FACTSHEET

WATER AND WASTEWATER VISIONING FOR DENSE UNPLANNED URBAN SETTLEMENTS: A CASE OF SANGAM VIHAR, DELHI

About the Study

Aim

To provide improved water, sanitation and storm water management in large dense unplanned urban settlements: A case for inclusive water, wastewater and storm water infrastructure planning and execution.

Objective

- To understand the water, wastewater and storm water challenges of dense unplanned urban settlements
- Contribute to the Global South water sensitive cities framing

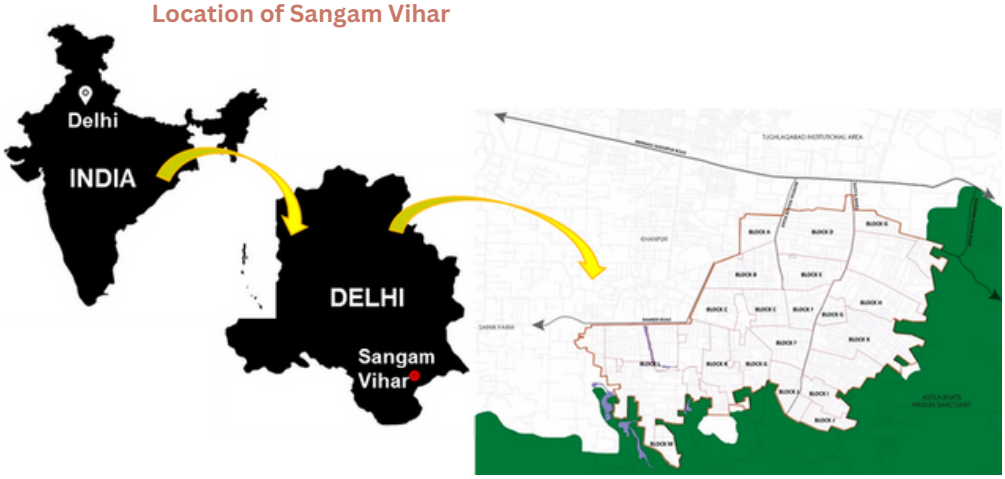
The study explores if retrofitting solutions for water supply, sanitation and storm water, is possible for dense unplanned settlements.

- The Economic Survey of Delhi 2021–22 estimtes that more than **30 per cent of Delhi's urban population resides in unauthorized colonies.**
- **1,800 Unauthorised colonies** with a total population of 40 lakh.
- Sangam Vihar is part of the 1,731 unauthorized colonies (affluent unauthorized colonies are excluded) in Delhi as per the gazette notification of October 29, 2019.

Sangam Vihar is located on the outer edges of the Southeast district of Delhi. There are no formal colony boundaries other than the electoral wards and the block-wise boundaries by SDMC and DDA.

Introduction to Sangam Vihar, Delhi

Location of Sangam Vihar



The 13 blocks of Sangam Vihar, have only two entry points - Ratiya Marg and Mangal Bazaar Road—that run north to south from the Mehrauli-Badarpur Road.

Retrofitting solutions of sewer and water lines are being done on these roads. It can take an hour to go from any location in Sangam Vihar to the major Mehrauli-Badarpur (MB) route during rush hours.

Why Sangam Vihar ???

- **Largest unauthorized colony in Asia**
- **To understand and address the water related challenges in such dense unplanned settlement**
- **Inadequate water supply and sewage network.**
- **Mere 15 minute moderate rainfall leads to flooding of the main road (MB) Road**

Study Area Profile

Sangam Vihar was established in 1979 and it is known to be the **largest unauthorized colony in Asia.**

Total Area: 5 sq.km
Total Blocks: 13
Total population: Approx. 10.3 lakhs
Total no. of HHs: Approx. 60,000

- *Majority of the **houses are self-owned** by the residents but are unauthorized constructions. Only a small fraction of the houses are rented, mostly by migrant workers.*
- *In few blocks the family size is greater than 10 which largely exceeds national average of 4.4 members per HH.*

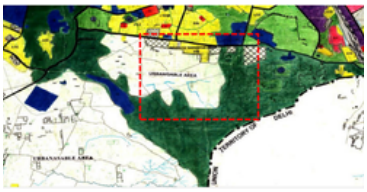
Evolution of Sangam Vihar

01

*The first Delhi Master Plan (1962) shows **Sangam Vihar as a forested area with a small habitation** (Deoli village).*
Early settlers of Sangam Vihar were labourers who arrived in Delhi from Uttar Pradesh, Haryana, Bihar and Rajasthan.

