

HINDON YATRA

A Multi-Stakeholder Journey Towards
River Rejuvenation



Acknowledgements

The Hindon Yatra Handbook is the result of collaborative efforts of the 2030 Water Resources Group, the Government of Uttar Pradesh particularly the Irrigation & Water Resources Department and local administration, industries, research institutes and communities involved in the Rejuvenation of the Hindon River. We hereby sincerely thank everyone who has contributed to the contents of this Handbook and look forward to continued cooperation.

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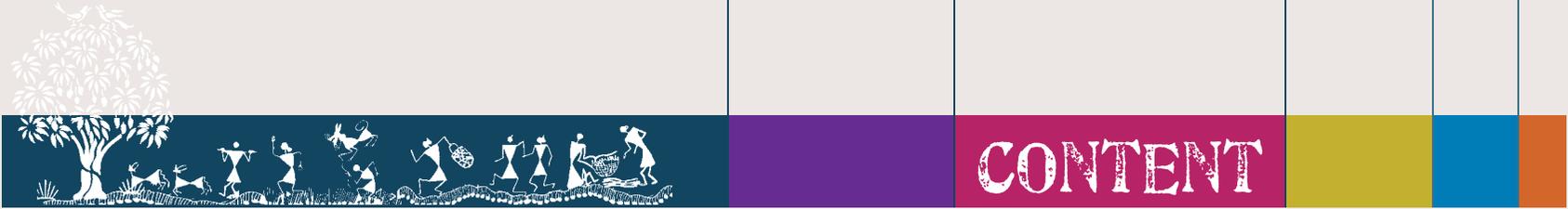
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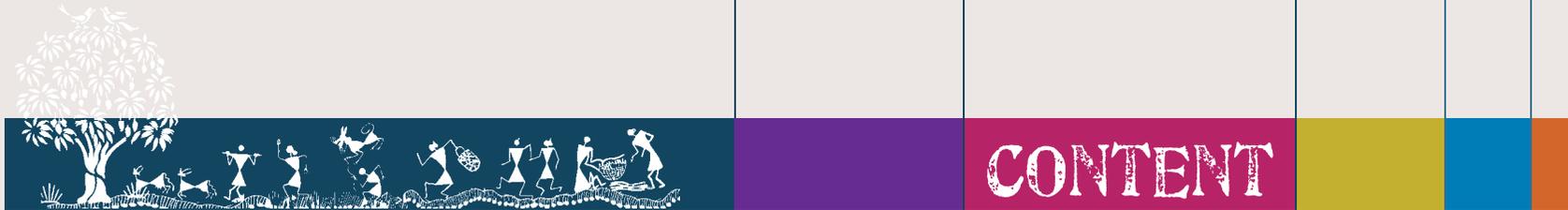
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VOICES OF HINDON





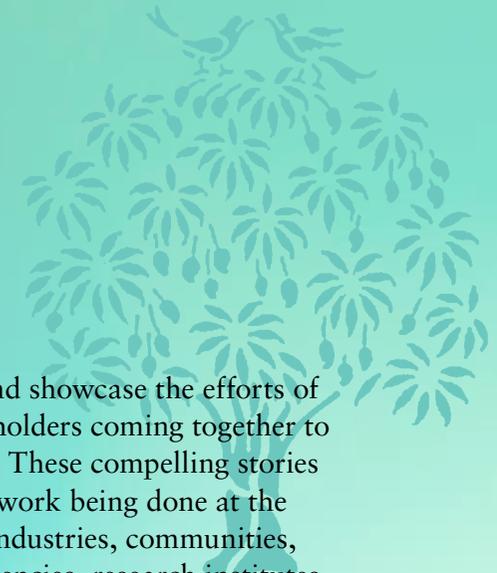
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FOREWORD



Uttar Pradesh boasts one of the largest areas of irrigated land in the world today. The Irrigation & Water Resources Department is pioneering new technological innovations to augment the state's water resources to sustain its population, industrial and agricultural growth. At the state level, the Department is planning to set up a world class centre of excellence for water resources. At the tributary level, it is pioneering a multi-stakeholder approach towards river rejuvenation by tackling one of the most polluted rivers in the world – the Hindon.

