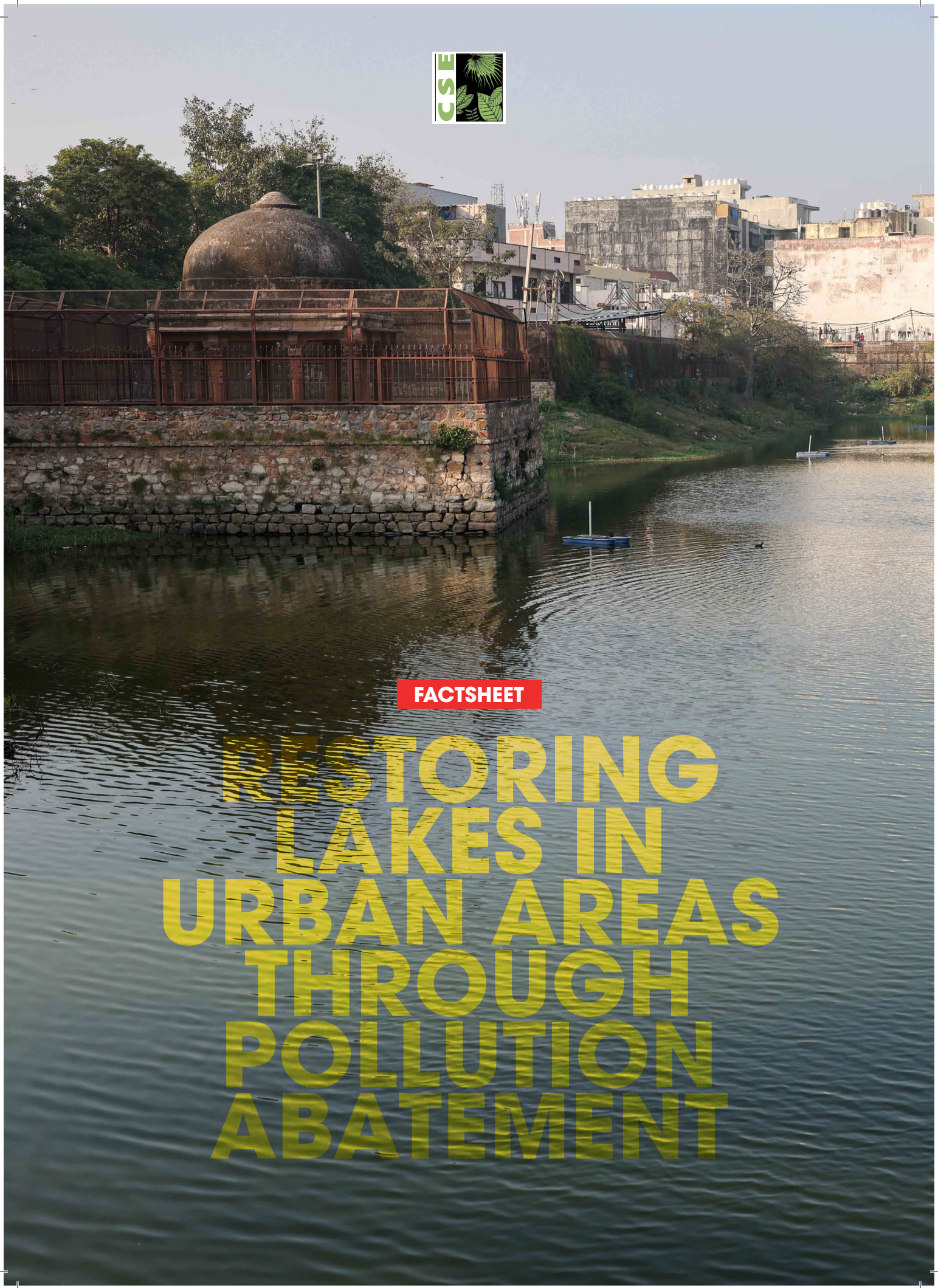

FACTSHEET

RESTORING LAKES IN URBAN AREAS THROUGH POLLUTION ABATEMENT

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INTRODUCTION

Unplanned urbanization and changing rainfall patterns due to climate change are drying up lakes globally and choking them with pollutants. Eutrophication, the process of excessive plant growth in polluted waterbodies, has become common in urban lakes due to outbreaks of cyanobacteria (blue-green algae), impacting the colour of water and producing severe odour.

Urban areas face the challenge of uncontrolled wastewater and faecal sludge entering the lakes. Nitrogen and phosphorous enter waterbodies due to the free passage of wastewater and raw sewage.

What is the solution? An integrated management system for the catchments and the lakes is required for reducing phosphorous and nitrogen in lakes. The solution has to be problem-centric and cost-effective, and not harm downstream ecosystems. One solution cannot fit all—the hydrogeology, physiography and soil must be considered in the restoration plan. The restoration process will be sustainable if there is a close-knit relationship between environmental, social, political and economic sectors.[1]

Many large cities in India have failed to sustain healthy waterbodies post-restoration. The main reasons are lack of funds, capacity and community disconnect. Pollution abatement in lakes has been found in only a handful of lakes. In the name of restoration, the main activity has always been deepening and desiltation of waterbodies and removal of weeds. No attention is given to catchment restoration or managing wastewater entering lakes. Even sustainability of lakes has not been taken care of in most cases.

METHODOLOGY

This factsheet is a collation of a few success stories across different hydrogeological areas, analysed to develop an agenda for protecting urban lakes and/or ponds. A team from the Centre for Science and Environment (CSE) travelled to eight states, namely Delhi, Haryana, Uttar Pradesh, Maharashtra, Tamil Nadu, Madhya Pradesh, Odisha and Telangana, and surveyed on the ground around 50 waterbodies in the large cities of the states. The spread of lakes and ponds covered the Gangetic plains, Deccan Plateau and coastal plains.

The CSE team studied the history of challenges, restoration, involvement of the communities, source of funds and impacts brought in post-restoration. This helped the team understand what worked and where. The team has also tried to map the plan for sustainability for the change (see *Table 1: List of lakes and ponds surveyed across different terrains*).

Table 1: List of lakes and ponds surveyed across different terrains

State	Number of waterbodies checked	Type of terrain
Delhi	16	Alluvial plain
Haryana	4	Alluvial plain
Uttar Pradesh	2	Alluvial plain
Madhya Pradesh	3	Deccan Plateau
Maharashtra	6	Deccan Plateau
Telangana	4	Deccan Plateau
Odisha	5	Coastal plain
Tamil Nadu	10	Coastal plain
Total	50	

Source: Compiled by CSE

SUCCESS STORIES

A. ALLUVIAL PLAINS

Case study 1: Hauz-i-Shamshi, Mehrauli, Delhi

Centuries-old traditional waterbody revived—government agencies and non-profit come together

Hauz-i-Shamshi is an 800-year-old waterbody. It was once a thriving 13th-century reservoir that sustained the people of Delhi and supplied water as far as Tughlakabad Fort. Unchecked urbanization, years of apathy and influx of wastewater turned the historic lake into a polluted pond. Its catchment was encroached upon, natural inflows were blocked, and the wetland ecosystem collapsed.

Intervention

Year of intervention: 2021

What has been done to restore the lake health?