DELHI MASTER PLAN 1962

02



DELHI MASTER PLAN 2021

***Sangam Vihar colony was not demarcated under any land use** in the MPD 2021; it had been shown as **an urbanizable area,** which indicates that the area was available for development.*
However, as per the Zonal Plan, Sangam Vihar fell under residential-designated land use.

03

*In the Master Plan Delhi 2041, **Sangam Vihar colony has been demarcated as an unauthorized colony.***
*It can be seen in the map that **one-third of the area of Sangam Vihar has been built on forestland.***

DELHI MASTER PLAN 2041

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WATER

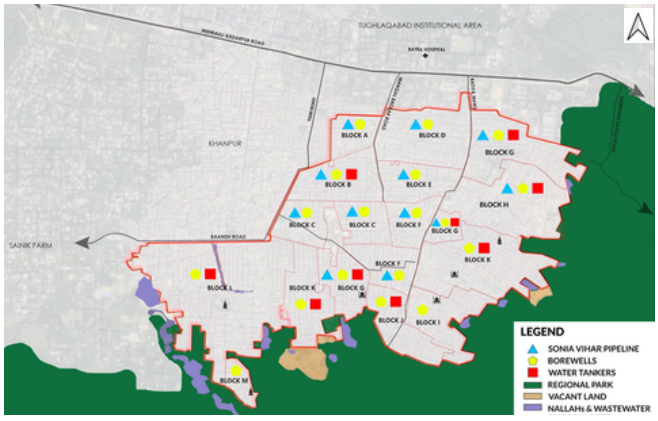
Delhi Scenario

- Water Demand: **1,380 MGD**
- Per Capita Water Supply as per MPD 2041: **50 GPCD**
- Water Supply Targest as per MPD 2041: **1,455 MGD**

Sangam Vihar Scenario

- Water Demand: **138.3 MLD**
- Avg. Per Capita Water Consumption: **45.39 MLD**
- Water Supply Gap: **92.9 MLD**

Water supply challenges in Sangam Vihar

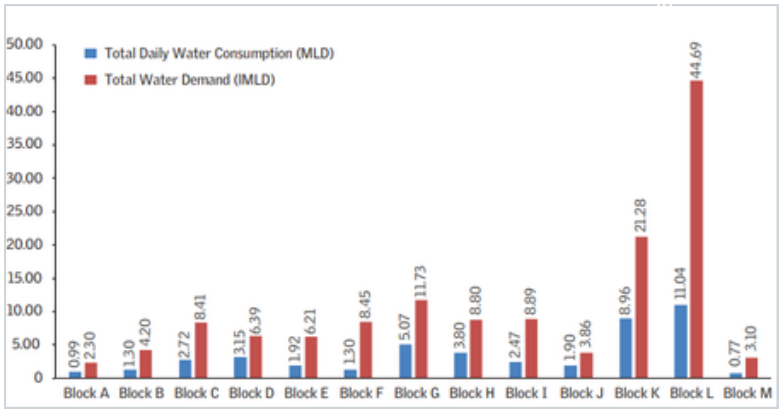


Source : Primary Survey,CSE

WATER SUPPLY SOURCES IN SANGAM VIHAR

- Majority of the **13 blocks are dependent on borewell-supplied water and water tankers.**
- For potable usage, **80% population** relies on the **purchase of bottled water**.
- Each HH invests in more than one storage tanks or large tanks of 2000 liters, and pump set.
- **Water mafia** exists in all the three water supply sources – Borewells, Tankers and Piped water supply.

WATER CONSUMPTION AND DEMAND (IN MLD)



Source : Primary Survey,CSE

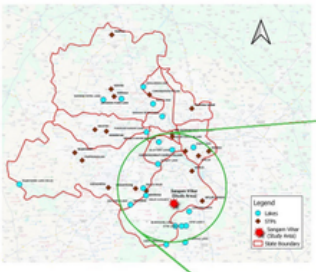
- **Water supply deficiency of Sangam Vihar is as high 67%** (as against a formal supply-norm of 135 lpcd).
- In larger blocks like block L where the population is high, this gap between total water demand and availability **is more than 3 times.**

Reimagining decentralized water supply and its urgent augmentation priority

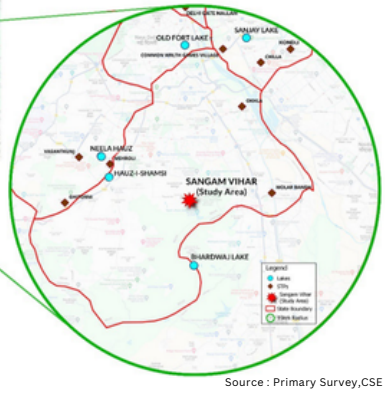
TOP PRIORITY WHEN ADDRESSING WATER-RELATED CHALLENGES

- Securing water quality
- Ensuring adequate supply of water for every household
- Providing Sonia Vihar pipeline and repairing the existing pipeline network to improve water pressure and water quality
- Ensuring affordability of water

STPs AND LAKES SURROUNDING SANGAM VIHAR



Map aims to locate areas from where the treated wastewater can be attained.