Hindon River is a tributary between Ganga and Yamuna rivers, meandering through 355 kilometers across Western UP from Saharanpur to Noida. There are over 100 drains that fall into the Hindon discharging industrial effluents from sugar, paper, textile and tannery industries. The second major source of pollution stems from large inflows

of untreated sewage from the cities located along the river basin. Due to highly polluted discharge into the river, the water quality in the Hindon is not suitable for drinking and bathing. The natural habitat and wildlife in the river has also diminished.

For rehabilitation of Hindon and its tributaries, it is essential to ensure continuous and clean water flow into the river. In 2015, The Irrigation Department initiated a bold effort to rehabilitate the Hindon. This includes various schemes to augment water flows in the perennial river. To ensure pollution free flow into the river, the department is leading a multi-sectoral effort in coordination with the UP Pollution Control Board, local municipal bodies and concerned stakeholders.

The Irrigation Department is proud to host the Hindon Yatra exhibition and symposium

in Lucknow and showcase the efforts of multiple stakeholders coming together to clean the river. These compelling stories document the work being done at the local level by industries, communities, government agencies, research institutes and lawyers to address the complex and multiple challenges of river rejuvenation. If we can succeed in the Hindon, we can succeed in the larger Ganga basin.

These programs form an integral part of the Chief Minister's Clean UP, Green UP Campaign through providing water to sustain the trees and green technologies being adopted by the state. We are happy to collaborate with the 2030 Water Resources Group and its partners to scale up the work in the Hindon to rejuvenate the rivers of the state.

Deepak Singhal
Principal Secretary
Irrigation & Water Resources Department
Government of Uttar Pradesh

PREFACE

The Government of Uttar Pradesh is in the process of developing a dynamic vision to rejuvenate the State's water resources including the Ganga river basin and its tributaries in the interest of farmers, industry, households and other water users. The 2030 Water Resources Group (2030 WRG) is proud to support this process, starting with facilitating a multi-stakeholder initiative to rejuvenate the Hindon river as a demonstration basin. The participatory model and integrated approach could then be replicated in other tributaries in the Ganga and beyond.

2030 WRG is a public-private-civil society partnership at the global level, dedicated towards promoting multi-stakeholder approaches for addressing water security in developing countries. In keeping with its core strength of stakeholder engagement, 2030 WRG establishes multi-stakeholder governance structures for each of its

programs, comprising representatives from government, private sector, civil society, academia and international organizations. In each country, 2030 WRG initiates a process of conducting hydro-economic studies, stakeholder consultations and mobilizing funding to catalyze new projects in the agricultural, industrial and urban sectors.

The UP Chief Minister Mr. Akhilesh Yadav has pledged his commitment towards developing a participatory approach to river rejuvenation in the state. 2030 WRG will assist the UP Government in establishing the institutional mechanism and governance structure required to develop a multi-stakeholder platform (MSP) for water resources and river rejuvenation in UP, building on its success in developing similar approaches in countries like Peru and South Africa.