SEEDS (Sustainable Environment and Ecological Development Society), a New Delhi-based not-for-profit; Archaeological Survey of India (ASI); Municipal Corporation of Delhi (MCD); and agencies such as the Delhi Jal Board, Jal Shakti Mission and Namami Gange have started to revive the glory of Hauz-i-Shamshi with Corporate Social Responsibility (CSR) funds from IndusInd Bank Foundation.

The process began in 2021 when a Detailed Project Report (DPR) was made by SEEDS. It assessed the lake's hydrology, ecology, pollution sources, catchment degradation and encroachment. It started working on a community-driven rejuvenation model. The implementation process started in 2023, when the lake was desilted, bunds were recreated and strengthened to reduce bund erosion. The sewage was diverted to nearby sewage lines. The waterbody was de-weeded.

Leaking sewage, multiple entry points and dumping of solid waste posed major challenges in the restoration process.

Temporary repairs collapsed, and the lake reverted to the original condition.

Installation of a constructed wetland system (CWS) and floating bio islands were the two major initiatives that addressed the issues; these interventions were in line with the Delhi Jal Board's guidelines. The CWS used natural wetland functions to treat water contaminants, significantly reducing BOD, COD, nitrogen, phosphorus and suspended solids. Floating bio islands addressed waterborne pollutants by mimicking natural floating islands to reduce suspended solids and organic carbon.

SWATI BHATIA, CSE

Floating islands within Hauz-i-Shamsi help clean the lake.

SWATI BHATIA, CSE

Migratory birds have begun to visit Hauz-i-Shamshi

The restoration adopted an integrated approach. Awareness-generation programmes were implemented to sensitize children and communities around the pond. Community engagement included forming maintenance groups and conducting educational activities for students, supported by a local-community committee, the Pride of Shamsi, which looked after the lake. Protective measures such as fencing, solar-powered aerators, and signage were introduced, contributing to the project's success in promoting environmental sustainability and community ownership.

These measures have reduced dumping of solid waste into the pond. The water is clearing up, and many local and migratory birds are returning to the restored wetland.

Impact

Clean water in the lake, which has also brought back migratory birds and is sustaining borewells in nearby areas.

The Pride of Shamshi committee is actively engaged in looking after the lake.

Case study 2: Wazirabad Lake, Sector 53, Gurugram, Haryana

Using CSR funds to revive a lake that had turned into a cesspool

An 18-acre lake received the wastewater flow from surrounding high-rise buildings and malls. Initially, the lake received inflow of rainwater and runoff from the Aravallis, which is now hindered due to encroachment and concretization in the catchment area with development projects. The lake began to degrade due to the mad rush of urbanization in the catchment as well as the lakebed until it was reduced to a drain. The outflow was blocked and thus the lake was only a receptacle of stagnant wastewater, with huge dumps of construction debris around the lake periphery. It was full of water hyacinth.

RESTORING LAKES IN URBAN AREAS

Intervention:
Year of intervention: 2022

What has been done to restore the lake health: The project for restoration of the lake was taken up in three phases by Sustainable Environment and Ecological Development Society (SEEDS), India (a Delhi-based non-profit,) with the CSR funding under an MoU signed with Gurugram Metropolitan Development Authority (GMDA). Shri Subhash Yadav, former Additional CEO, GMDA, was actively involved in the initiative.

The work of restoration was done in three phases. Phase 1 involved cleaning and development of a park to create a community space, which was subsequently used as a space to make the community aware about pollution of the lake, remove encroachment and actively partner in the restoration and maintenance work of the lake. In Phase II, a part of the lake was revived, which involved managing the rainfall runoff from the Aravallis to reduce flooding in the area, improve the quality of water through bioremediation and other steps for beautification, including cleaning and desilting of lake, planting native species on the lake side, removing hyacinth etc. In Phase III, the remaining part of the lake was revived, and sustainability aspects were worked on.

The apartments and malls in the vicinity were required to adhere strictly to the notification and were asked to release only treated water. Apart from this, GMDA also made arrangements to transport treated wastewater to the lake as a water source. As the lake's pH improved, the water hyacinth issues also decreased. Around Rs 2.2 crore was spent to restore the lake. The lake was revived using CSR funds from Ingersoll Rand.

Impact
Reduced waterlogging, improvement in micro-climate around the lake, and increase of property values as the area became clean. Flora and fauna became visible in the lake again. The local people also talk about sustaining groundwater levels in the borewell.

The plan for sustainability is under preparation. Currently,

SWATI BHATIA, CSE

Clean water can be seen in Wazirabad Lake; communities assemble around the waterbody daily.

the apartments and malls around the lake are not allowed to discharge untreated wastewater into the lake. Over and above this, a 2019 notification from the state of Haryana mandated that only treated water can be released into the waterbodies. GMDA ensured that only treated wastewater fills the lake. Awareness drives have been conducted by the department to make the communities around the lake aware about the water quality in the lake. If there is any dumping of waste in the lake or adjacent area, the communities connect with the department.

Case study 3: Brookfield pond, 95 BSF, Gurugram, Haryana

Multiple owners of the waterbody came together to restore lake

Brookfield pond, almost 0.5 acres in area and located in 95 BSF, Bhondsi, Gurugram, lies under the jurisdiction of the Municipal Corporation Gurugram. Ownership of the land is under the are under the jurisdiction and stewardship of the Border Security Force (BSF).

The pond was severely polluted as untreated sewage entered the pond. A 50-KLD sewage treatment plant (STP) existed in the vicinity of the pond, but was dysfunctional. Due to continuous wastewater exposure, the soil in the area around the waterbody was degraded. The area would be waterlogged even after a small shower as the waterbody could not absorb the extreme event. The pond embankments

were eroded due to unregulated vegetation. The pond turned into a cesspool.

Intervention:
Year of intervention: 2022

What was done to revive the health of the pond:
Abhipsa Foundation's WeForWater initiative in partnership with GuruJal, a Gurugram-based non-profit, transformed the site in 2023, with a comprehensive restoration project designed using principles of a nature-based system and launched after securing formal approvals from BSF authorities.

The transformation began with excavation, site demarcation and reconstruction of the long-defunct 50-KLD wastewater treatment plant (WWTP). The old plant was replaced with a nature- and gravity-based decentralized wastewater treatment. The anaerobic baffled reactor (ABR) of the previous treatment system was physically intact. The implementation team thus decided to reuse the same system rather than constructing a new one, thus saving time, space and money.

The old ABR was cleaned and repaired. This was followed by a constructed wetland so that wastewater flowed through the ABR and constructed wetland, was treated and discharged into the pond. A separate arrangement was made for entry into the pond. Apart from this, the pond was desilted, and geo-choir mats were used to stabilize the slopes. Landscaping was done and a walking path was made around the pond. Proper fencing and boundaries were provided for safety. An automatic water-level recorder was installed to monitor groundwater levels around the pond. Water quality was tested before and after the implementation to set a baseline for monitoring data to measure performance. Around Rs 31 lakh was spent to revive the pond.

The treatment system has a capacity to treat 50 KL per day of wastewater, and this volume of water fills the pond every day. The project also considered an O&M cost of Rs 10–12 lakh for algae control, sludge management, wetland upkeep, water testing, vegetation management and regular monitoring.

