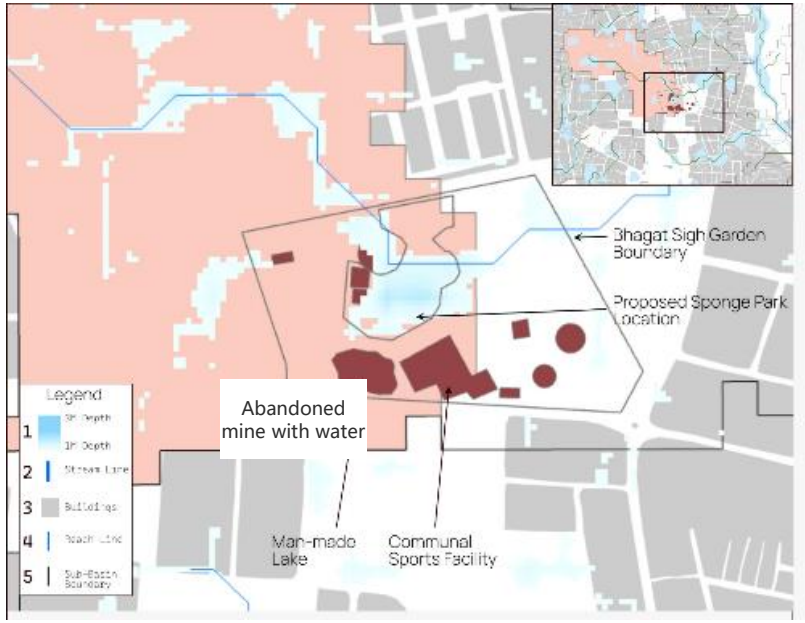


Zooming in on the runoff catchment feeding the selected park

Hydrological analysis showcases that runoff from the feeding sub-catchment, naturally passes through the garden plot area.

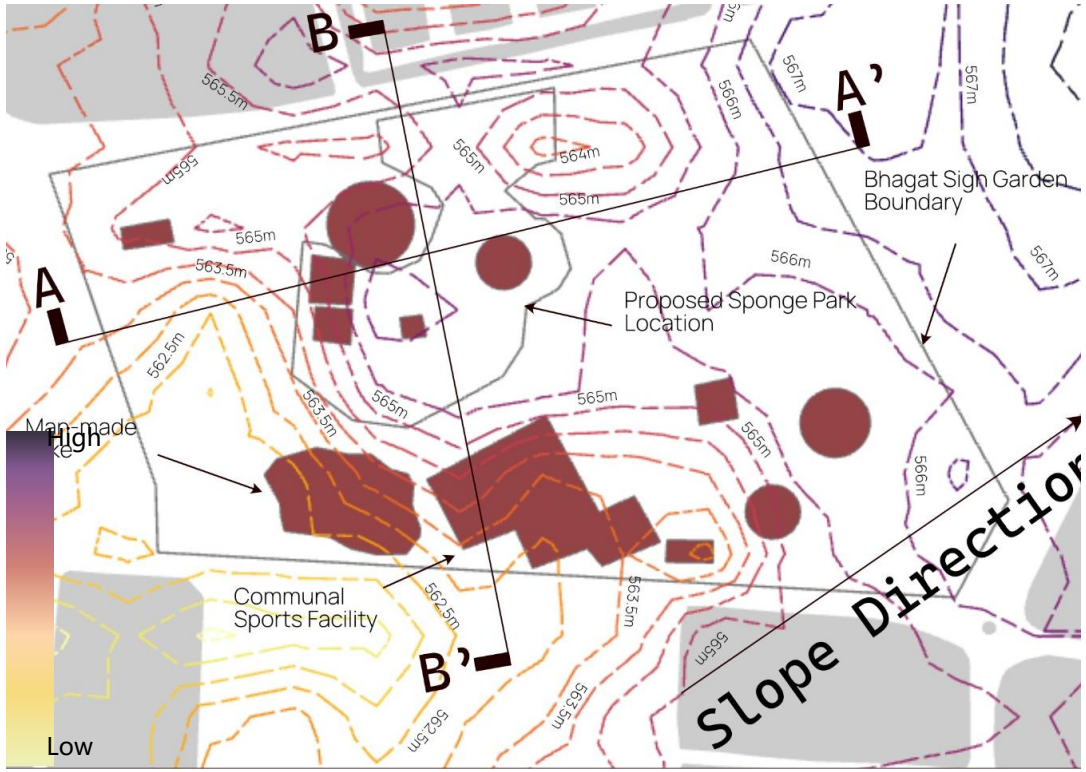
As garden plot has a **compound wall** and overlaying draingage network, the runoff is diverted.