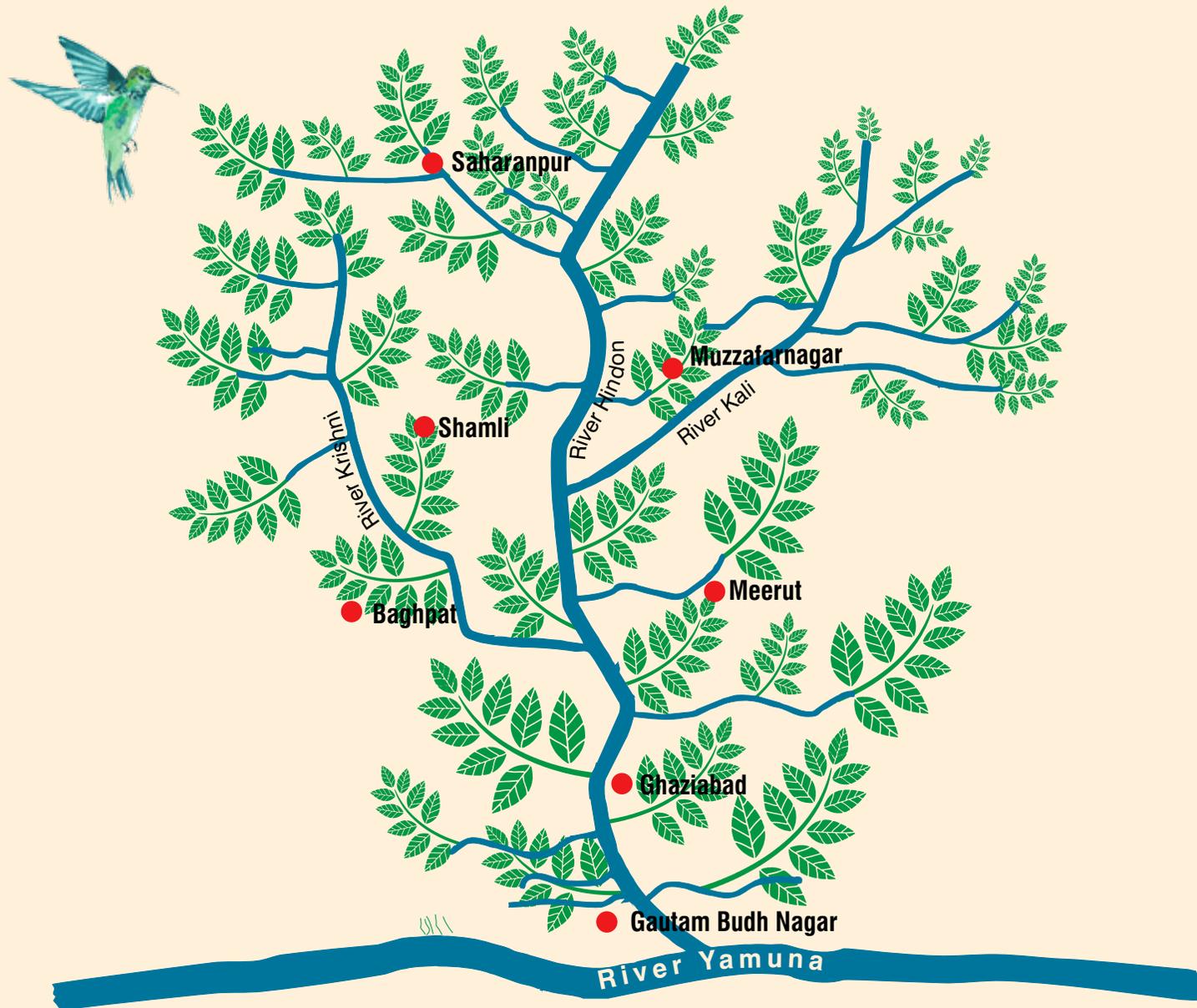
The state government is setting up a Steering Committee consisting of key stakeholders across government, private sector and civil society, chaired by the Chief Secretary of UP, with a clear mandate to provide guidance to the transformation of the water resources

management in the State. The Committee will confirm a number of work streams that will form the essence of our partnership. These may include the following areas of work going forward: developing a tributary approach for river rejuvenation through piloting new projects related to urban waste water and industrial effluent treatment in the Hindon along with agri-water use efficiency pilots at the state level.

The UP Irrigation & Water Resources Department is the nodal agency coordinating these different work streams to rehabilitate the Hindon river. We have partnered with the Irrigation Department, India Water Partnership, Jal Jan Jodo Abhiyan and FICCI to document 20 good practices from the Hindon basin and bring you the Hindon Yatra symposium and exhibition to showcase these local efforts. The Hindon Yatra will travel through the cities of the Hindon basin demonstrating the power of multi-stakeholder approaches to river rejuvenation and providing a common platform for divergent groups to address water challenges.

Anders Berntell
Executive Director
2030 Water Resources Group

HINDON BASIN



EXECUTIVE SUMMARY

The dire condition of the Harnandi (Hindon) river is well documented by the National Green Tribunal, environmentalists and the media today. But less is known about the silent revolution that is brewing on the banks of the Hindon in a valiant attempt to save the river.

The Hindon Yatra documents the journey of the river Hindon and its people from its source in the Shivalik hills of Western Uttar Pradesh as it traverses almost 400 kilometers downstream to merge with the Yamuna. The Yatra is the culmination of a stakeholder mapping exercise conducted by 2030 Water Resources Group and India Water Partnership in 2015-2016 to assess the current levels of pollution in the Hindon river as well as numerous efforts to revive the Hindon. Over the past six months, we conducted literature reviews, field visits and focused group discussions with local government, industries, NGOs and academia working along the banks of the Hindon.