Case study 4: Shaheed Ahlawat pond, BSF campus, Gurugram, Haryana

Multiple water challenges sorted through lake restoration

Another pond, the 0.4-acre Shaheed Ahlawat pond on the BSF Bhondsi Campus, Gurugram, was revived through a similar collaborative effort of GuruJal; Xebia, a Netherlands-based not-for-profit; and the Border Security Force (BSF), utilizing nature-based solutions (NbS) to rejuvenate a dry pond and establish a sustainable, decentralized wastewater treatment system.

The restoration of the Shaheed Ahlawat pond project addresses multiple challenges of both water conservation and sanitation. Three public toilets are located near the pond, the wastewater from which was being discharged into a septic tank. BSF had to continue constructing several tanks to avoid spilling of wastewater into nearby areas, but the exercise of constructing innumerable tanks became a tedious process. Hence new ideas were invited from GuruJal to manage the wastewater.

Intervention

Year of intervention: 2025

What was done to improve the health of the lake:

The existing septic tank connected to the public toilets was converted to a biodigester, which was then connected to a root zone treatment system, a polishing pond, and then to a spillover pond to oxygenate the water and facilitate the UV treatment. The pond was at a specific distance from the treatment unit, so to channelize the water to the pond, a bioswale—a shallow trench with gravel and nutrient-absorbing plant species through which water flows, thus ensuring further removal of residual nutrient and pathogens that remained after treatment—was created. The treated water then recharges the pond. The treatment plant could treat 75 KLD of wastewater per day.

The pond was also fitted with a rainwater harvesting system, which collected rainwater from 233 sq. m of rooftop area. Two gully plugs, with a combined holding capacity of

390 KL, were constructed, which channelize runoff water from the nearby hill area of 16,532 sq. m.

The soil in this region is unstable, and a challenge to stabilize. Also, the gully plugs are degraded by mice and porcupines in the area. Thus while maintaining the soil remains challenging, the implementation team expects to reduce the net effective pressure on the soil by channelizing storm water through gully plugs and the rainwater harvesting system and reducing the flow of water.

The area around the pond was also transformed into a multifunctional community space. Landscaping efforts prioritized the plantation of native species—such as *Butea monosperma*, *Acacia catechu* and *Prosopis cineraria*—to restore the natural balance, reduce erosion and support local fauna.

SOURCE: GURUJAL

Shaheed Ahlawat pond pre- and post-restoration

BSF cadets clean the pond regularly and maintain the water quality in coordination with GuruJal.

Case study 5: Dhankot pond, Gurugram, Haryana

Small pond restored to solve the waterlogging issues of the area
Dhankot pond is under the Municipal Corporation of Gurugram. The pond was a dumping ground for wastewater. The inlet and outlet channels were encroached on and blocked. After every small shower of rain, the pond would overflow and flood the entire area. It became a breeding ground for mosquitoes. The deterioration didn't just erode the natural ecosystem—it also affected groundwater recharge, local biodiversity and the health of nearly 250 residents who lived around it.

Intervention:
Year of intervention: 2024

What has been done to restore the lake health:
The community around the pond approached the Municipal Corporation of Gurugram (MCG) for restoration of the pond. In 2024–25, a resolution to community appeal came when MCG engaged with SEEDS; CSR funds from Ingersoll Rand were mobilized for the restoration process. SEEDS initiated the process by conducting a detailed assessment of the lake's physical condition, its inlet–outlet systems, and the surrounding land use. A comprehensive boundary survey helped identify critical intervention zones. They also conducted water testing to analyse the scale of the problem.

The mapping process revealed that sewage from over 30 households was directly contaminating the pond. The restoration process thus involved desilting, bund strengthening using geotextile bags and then planting grass to hold the soil. The wastewater was diverted to the nearby MCG sewerage network. Plant species such as *Canna indica* were planted on banks to absorb nutrients, and solar-based aerators were involved to oxygenate the water. The pond was

RESTORING LAKES IN URBAN AREAS

SWATI BHATIA, CSE

Dhankot pon restored, with wastewater from the nearby areas diverted for treatment.

SWATI BHATIA, CSE

Public awareness board near the pond to ensure that the pond remains clean.

restored as a community space, with a jogging track and an open gym for communities to socialize as well as to maintain the pond.

The pond was filled with semi-treated water and is primarily rainfed, as the catchment is encroached on and difficult to restore with available funds, along with other issues. It was restored in 2024 and handed over to MCG in March 2025.

MCG brings semi-treated water in tankers when required. Small maintenance work is carried out by community contributions, while major maintenance is handled by MCG.

The restoration has ensured space for recreation and kids

to play. The property values have gone up. The microclimate in the area is cooler, and dependence on electricity has reduced as the cooler weather in the area allows communities to sit in the park during daytime. Ducks, Indian herons and kingfishers can be seen at the site, with many more birds reported in the mornings.

The plan for sustainability is under preparation as per the government department.

Case study 6: Sadarpur tank pond in Sadarpur village, Ghaziabad, Uttar Pradesh

Nagar Nigam uses both the government and CSR funds effectively to restore lakes and ponds

Sadarpur tank under the Nagar Nigam Ghaziabad faced reduced water-holding capacity due to siltation. Untreated wastewater from the ward entered the pond continually. Over and above this, there was an encroachment along the lake boundary.

Intervention:

Year of intervention: 2022

What has been done to restore the lake health:

Nagar Nigam Ghaziabad (NNG) restored a 5-acre waterbody, Sadarpur tank pond in Sadarpur village, which had long suffered from siltation, encroachment and continuous inflow of untreated wastewater.

The initiative—implemented in partnership with RSPL Welfare Foundation and Aastha Welfare Society—aimed to transform the polluted pond and also manage the wastewater generated in the village under NNG, using a 100-KLD nature-based decentralized wastewater treatment system, strongly encouraged under AMRUT 2.0.

The pond was dewatered, desilted, desludged and fenced to secure the site. A nature-based gravity-driven treatment system was opted for, which included treatment of wastewater anaerobically. This involved passing the water through a planted gravel bed for oxygenation and nutrient

RESTORING LAKES IN URBAN AREAS

NAGAR NIGAM GHAZIABAD

Sadarpur tank pond pre- and post-restoration

removal, and then release into the pond. The area around the pond was landscaped and beautified. Seating arrangements were made for the community. Treated water is to be reused for plantation, landscaping and groundwater recharge, reducing dependence on freshwater sources.

This is an excellent example of how wastewater can be managed at the ward level and treated water can be used to restore the ponds. This not only reduces the pressure on existing STPs but also reduces dependence on expensive technologies for managing wastewater. Besides this it is also expected to evolve into a community-friendly green space—an example of how nature-based solutions can revive dying urban waterbodies. NNG has revived several other ponds.

The sustainability plan is under preparation. The communities are being made aware through a plantation drive and linked to the pond for basic upkeep. Currently, Nagar Nigam has undertaken the major part of the maintenance of the pond under AMRUT 2.0 funds.

B. DECCAN PLATEAU

Case study 7: Pashan Lake, Pune, Maharashtra

Municipal Corporation creates a restoration committee to restore a lake

Around 130 acres (0.52 sq. km) in area, Pashan Lake in Pune City is a manmade lake made during the 1860s on the Ram Nadi River. Thus Ram Nadi's catchment through Bavdhan, Bhugaon, Baner, etc. also form the catchment for Pashan Lake.