Source : Primary Survey,CSE

Lakes above 2 hectares can be used for recharge and water supply (with secondary and tertiary treatment) to nearby colonies, planned and unplanned.

This way Sangam Vihar water security can also be enhanced with an assured nearby water supply from recharged lakes.

*If **decentralized STPs** around Sangam Vihar are built, the treated wastewater and stormwater itself can be used to fill the existing waterbodies to recharge the groundwater, thereby assuring groundwater supply for non-potable purposes*

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WASTEWATER

Delhi Scenario

- Estimated total wastewater generated in Delhi: **792 MLD.** Only 617 MGD is treated.
- The treatment capacity of 617 MGD capacity is not fully utilized as **only 458.75 MGD of wastewater actually gets treated**
- Sanitation services in informal settlements of Delhi are largely through community toilets.
- Delhi **reuses 12 %** of its generated wastewater.

Sangam Vihar Scenario

- Estimated total wastewater generated in Sangam Vihar is **36 MLD**
- Total black water generated is **9.08 MLD** Total grey water generated is **27.23 MLD**
- There is **no community or public toilet** in the 5 sq. km of dense settlement.
- **Non-sewered sanitation systems** dominate all the 13 blocks .

Wastewater challenges in Sangam Vihar

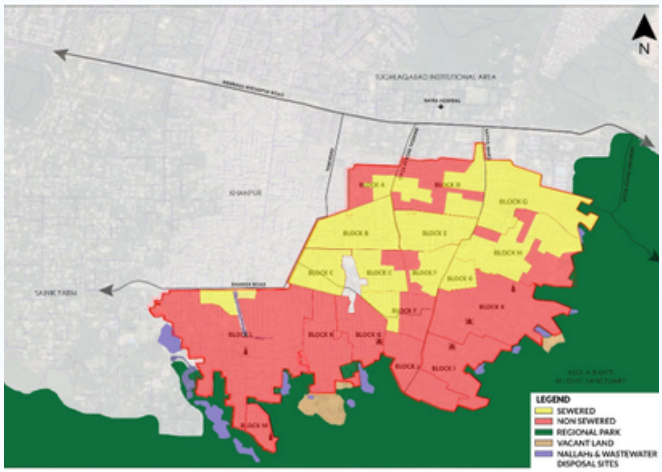
- Sewer line in only a few blocks of the settlement (See map)
- People are dependent on **on-site sanitation** systems. More than **70% of the septage holding tanks have unlined bottoms**, allowing for increased soaking.

- Frequency of desludging varied from **six months to three years.** However, some residents informed that it is **emptied only when there is a blockage, backflow or overflow issue.**
- Desludging is done by private desludgers who charge Rs1000/2000 per trip.

Source: CSE

Sewage channels discharging into plots of land

SEWER LINE COVERAGE IN SANGAM VIHAR



Source: Primary survey by CSE in February 2024

Reimagining sanitation systems—combining centralized and decentralized sanitation systems

A combination of **centralized (retrofitting with existing infrastructure) and additional decentralized** sanitation systems is required

- DJB should consider **alternative decentralized STPs** in the periphery of Sangam Vihar instead of trying to cover the entire Sangam Vihar with the sewerage system
- The sewerage system can be designed to take all the grey and black water, estimated at more than 25 MLD at the current low per capita supply, to at least three to five decentralized STPs in the southern periphery.
- This will provide treated wastewater that can serve as a valuable blue resource to **recharge small waterbodies** around Sangam Vihar, contributing to **groundwater recharge** and its use in the settlement.

Together, one half of Sangam Vihar connected to the existing sewerage system and another to a decentralized system, will ensure a safe, sustainable and climate-risk-proofing water and sanitation solution.

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STORMWATER

Delhi Scenario

Delhi has a total of **426.55 km natural drainage** lines and about **3,311.54 km of engineered stormwater drains** which are managed by 11 different agencies.