After traveling across the basin and engaging with stakeholders, we discovered that while the challenges of saving a dying river are immense, a number of impressive actions are being implemented across the Hindon. The challenge is that most of these are being undertaken in silos. This gave birth to the idea of the

Hindon Yatra – an attempt to document good practices comprising completed projects, works in progress and in pipeline from across the Basin being led by different groups of actors. The objective is to demonstrate how every dimension of the complex processes involved in rejuvenating a river are already in motion in different parts of the Hindon.

A partnership is formed among the UP Government, 2030 Water Resources Group, Jal Jan Jodo Abhiyan, India Water Partnership, FICCI and others to develop a vision and roadmap for rehabilitating the river to increase water flows and decrease pollution loads to global standards. This will inevitably require bold measures to reduce agricultural, industrial, sewage discharge; solid waste dumping and land encroachment along the river. Legal action will need to be accompanied by community mobilization programs to change public behavior and actions from pollution towards conservation.

The Hindon Yatra case studies provide a ray of hope by showcasing work already being undertaken by the state government, NGOs, lawyers, activists, private sector and research organizations to address each of the above challenges. In the upper reaches of the Basin, district officials and local communities have

partnered to clean up the Paondhoi river. Paper mill owners in Muzzafarnagar have invested in clean technologies to reduce their operating costs and pollution loads. Local municipalities have outsourced solid waste collection and management to the private sector. As we move downstream, the Irrigation Department is actively rejuvenating hundreds of ponds in Noida to recharge ground water. Local farmers are going the extra mile to diversify from water intensive cropping to organic farming. Communities in Ghaziabad are undertaking river walks, charchas and aartis to spread awareness about the need to save the Hindon and educate children about rivers.

Our vision is to scale up this inspiring body of work to develop a collective approach to river rejuvenation that focuses on addressing the needs of the entire ecosystem. A multi-stakeholder approach provides a practical framework to integrate all these different pockets of development into a larger picture for maximizing their impact. The Hindon Basin Committee chaired by the District Commissioners of Meerut and Saharanpur provides an ideal coordinating mechanism to scale up these good practices to rejuvenate the Hindon.

Introduction to the HINDON YATRA

The Hindon Yatra traveling exhibition and symposium demonstrates the positive energy and efforts being undertaken by multi stakeholders across governments, civil society and the private sector for rejuvenation of the the Hindon river. The documentation of these projects will encourage a significant scaling up of the collective action required to complete the task in coming years. The Yatra includes a few cases from outside the Hindon basin that provide for a strong replication opportunity in support of the Ganga tributary approach.

The exhibition is accompanied by a series of symposiums as it travels across the Hindon basin from Lucknow to Delhi, weaving together multiple stakeholders to collaborate to save the Hindon. An advisory committee comprising of senior leaders in each of the different sectors impacting river rejuvenation have guided the compilation of good practices from the Hindon into a handbook and multi-media exhibition. While 2030 Water Resources Group served as the secretariat for the project, financial, logistics and in kind support was provided by the stakeholders involved as participants and owners of the process.

Background

The multi-stakeholder tributary approach to river rejuvenation is gaining momentum across the country. Recent examples include the water quality monitoring stations of National Mission for Clean Ganga, World Wildlife Fund's clean up of the Ramganga in Uttar Pradesh and the Noyyal River Restoration Federation in Tamil Nadu. The Hindon River, which is a tributary of the Yamuna River, originates in the Saharanpur district and flows across the industrial belt of Western Uttar Pradesh before discharging into the Yamuna River in Noida. Due to urban, agricultural, and industrial waste which is being released without sufficient treatment into its waters, the Hindon is now one of the most polluted stretches in the Ganga basin.

The 2030 Water Resources Group (2030 WRG) was requested by Mr. Rajendra Singh in May 2015 to support a participatory process to rejuvenate the Hindon. Since then 2030 WRG has held several field missions and meetings with stakeholders from government, civil society, industry and academia. While there are multiple challenges, there are also many good initiatives on the ground. This was the genesis of the Hindon Yatra...