The river has long been a silent witness to the city's transformation and the rich ecosystem that was home to various migratory and native birds and other biodiversity. Today it stands at a tipping point.

The extensive urbanization in the Ram Nadi's catchment turned the river and lake into a reservoir and channel for sewage collection, and it remains polluted. Broken sewage lines and untreated sewage from urban areas and slums entering the lake and polluting the river have resulted in invasive species and weeds choking the lake and the native flora and fauna dying a slow death.

In response, PMC formed the 16-member Pashan Lake Development & Restoration Committee in 2022, comprising experts, NGOs and citizens, to chart a revival path. Various measures in the past to restore the lakes failed as sewage entry was not addressed.

RESTORING LAKES IN URBAN AREAS

Intervention

Year of the intervention: 2025

What has been done to restore the health of the lake:
PMC undertook a complete restoration project which would not involve just desilting and de-weeding but also beautification of the lake, and now also addresses sewage entry in the lake. PMC has set up a 1-MLD sewage treatment plant (STP) upstream of Pashan Lake to intercept incoming wastewater and treat it before it enters the lake. Additionally, desilting would increase the storage capacity and the nutrient-rich silt shall be sent for agricultural purposes. The work on the STP is complete—the trial was conducted in October 2025—and the STP is now fully functional. The irrigation department will now take over to restore the lake.

The STP has come up under the 15th Finance Commission. A budgetary provision of Rs 549 lakh was sanctioned, with the work order awarded to M/s Parshuram Construction Group. The project includes laying 1,380 metres of new sewer lines to divert sewage to the newly constructed 1-MLD sewage treatment plant. The total cost of STP construction

PMC

Pashan Lake

SWATI BHATIA, CSE

A 1-MLD sewage treatment plant (STP) near Pashan Lake to clean the pollution entering the lake

is Rs 4.98 crore, with an additional Rs 50.7 lakh earmarked for three years of maintenance and Rs 4.89 lakh for material testing and royalty. The plant is designed to treat sewage with influent BOD of 250 mg/L, COD of 400 mg/L and TSS of 350 mg/L, using IFAS (Integrated Fixed-Film Activated Sludge) technology, ensuring treated water meets stringent NGT norms, including BOD <10 mg/L, COD <50 mg/L, TSS <20 mg/L, and faecal coliform <100 MPN/100 ml. The treatment process includes coarse and fine screening, grit removal, equalization, anoxic and IFAS biological treatment, tube settler clarification and chlorination, with the final treated water stored for recharging the lake and reuse in gardening and construction. Additional components include repairing the right bank wastewater channel and manholes along the Ram River and stopping direct sewage discharge into the river. Overall, the project will significantly reduce pollution in the Ram River, improve lake water quality, and reduce the foul odour in the surrounding areas while ensuring sustainable reuse of treated wastewater.

PMC has considered a maintenance cost of around Rs 50.71 lakh for the lake for a period of three years. Apart from this, the corporation would desilt and de-weed the lake as required. The Corporation is also tapping any leaking pipelines in the sewer network that can affect the lake.

Case study 8: Annapurna Lake, Indore, Madhya Pradesh

Use of CSR funds to improve the health of lake and consequently the thriving biodiversity

Annapurna Lake, also known as Pipliyahana or Lotus Lake, has been subjected to multiple environmental stresses over the years, leading to a significant decline in its ecological health. The lake is under the Indore Municipal Corporation.

The most critical threat arose from the continuous discharge of untreated sewage from two major inlets serving densely populated residential areas nearby. This regular inflow of wastewater introduced high levels of organic pollutants, resulting in elevated BOD and COD, and severely reducing the dissolved oxygen required to sustain aquatic life.

In addition to sewage inflow, the lake suffered from indiscriminate dumping of organic and non-organic solid waste. Household refuse, plastic debris and other unmanaged waste materials accumulated over time, contributing to sludge formation and altering the lake's natural water chemistry. The lake's proximity to the bustling Annapurna Temple further intensified the pollution load. Religious offerings—including flowers, idols, ashes and other ceremonial materials—were regularly discarded into the water, introducing chemicals and organic matter that disrupted the ecological balance.

The excessive nutrient load entering the lake created ideal conditions for eutrophication, leading to the rapid spread of invasive plant species such as water hyacinth and duckweed. These plants formed dense surface mats that blocked sunlight penetration, restricted gas exchange, and ultimately depleted oxygen levels in deeper waters. The resulting algal blooms further deteriorated water quality and contributed to foul odours emanating from the lake.

These cumulative impacts culminated in a severe fish die-off in 2023, a stark indicator of ecological collapse. Low dissolved oxygen, combined with excessive sludge and toxic algal conditions, made the lake uninhabitable for aquatic life. The absence of regular monitoring, maintenance and

treatment interventions over many years accelerated the degradation process, transforming what was once a vibrant community lake into a polluted and ecologically stressed waterbody.

Intervention

Year of intervention: 2024

What has been done to restore the lake health:

To restore the deteriorated Annapurna Lake, a focused and science-based rejuvenation plan was implemented. The process began with a detailed assessment of water quality and ecological conditions following fish die-off in 2023, which highlighted issues such as high nutrient levels, low dissolved oxygen, sludge accumulation and invasive vegetation.

Based on the findings, Clean Water, an Indore-based start-up, installed floating wetlands that acted as natural biofilters absorbing excess nutrients and supporting beneficial microbial activity. Four sub-surface floating aerators were deployed to increase dissolved oxygen and improve water circulation without disturbing sediments. Regular dosing of beneficial microbial cultures further accelerated breakdown of sludge, reduced nutrient loads, and curbed algal and hyacinth growth. To ensure uninterrupted aeration and enhance the lake's visual appeal, an innovative lotus-shaped solar aerator was developed and installed, reducing dependence on grid electricity and preventing disruptions caused by cable theft. The lake was also cleaned of invasive species and floating waste, restoring open water surfaces and improving sunlight penetration.

The project was supported through collaboration with the Indore Municipal Corporation, IIT Kanpur, IIT Ropar, and environmental organizations, enabling both ecological restoration and aesthetic enhancement. Post-intervention water tests showed marked improvements in dissolved oxygen, nutrient levels, and overall water clarity, demonstrating the effectiveness of the integrated restoration approach.

Source of funding: CSR funding—IIT Kanpur under Citi Bank's Initiative and IIT Ropar under HDFC Bank's Parivartan Initiative

Impact

The combined use of floating wetlands, aerators and beneficial microbial cultures significantly improved water quality, raising dissolved oxygen to 6.7 mg/L, reducing BOD to 2.5 mg/L, and bringing nitrates, nitrites and phosphorus to below detection levels within two months of intervention. Invasive species and algal blooms were effectively controlled, foul odours disappeared, and biodiversity began to return as floating islands created new habitats. The intervention helped in improving the lake's aesthetic and recreational value for the surrounding community (see *Table 2: Water quality of Annapurna Lake post-restoration*).

Table 2: Water quality of Annapurna Lake post-restoration

Parameters	September 2024 (post-restoration)
BOD	2.4 mg/L
COD	20 mg/L
DO	6.7 mg/L
Faecal coliform	0 MPN/100 ml

Source: Clean Water, Indore

PRADEEP KUMAR MISHRA, CSE

Annapurna Lake with a floating solar lotus aerator

'Clean Water aims to work on other waterbodies in Indore and develop an integrated waterbody management system. It hopes that this "Indore Model of Restoration" will inspire other waterbody restoration efforts that use bioremediation methods across the country. Through further projects, Clean Water will further refine this model and hope to take it to other municipalities in the country to ensure conscious, sustainable development of India's waterbodies.'