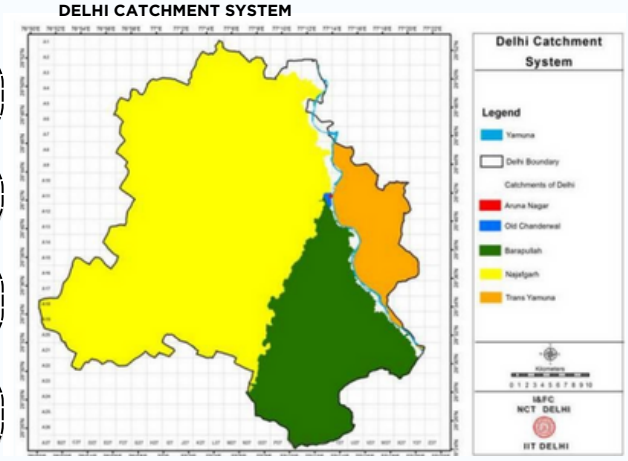
Delhi's **average annual rainfall is 774.4 mm**. However, rainfall in Delhi can vary from year to year

Every monsoon, even during moderate rainfall, the city faces **urban flooding**. PWD estimates that the old drainage system can accommodate 50 mm of rainfall only.

According to DJB , at present **81% of Delhi is covered under Sewerage system**. In the remaining 19% of the area including 1,800 unauthorized colonies, **network is being extended** in a phased manner.

The groundwater table is **40 m below ground level** in as much as 30% of the city.

DELHI CATCHMENT SYSTEM



Divided into three basins: Barapullah, Najafgarh and Trans-Yamuna , Najafgarh IS the largest one.
The study area lies in the Barapullah basin.

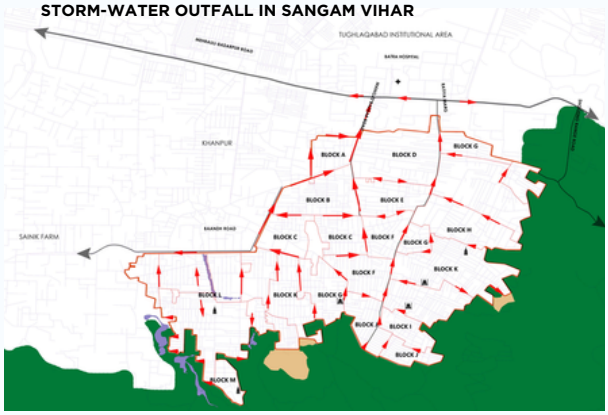
Sangam Vihar Scenario

Almost all of the households in each block **rely on a combined drainage system** for storm water and grey-water discharge.

The drains found in Sangam Vihar are constructed **open drains (92%)**

In more than **80% of Sangam Vihar**, it takes **30 minutes to three hours** for stagnant water to be **drained away** from the streets after heavy rainfall

STORM-WATER OUTFALL IN SANGAM VIHAR



Stormwater Challenges in Sangam Vihar

- **Drains** in most part are **not well maintained or frequently cleaned** by the MCD
- **Chocked drains due to dispose of solid waste**, and at times they are encroached by HHs.
- A 15 minute moderate rainfall leads to flooding of the main MB Road as the slope is in one direction (see map).
- **90% area is paved, reducing the infiltration rate**, and generating more surface runoff.

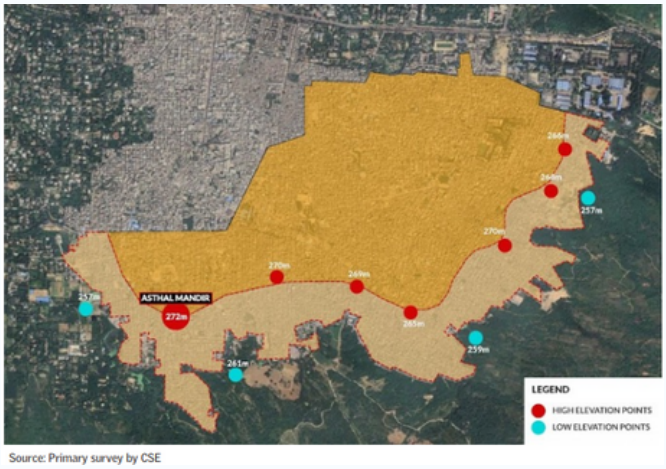
Addressing urban stormwater management for both recharge of groundwater and for discharge, to prevent in-situ urban flooding

Channelling and redirecting internal sewage and storm water, on the periphery of Sangam Vihar (where sewer lines have not yet come) to at least four decentralized STPs can offer a long-term sustainable, climate-proof and equitable solution.

Treated wastewater from the decentralized STPs will help in recharging groundwater and improve water security of Sangam Vihar by diverting the water to shallow waterbodies, **reducing flooding risk** on the MB Road and also **reducing the risk of breakdown of the retrofitted sewer lines.**

This approach would **alleviate pressure on MB Road infrastructure** and effectively address the management of total wastewater and storm water in Sangam Vihar.

HIGHEST ELEVATION POINTS IN SANGAM VIHAR



Source: Primary survey by CSE