First of all, there is a growing civil society movement for Hindon rejuvenation. Several NGOs and individuals have been active for the past 15-20 years. They have documented the state of the river basin through reports, scientific research, videos etc. They also initiated awareness campaigns and environmental education programs for children and youth in schools on the need for water conservation and pollution abatement.

The State Government has demonstrated increased interest and commitment to rejuvenate the Hindon River in an integrated and participatory manner. Proposals have been made by officers of the Irrigation Department for additional water recharge structures, rubber dams and other structural measures to be put in place to increase water availability and environmental flow in the basin. On the water quality side, a rapid assessment study is planned and the State Pollution Control Board is considering a comprehensive monitoring and information system, which will support evidence-based decision making on cost-effective measures and track progress made to rejuvenate the river in the long term.

Also local industry players, particularly paper & pulp mills, have invested in installing water treatment plants in the past 1-2 years as a result of government Charters and Guidelines. An online monitoring system has been put in place which automatically sends data regularly to the State Pollution Control Board. Paper mill owners have taken the lead in taking responsibility for pollution abatement in the Hindon basin and they are keen to show the results of their investments on the reduced water intake (recycling) and improved water quality outflow of their plants.

Traveling Exhibition and Symposium

To showcase the good initiatives currently being taken in the Hindon basin by multiple stakeholders, the 2030 Water Resources Group and its partners are organizing a traveling Hindon Yatra Exhibition & Symposium. The traveling exhibition (Yatra) will cover a period of about three months. It will be inaugurated in Lucknow, followed by

a basin-wide Hindon Yatra starting upstream – near the source of the Hindon river – in Saharanpur. It will then travel downstream to visit the following towns: Shamli, Muzaffarnagar, Meerut, Baghpat, Ghaziabad and Gautam Buddha Nagar (Noida). In each town a local symposium and exhibition will be held to serve as a platform for stakeholders to come together and address local challenges in the Hindon. Stakeholders will be encouraged to organize a range of activities to sensitize and involve citizens around this time. The Hindon Yatra will end in Delhi with a closing symposium and exhibition, demonstrating the power of partnerships for river rejuvenation and triggering further collaboration between stakeholders in the Hindon and beyond.

The focus of these good practices is on achievements and success stories of the past, work-in-progress initiatives that are currently being implemented and pipe-line projects or plans for the near future (next 1-2 years). A high-level symposium with speakers and

participants from government, civil society, industry and academia will be organized on the first day of the exhibition in each city/town. Each city has a local organising committee that is hosting the Yatra to address their local water challenges.