—Priyanshu Kumat, Founder, Clean Water, Indore

Case study 9: Lower Katraj Lake, Pune, Maharashtra

Use of Fifteenth Finance for restoration of lake

Katraj Lakes were formed in the process of construction of two dams, which were built on the Ambil Odha River. The lake formed on the upstream was for settling silt and the lower one for providing water. Lower Katraj Lake is located 10 km south of Pune city in Rajiv Gandhi Zoological Park.

PMC took over the system in 1879 and declared it a heritage site. It was a supplementary water source and a standby in times of emergency, such as during the 1961 Panshet floods. Until 1970, it was used to supply water to the residents of Bibwewadi and Sahakar Nagar.

The Corporation has undertaken a major rejuvenation initiative to restore lower Katraj Lake, an ecologically significant 29-acre waterbody located within Rajiv Gandhi Zoological Park. Years of urbanization and uncontrolled sewage inflow from Santosh Nagar, Katraj Vasahat and Rajas Society had severely deteriorated the lake's water quality, evidenced by elevated BOD (14.76 mg/L), COD (29.18 mg/L), high TDS (860 mg/L) and dense growth of water hyacinth.

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SWATI BHATIA, CSE

A Tiger Biofilter-Based Technology treatment plant has been installed to treat sewage before releasing into Katraj Lake

Intervention

Year of intervention: 2025

What was done to improve the health of the river:

Pune Municipal Corporation (PMC) has implemented an integrated restoration plan, which included a 2-MLD decentralized sewage treatment plant (STP) using Tiger Biofilter technology, an eco-friendly, vermifiltration-based system endorsed under the Swachh Bharat Mission. The STP was constructed at Rajiv Gandhi Udyan under the 15th Finance Commission at a project provision of Rs 894.16 lakh.

The Corporation has completed its trial run. Designed to treat wastewater to NGT-compliant standards (BOD ≤ 10 mg/L, COD ≤ 50 mg/L, TSS ≤ 20 mg/L, faecal coliform ≤ 100 MPN/100 ml), the plant eliminates sludge-handling needs and reduces energy consumption significantly.

Complementing the treatment infrastructure, PMC has executed extensive sewer line development and hydraulic improvements. A total of 580 metres of sewer lines, along with gabion walls, have been constructed to intercept and divert sewage from two major drains, Santosh Nagar Nalla and the Peshwa Talav overflow drain. These gabion structures (approx. 1,050 cubic metres [cu. m]) stabilize banks, prevent erosion and ensure sewage no longer enters the lake.

The combined engineering interventions—including sewer collection systems, site development, STP construction

and allied works—cost Rs 9.01 crore. The Pune Municipal Corporation has included an O&M cost of Rs 80.09 lakh within the restoration plan.

Case study 10: Jail Lake, Thane, Maharashtra

Lake was restored using government and CSR funds jointly

Water quality of the 6.81-acre Jail Lake was affected due to stagnation and leakage of wastewater from nearby areas. This resulted in a decline of aquatic life. The lake was silted up with a remaining depth of 10–15 feet, thus reducing the water-holding capacity by 40 per cent. It was a dumping site for plastic and other material. Runoff from roads and surface flow contributed towards the pollution of the lake. Water coming through surrounding roads directly to the lake contaminated the waterbody. The lake had multiple inlet points from which sewage would enter the lake.

Intervention

Year of intervention: 2024

Source of funding: AMRUT 2.0 and CSR funds from Kotak Mahindra Bank Limited and implementation support was provided by Green Yatra.

What was done to restore the lake health:

The initiative was rolled out by Thane Municipal Corporation, the owner of the lake. The restoration was initiated with site surveys, water quality testing, soil testing, assessment of biodiversity and mapping the inflow and outflow channels and the sewage entry points. The intention was to use nature-based solutions to restore and sustain the lake.

The lake was dewatered and desilted, with nearly 120 tonnes of accumulated silt removed from the lakebed, which was used for embankments and making Bird Island in the middle of the lake. Desilting increased the depth to 25–30 feet and improved the lake's water-holding capacity from 5.5 crore litres to 9.46 crore litres. Implementation support was provided by Green Yatra, a Mumbai-based not-for-profit.

RESTORING LAKES IN URBAN AREAS

Another challenge that eventually cropped up was the leaking sewage network as the city network is old. Due to this the lake had odour issues. M/s Microbact Bio Culture, a Pune-based consultant was engaged to find a solution. They installed floating islands, with vetiver and wedelia plantations, and silt traps to treat incoming water and prevent future pollution. They also inject bio culture solutions twice a month, which helps faster degradation of organics in wastewater. The lake area also recorded wildlife sightings—snakes, squirrels, egrets, and kites—all of which were rescued safely and transferred to authorities. A temporary fish and

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Floating islands installed in Jail Lake, Thane, to clean the lake

SWATI BHATIA, CSE

Migratory birds visit the lake post-restoration.

turtle pond was created to protect aquatic fauna during restoration. A person has been hired by the Thane Municipal Corporation to upkeep the health of the lake.

Case study 11: Lakha Banjara Lake, Sagar, Madhya Pradesh

Lake restored using the funds from Smart City Mission
Lakha Banjara Lake, a traditional waterbody, is the primary source of water for the city of Sagar. Situated in the heart of Sagar city, this rain-fed lake with an area of 82 hectares, has a small catchment (588 hectares).

The lake can be divided into two parts: the main lake with an area of 68 hectares, and a small wetland of 14 hectares. Rainwater from the southwestern side enters the satellite lake through the feeder canal in the west, while the outflow is through the Mongha weir in the main lake situated at the back of the Ganga Mandir. This weir regulates the outflow and helps to maintain the water level. The lake is used for bathing, washing clothes, recreation, navigation, etc.

The lake, like many others, was facing issues of pollution from domestic and industrial sewage, encroachment and solid waste dumping, and suffered owing to the neglect.

Intervention:
Year of intervention: 2022

Source of funding: Smart Cities Mission
The restoration work focused on improving water quality by stopping the entry of wastewater. Various measures were taken, including laying of a 5.3-km drainage tapping network to divert incoming sewage. This 5.3-km network tapped 41 drains around the lake. With help of 67 manholes and three inlets, the entire wastewater is now diverted from entry into the lake. This helped to a large extent in the revival of the lake.

The lake also had an old weir, Mongha weir, which was made of clay and stone and would collapse any time due to

RESTORING LAKES IN URBAN AREAS

SAGAR SMART CITIES

Restored Lakha Banjara Lake, Sagar

SAGAR SMART CITY LIMITED

Communities have reestablished their connection with Lakha Banjara Lake

water pressure. The weir was repaired with RCC material, with proper sluice gates for water discharge; 921 lakh cu. m of silt was removed from the lake, 5.30 km of embankment and 4.60 km of stone pitching helped prevent erosion of lake embankments and stabilized them. Infrastructural arrangements such as street lights, community toilets, etc. were made. The lake installed its own 4-MLD sequencing batch reactor (SBR)-based treatment plant, which purifies wastewater from the drains and channels meeting the lake. The lake now hosts the Jal Ganga Aarti, which is

strengthening public awareness around cleanliness, conservation and the cultural significance of the waterbody. It also hosts a scenic Sanjay Drive, built between the small and large lakes, which is now one of Sagar's most attractive public spaces. Its connection to Bhopal Road provides a clean and beautiful corridor for morning walks, jogging and leisure.