Despite this, we see flooded locations inside the park, indicating that **sponge elements in this location will be beneficial**

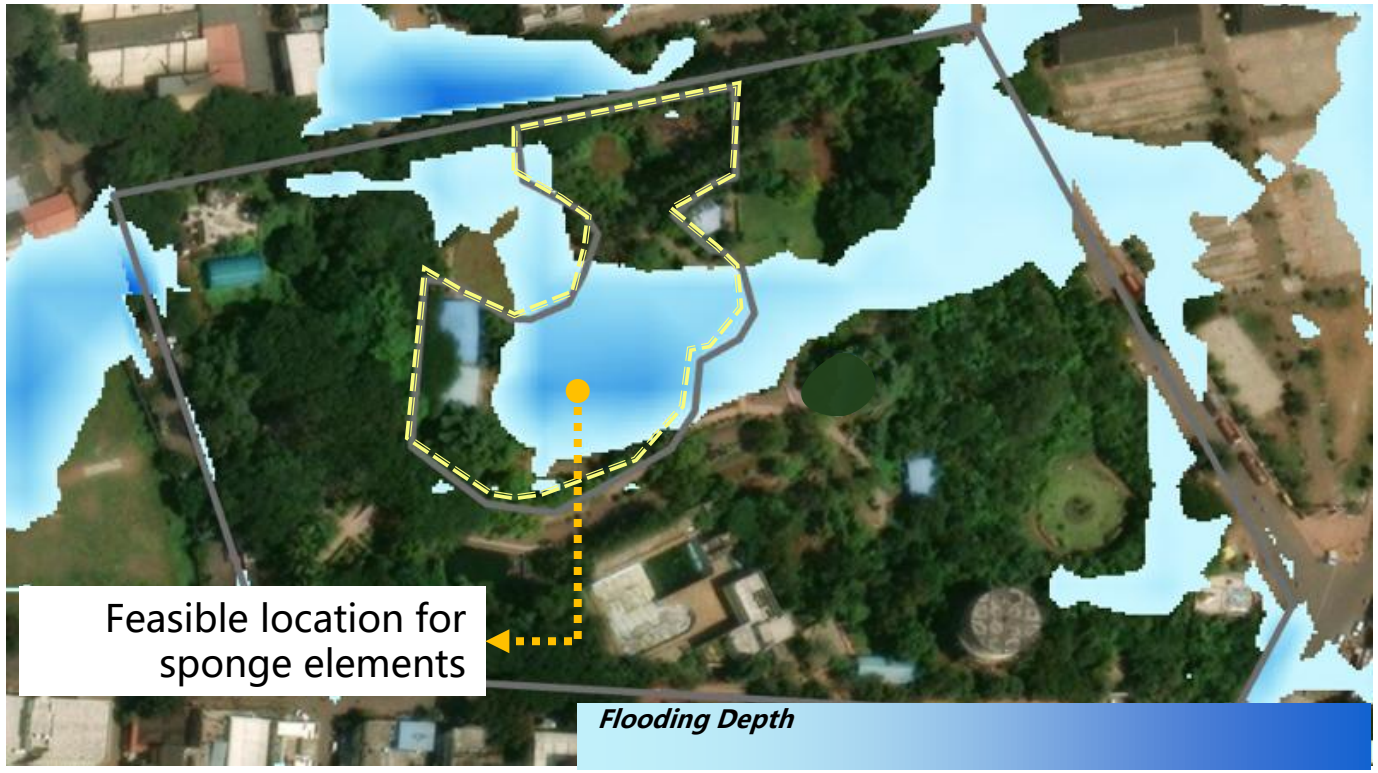


Topography Analysis inside proposed sponge park site - Bhagatsingh Garden

Contours within the garden area

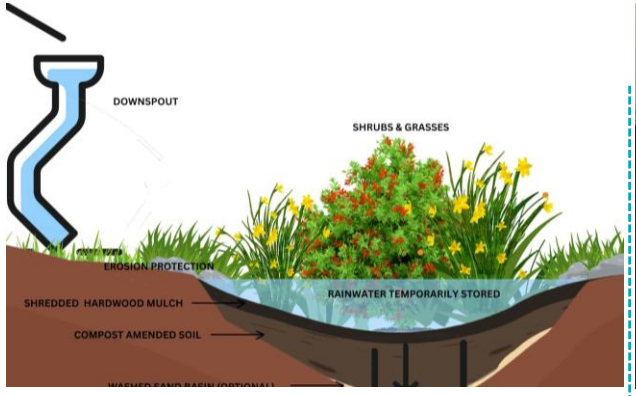


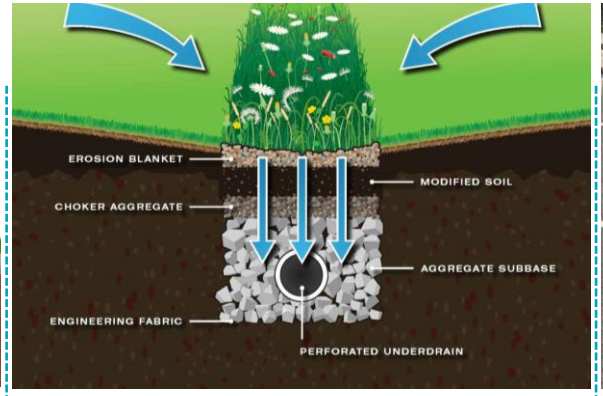
Feasibility of sponge elements

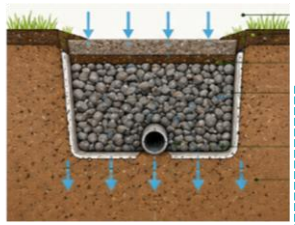


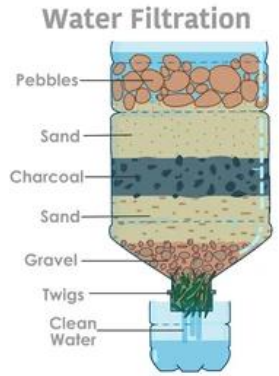
Garden is hydrologically isolated – only water from inside the boundary creates flooding.
Using contours, stream delineation, soil type and appropriate runoff constants it was calculated that the **proposed sponge elements should be able to handle upto 3.8 million litres of water on storm day**

Proposed elements of sponge park









Green Depressions / Rain Gardens

Shallow landscaped depressions designed to capture and temporarily store rainwater from surrounding areas.

They slow down runoff, reduce waterlogging, naturally filter pollutants, and allow water to gradually infiltrate into the ground while enhancing the park's greenery and biodiversity.

Bioswales

Vegetated channels that convey stormwater runoff across the site while slowing its flow.

As water moves through the swale, plants and soil filter sediments and pollutants, improving water quality and reducing the risk of flooding and erosion.

Infiltration Trenches

A combination of mulch, soil, sand, gravel, and stone layers that naturally clean stormwater before it infiltrates or is discharged.

These layers remove sediments and contaminants, improving water quality and protecting groundwater resources.

Natural Infiltration System

Underground gravel-filled trenches that temporarily store stormwater and allow it to slowly percolate into the surrounding soil.

They help recharge groundwater, reduce surface runoff, and alleviate pressure on conventional stormwater drainage systems.

Women SHGs have been formally engaged for managing Nature based Solutions (NbS)

- **Formal Contract signed with NULM SHG for maintenance of RWH-GWR pilots**: In order to ensure that community is engaged for maintenance of the pilot demonstration projects, NULM women SHGs have been formally engaged. Formal contract was signed between ERA Consultants and the SHG.

- **Community Engagement with SHG women:** Women SHGs were actively engaged during slum-level WASH assessments and FGDs. They showed willingness to get engaged

- **Financial Access and Linkages:** Preliminary discussions were conducted with SHGs, community members, and NULM officials to understand access to finance, willingness to take loans, and perceived risks.