Restoration of the lake was taken up under Smart Cities Mission, at a total cost of Rs 111.33 crore. The lake witnessed better water quality, ecological restoration, upgraded ghats and other improvements.

The restoration process started in 2020 and was completed in December 2024. The lake is currently maintained under the Smart Cites funds. The Corporation plans to lease the lake under the public–private partnership model to generate revenue as well as to maintain the lake in the future.

Case study 12: Kotha Cheruvu, Kokapet, Hyderabad, Telangana

This restoration process worked beyond lake cleaning—it connected the communities for regular awareness campaigns

Increasing urbanization around this 72-acre lake led to encroachment of the lake area, discharge of untreated sewage, solid waste dumping, broken bunds and neglected flora and fauna near the lake. Around 25 MLD of untreated sewage from the surrounding residential area of Kokapet would enter the lake; 15 MLD of sewage entered the lake from a 15-MLD sewage treatment plant (STP) near the lake.

The lake is owned by the Hyderabad Metropolitan Development Authority. It was given to Dhruvansh NGO for restoration.

Intervention:

Year of intervention: 2024

What has been done to restore the lake health:

The restoration process for Kotha Cheruvu included the following interventions:

- Desiltation of the waterbody;
- Strengthening of bund and plantation of trees; and
- Installation of floating wetlands and solar aerators

These activities were done to restore the lake and ensure that the lake's aesthetics and water quality improve.

According to Madhulika Choudhary, Founder, Dhruvansh, a Hyderabad-based NGO, lake restoration is not merely an activity, but a continuous process that involves many interventions simultaneously. Cleaning of the lake is one of

PRADEEP KUMAR MISHRA, CSE

Floating wetlands installed in Kotha Cheruvu Lake

PRADEEP KUMAR MISHRA, CSE

Entry of sewage into Kotha Cheruvu Lake

PRADEEP KUMAR MISHRA, CSE

With increased biodiversity in the lake, birds can be seen in and around the lake.

the jobs that is done, but a major part of restoration comes from people's behaviour. She adds that we not only restore the lake physically, but motivate people to take care of these waterbodies through regular campaigns, cleaning drives, yoga sessions on the lake and other social activities. More than Rs 1 crore has been spent for restoring the lake.

Impact

Kotha Cheruvu has seen significant improvement after its restoration (see *Table 3: Comparison of the pre- and post-restoration water quality of Kotha Cheruvu*). Its water quality has improved, the bunds are strengthened, its biodiversity has increased and social activities have increased.

Table 3: Comparison of the pre- and post-restoration water quality in Kotha Cheruvu

Parameters	February 2025	November 2025
BOD (mg/L)	16.5	8
COD mg/L)	60	27
DO (mg/L)	5.8	6.2

Source: Dhruvansh, Hyderabad

Source of funding: Gemini Edibles and Fats India Limited, Hyderabad

To maintain the health of the waterbody, Dhruvansh employs the following strategies:

- Introduced phytoremediation, using bamboo plantation around lake, which gives fencing to lake;
- Stopping floating garbage and solid waste from entering the lake from all sides;
- Treating the sewage in the lake through nature-based solutions;
- Increasing the inflow of storm water in the lake; and
- Planning the models to generate revenue for lake.

Case study 13: Chikli Lake, Pune, Maharashtra

Municipal level plan to revive lakes with treated wastewater

Chikli Lake in Pimpri Chinchwad Municipal Corporation (PCMC) was created in 1993 to accommodate secondary-treated water from a 16-MLD sewage treatment plant (STP) based on extended aeration technology. In 2000, this STP capacity was enhanced by 16 MLD using the Activated Sludge Process technology. The treated wastewater from this STP continued to fill up Chikli Lake. The lake was also supplying water for irrigation to nearby agriculture fields free of cost. Although the treated wastewater from the STP was within the standards specified by the Pollution Control Board, there were still traces of nutrients such as nitrogen and phosphorous post the secondary treatment, which led to frequent occurrence of algae, affecting the aesthetic appeal, and other challenges. The lake also faced threats due to siltation, weeds and damaged embankments.

Intervention:

Year of intervention: 2024

What was done to improve the health of the lake:

PCMC decided to restore the lake and open it for public access. A few years ago, it restored Bird Valley Lake, which

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Clean water in Bird Valley Lake (above and below)

was developed from an abandoned quarry site situated 2 km from Chikli Lake. The source of water to the lake was the runoff from the adjoining hill. PCMC restored it under Fifteenth Finance Commission. The lake now offers boat rides and musical shows in the evenings and is a popular destination for citizens. The revenue generated is also shared with PCMC and used for upkeep of the lake.

PCMC intended to restore Chikli Lake under a similar model and took up its restoration under AMRUT 2.0. The lake was desilted and deweeded. An aeration system and floating rafters were installed to aerate the water and maintain oxygen levels in the lake. The overflow of the lake was connected to the adjacent Bird Valley Lake. This acted as an additional source of water to Bird Valley Lake.

PCMC has started using the lake water for industries. It had already spent Rs 5 crore approximately to install

an ultrafiltration-based tertiary treatment plant of 5-MLD capacity to treat the lake water. It is also being sent to a bio-CNG plant run from hotel waste and also to a Construction and Demolition (C&D) waste plant. The average cost of tertiary treatment of water is Rs 3.8 lakh per month, which roughly amounts to Rs 2.53 per kilolitre.

Chikli Lake and Bird Valley are popular destination for various migratory and native birds. Thus these lakes are also ecologically sensitive sites and the Corporation is developing these sites for community access to connect them to nature and also not dump its treated water back to dirty drains (see *Table 3: Other lakes restored by PCMC by refilling themit with treated wastewater*).

PCMC is generating revenue from selling lake water to the waste-to-energy plant for use in boilers, which generally require good quality water to prevent scaling. Treated water is also being sent to the bio-CNG plant run from hotel waste as well as to the construction and demolition (C&D) waste plant and the revenue earned is used to maintain the water quality of the lake. Additionally, PCMC is also generating revenue by converting the area around Chikli Lake into a tourist spot.

Table 3: Other lakes restored by PCMC by refilling them with treated wastewater

	Chikhli Lake (AMRUT 2.0)	Bhosri Lake (XVFC)	Ganesh Lake (XVFC)	Bird Valley (XVFC)
Project area	12,875 sq. m	21,450 sq. m	10,120 sq. m	84,990 sq. m
Project cost	Rs 6.42 crore	Rs 16.57 crore		
Fund allocated	Rs 3.82 crore (AMRUT 2.0)	Rs 10 crore (XVFC)		
Work done	Restoration of bunds, desilting, deweeding, walkway access for citizens, aeration arrangements using nature-based systems and aerators	Restoration of bunds, desilting, deweeding, walkway access for citizens, aeration arrangements using nature-based systems and aerators. The site is already open for public access and is generating revenue	Restoration of bunds, desilting, deweeding, walkway access for citizens, aeration arrangements using nature-based systems and aerators	Restoration of bunds, desilting, deweeding, walkway access for citizens, aeration arrangements using nature-based systems and aerators

C. COASTAL PLAINS

Case study 14: Odisha's Ama Pokhori scheme revives ponds

A state scheme to restore traditional waterbodies

The scheme was launched by the Housing and Urban Development Department in 2023 to restore more than 2,000 waterbodies using nature-based systems. A Waterbody Rejuvenation Unit has been created to oversee the scheme. It has an expert advisory unit to guide technical, ecological and community engagement aspects.

The programme aims to avoid concretization and use nature-based solutions to improve water quality and the soil–water interface. The waterbodies are to be selected on the basis of a score health card assessing the level of degradation. The waterbody to be restored should map all the inlet, outlet and sewage entry points, and measure inflow and outflow velocity of the waterbody to prepare check dams or diversion channels. The Standard Operating Procedure (SOP) details the restoration process based on a proper drone survey and bathymetric analysis, geotechnical investigation, water testing, map preparation, preparation of DPRs and then it is implemented with the help of self-help group members. The funding for restoration work is tied to existing state schemes or funding mechanisms (Municipal Service Grants, Urban Local Body budget or other urban infrastructure funds).

Year of intervention: 2025

What has been done to restore the lake health:

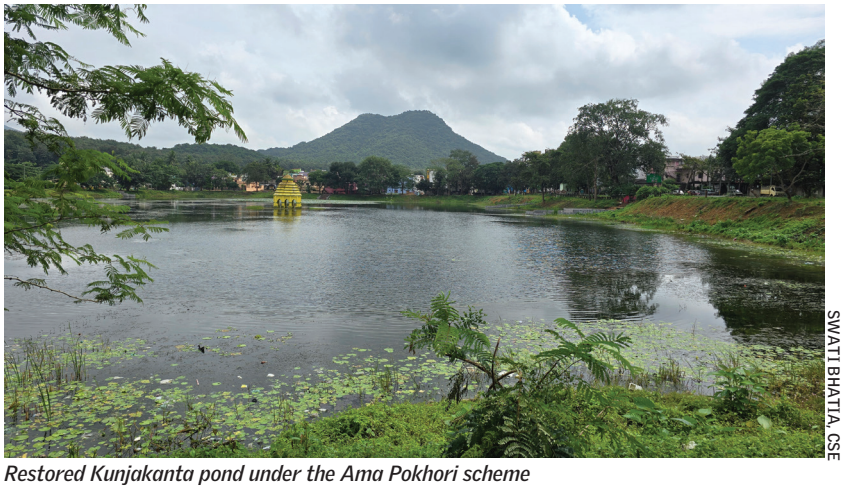
Dhenkanal Municipality has restored five ponds under the Ama Pokhori Scheme. Three of these have diverted wastewater to the major drain lines nearby, which end up in a bigger pond or river outside the city (see *Table 4: Selected pokhoris restored under the state scheme*).

Self-help groups in each ward are used extensively for cleaning the lakes.

Table 4: Selected pokhoris restored under the state scheme

ULB	Name of waterbody visited	Ward no.	Area (in acres)	DPR cost (in Rs lakh)	Project taken up under the scheme	Number of SHG involved	Work done
Dhenkanal Municipality	Hirasagar	14	3.67	55.36	Non-AMRUT	8	Dewatering, de-weeding, desilting, bund strengthening, provision of inlet and outlet, plantation, walking track, wastewater diversion, bathing ghats. The DPR claims to make provision of fishes for aeration and floating wetlands for bioremediation and bio-filter-based water treatment system.
Dhenkanal Municipality	Kunjakanta	3	12.78	96.47	Non-AMRUT	8.0	
Dhenkanal Municipality	Sarjangsahi tank	10	2.41	39.49	AMRUT 2.0	4	
Dhenkanal Municipality	Pachhibandha tank	10	4.32	60.71	Non-AMRUT	4	

Source: Compiled by CSE



SWATI BHATIA, CSE

Restored Kunjakanta pond under the Ama Pokhori scheme

THE WAY FORWARD

Changing patterns of rainfall have pushed cities to focus on their water wealth. Lakes and ponds help in recharging groundwater as well as in absorbing extreme storm events. But what is done to restore the waterbodies is questionable. CSE's research shows that the lakes are either encroached upon, dry or polluted, the reason being mad rush towards urbanization.

Cities are going for one-fit solutions, without identifying the type or magnitude of threat. The catchments of lakes are usually neglected and not considered part of the restoration process. In the name of restoration, what is done is desiltation or deepening of the lakes. In most cases, communities are not part of the planning or process of rejuvenation of lakes and ponds. Of the 50 lakes checked on the ground, only a handful of lakes and ponds had looked into pollution abatement and ensured that changes on the ground are sustainable.

Another key aspect is sustainability, which in most cases is observed not to be part of the city plan. Sustainability plans are treated as an additional activity. The reason may be lack of knowledge, funds or even manpower. As a result, many city lakes, once restored, have reverted to their original states. In Delhi, several high-cost lake restoration projects did not sustain due to the absence of a plan for sustainability and monitoring. Bhalsawa and Kitchener Lakes and Welcome Jheel are examples. These waterbodies have not only shrunk in size but are suffocating due to dumping of solid waste and flow of wastewater. Once restored, with an expenditure of crores of rupees, these lakes are now virtually gasping for breath and have turned into foul black pools. Water hyacinth covering most of the lakes point clearly to the entry of raw sewage. Another glaring example is in the city of Coimbatore, where lakes were restored but the absence of a sustainability plan killed the big lakes of the city (see *box: Once revived but fail to sustain: Coimbatore, Tamil Nadu*).

Once revived but fail to sustain: Coimbatore, Tamil Nadu

There are nine tanks and 10 ponds within the city boundary as per the data of Coimbatore-based non-profit, Siruthuli. The big tanks in the city are connected mostly in a cascading manner so that overflow of one passes to another.

The city of Coimbatore produces 133 MLD of sewage and treats only 30 MLD of sewage. The 170-MLD sewage treatment plants (three in number) show only 18 per cent efficiency.[2] Thus huge amount of wastewater flows into the drains and large and small lakes of the city.

Siruthuli has been restoring the waterbodies in Coimbatore since 2002–03. Bund strengthening, desiltation and weed removal were part of restoration process. No work was done on pollution abatement although the lakes are in highly urbanized areas.

These solutions were considered the best available remedies. The immediate impact was clean waterbodies. But sustainability was not looked into. The Municipal Corporation took the custody of all the lakes in the city but they did not have a sustainability plan in place. The lakes thus reverted to their old states once again. Wastewater freely entered into the waterbodies.

Table 5: Snapshot of the surveyed lakes and the solutions for moving towards a clean state

Name of the waterbody	City	Groundwater	Pollution issues	Solution
Hauz-i-Shamshi, Mehrauli	Delhi	Overexploited	Untreated municipal sewage and solid waste dumping	Floating constructed wetlands and communities made aware to stop any solid waste dumping. The RWA association, Pride of Shamsi, works with the MCD, with the sanitary inspector ensuring residential waste pick-up.