Capacity Building and Community Engagements for Nature based Solutions (NbS)

- **335 citizens, women SHG members and school children** trained and oriented as part of capacity building and awareness generation activities
- **A capacity-building session** by the CWAS team, with support from the NULM department, oriented women SHG members on water security through RWH and GWR.
- **15 day on field hands on training** was conducted for the appointed women self-help group to build orientation and technical understanding of nature-based solutions, including GWR and RWH systems. The training covered aspects on basic understanding of the system/process involved, day-to-day operation and routine maintenance procedures, Safety practices and do's & don'ts during construction and operation
- On World Water Day 2026, CWAS, with IMC, conducted a **Drawing competition on water security** (RWH–GWR) around 300 students (Grades 5–7) participated, followed by a drawing competition and distribution of gift hampers.

Engagement with government stakeholders for sustainability of Nature based Solutions (NbS)

- Regular follow ups with updates and maintaining rhythm of engagement : **Based on the MOU between CWAS and IMC for the project, regular review meetings were held with IMC officials** across relevant departments, enabling close monitoring of project progress, timely decision making, and alignment on implementation priorities

- **Meeting with Mayor and IMC HODs** to orient them towards **water security and nature based solutions**

- **Meeting with IMC Commissioner with CWAS Leadership team:** The CWAS team presented updates IMC Additional Commissioner, along with a summary of the slum assessment. This was followed by visits to pilot sites, where key observations were discussed with contractors and IMC officials to improve project implementation.

Thank you

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cwas@cept.ac.in

cwas.org.in

About us

The Center for Water and Sanitation (CWAS) is a part of CEPT Research and Development Foundation (CRDF) at CEPT University. CWAS undertakes action-research, implementation support, capacity building and advocacy in the field of urban water and sanitation. Acting as a thought catalyst and facilitator, CWAS works closely with all levels of governments - national, state and local to support them in delivering water and sanitation services in an efficient, effective and equitable manner.

cwas.org.in

cwas@cept.ac.in
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