RESTORING LAKES IN URBAN AREAS

Name of the waterbody	City	Groundwater	Pollution issues	Solution
Wazirabad Lake	Gurugram	Overexploited	Untreated municipal sewage and C&D waste dumping	Bio-remediation. Only treated wastewater is allowed to enter the waterbody. Removed C&D waste and recycled the waste to construct pathways around the lake.
Brookfield pond, BSF campus	Gurugram	Overexploited	Municipal sewage	Nature-based gravity-run treatment system which included retrofitted Anaerobic Baffle Reactor and constructed wetland.
Shaheed Ahlwat pond, BSF campus	Gurugram	Overexploited	Municipal wastewater	Old septic tank retrofitted and converted to biodigestor from which the partially treated municipal wastewater flows to a root zone treatment system and then to polishing pond. The water then passes into the bioswale for UV and oxygenation and finally enters the pond.
Dhankot pond	Gurugram	Overexploited	Untreated municipal sewage and solid waste dumping	Diversion of the sewage to nearby sewage network. Regular awareness drives for the communities to stop any solid waste dumping. The local panchayat works with the Nagar Nigam and the RWA members are ensuring that their waste is dumped at a GMDA assigned location

RESTORING LAKES IN URBAN AREAS

Name of the waterbody	City	Groundwater	Pollution issues	Solution
Sadarpur tank pond	Sadarpur Village, Ghaziabad	Overexploited	Untreated municipal sewage and solid waste dumping	100-KLD nature-based decentralized wastewater treatment system. Regular awareness drives for the communities to stop any solid waste dumping also collection of municipal solid waste has started
Pashan Lake	Pune	Safe to semi-critical	Untreated municipal sewage	1-MLD STP using IFAS (integrated fixed-film activated sludge) technology for treating the sewage
Annapurna Lake	Indore, Madhya Pradesh	Overexploited	Untreated municipal sewage and solid waste dumping	Floating wetlands, solar aerators and regular dosage of microbial cultures. Regular awareness drives for the communities to stop any solid waste dumping
Lower Katraj Lake	Pune	Safe to semi-critical	Untreated municipal sewage	2-MLD decentralized STP using Tiger Bio-Filter (TBF) technology for treating municipal sewage
Jail Lake	Thane	Safe	Untreated municipal sewage	Silt trap at the entry of the lake. Floating islands with vetiver and wedelia plantations to treat the sewage entering the lake. Bio culture solutions added twice a month in the lake
Lakha Banjara Lake	Sagar, Madhya Pradesh	Safe	Domestic sewage and industrial effluents	4-MLD sequencing batch reactor (SBR) to treat any wastewater entering the lake
Kotha Cheruvu	Kokapet, Hyderabad	Critical to overexploited	Untreated municipal sewage	Floating wetlands and solar aerators to treat the sewage entering the lake

RESTORING LAKES IN URBAN AREAS

Name of the waterbody	City	Groundwater	Pollution issues	Solution
Chikli Lake	Pimpri Chinchwad Municipal Corporation (PCMC)	Safe to semi-critical	Lake was already receiving treated wastewater (after secondary treatment) but started facing algal issues and weed growth due to sudden increase in nutrient load	16-MLD STP based on extended aeration technology to treat water entering the lake; aeration system and floating rafters added to the lake system to maintain the health of the lake
Bhagirathisagar, Kunjakanta, Badhi Pokhori	Dhenkanal Municipality, Odisha	Safe	Untreated municipal sewage	Diversion of sewage to nearby sewage network

Source: Compiled by CSE

Restoring city lakes in a climate-risked world: The agenda:

1. **Plan for restoration should be holistic**: Cities should include catchments within the plan for restoration of lakes and ponds. In most cases, city lakes lose their catchments and feeder channels due to unplanned urbanization; a careful mapping of the catchment and feeder channels by using GIS and remote sensing becomes an essential part of the exercise.

2. **Sustainability plan should be in place along with the restoration plan**: In most of the cases, it is seen that once lakes are revived, the implementer hands over the lake either to the community or to the municipal authority. In the absence of a plan for sustainability, there is a chance that the city's lake goes back to a poor state. Absence of funds and lack of knowledge for sustainability make things worse. For example, several city lakes in Delhi, which were restored using crores of rupees, show signs of pollution again after a few years. Here the sustainability plan was taken as a separate activity.

3. **Funds should be used effectively for abatement of pollution, not for beautification**: In most cases, it is seen that funds are used for beautification, cycle and jogging

tracks and creating community spaces. For example, under the Smart City initiative launched in Coimbatore in 2016, the city is focusing mainly on its cascading big lakes, which ultimately connect to the Noyyal River. Currently, as per the dashboard of the Smart City, the main focus around lake renovation is on cycle and jogging tracks and community spaces.

4. **Community connect**: Communities should be part of mapping gaps and challenges as well as of preparing the rejuvenation and sustainability plan. In the success stories of lake and/or pond restoration such as Dhankot pond in Haryana or Kotha Cheruvu in Telangana, communities played an important role in the restoration and sustainability process. They were made aware about the lake management and this helped in maintaining the health of lakes.

5. **Using treated water as a source for filling the lakes:** In times of climate change, when there is a variability of rainfall and reduced run-off from the catchment, treated wastewater can be used to fill up lakes and ponds. Delhi's City of Lakes initiative can be applauded for this. The lakes and ponds near the wastewater treatment plants can be filled with treated wastewater. This will in the long run also prohibit the mixing of treated water with untreated wastewater flowing through drains in the city.

6. **Documentation of the success stories:** Cities should document their success stories on their dashboard for public viewing so that they can be easily replicated in areas of similar hydrogeology. Relevant data should be available in the public domain for further research and scaling up.

7. **Availability of menu of technologies:** A menu of technologies should be available to city officials for restoration of lakes, catchments and feeder channels in

a particular hydrogeological setting so that the cities do not use one-size solutions. O&M guidelines should also be part of such technology manuals/guidelines. Toolkits developed at the city level will be helpful in such cases.

8. **Integrated approach in case of joint ownership**: The lake or pond and its catchment may be under separate departments in which case departments should come together and restore the lake in an integrated manner. There should be a city-level policy to outline ownership and responsibilities. The departments should not work in silos. They should work in an integrated manner and rope in hydrogeologist, planners, researchers, limnologists and engineers.

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A Centre for Science and Environment (CSE) team visited over 50 lakes and ponds across three geographic terrains in eight states across the country. The team surveyed the lakes and ponds restored by both government and private organizations. Only a handful—16 waterbodies—were found to be sustaining their health post restoration, as these waterbodies had post-restoration O&M plans.

In our climate-stressed world, there is a need for an integrated management system to protect lakes and ponds in urban areas. These waterbodies are under constant threat of maddening urbanization. Unabated flow of wastewater is seen to enter the lakes and ponds from both sewered and non-sewered areas. Urban areas need to protect their water wealth as these contribute towards groundwater recharge and the prevention of waterlogging. Many big cities have failed to retain the health of their waterbodies; in many cases, it has been seen that huge amounts of money has been pumped in, but this has gone mostly towards unsustainable beautification of the lakesides.

This factsheet brings together and analyses success stories of restored and sustaining lakes and ponds in urban areas. The stories narrate how polluted lakes in the cities have been restored by means of economic and nature-based solutions. The restoration processes were thus more than desilting and deweeding.

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