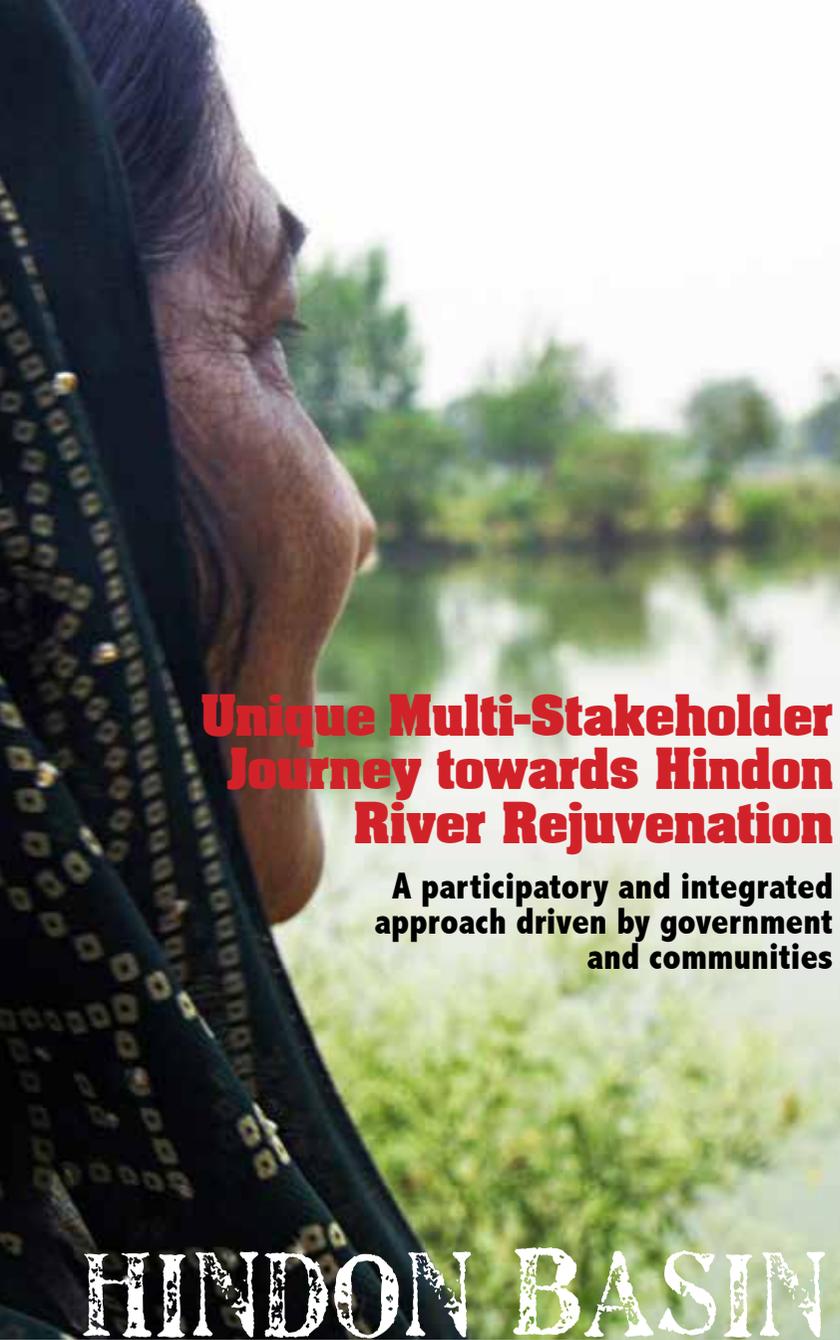
Advisory Group

The Advisory Group of water experts endorsed the project, identified potential partners with good practices, reviewed the case studies and identified opportunities for scaling up such multi-stakeholder approaches to river rejuvenation. The group comprises of Rajendra Singh – Tarun Bharat Sangh, Veena Khanduri – India Water Partnership, V. Rajagopalan – Retired Secretary MoEF, Nadeem Khalil – Aligarh Muslim University, Nitin Verma – Sustain Asia, Vivek Kumar - IIT Roorkee, Karishma Bist – FICCI and R.S. Pathak – Retired World Bank Senior Water Expert.





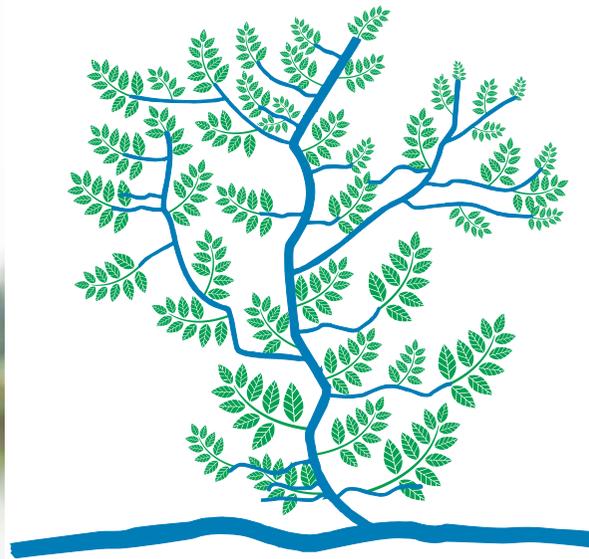




Unique Multi-Stakeholder Journey towards Hindon River Rejuvenation

A participatory and integrated approach driven by government and communities

HINDON BASIN



A fresh momentum created by a people's movement...

Building on many years of environmental activism by several local community based organisations across the Hindon basin, such as Jal Biradari and others, Jal Jan Jodo Abhiyan (the union of water and people) launched an initiative to rejuvenate the Hindon River basin in early June 2015. With the aim to inspire a participatory approach for the revival of the Hindon, Jal Jan Jodo Abhiyan is spearheaded by the Waterman of India, Shri Rajendra Singh. At the first Hindon River Panchayat (parliament) meeting on 11th of June, the forum brought together

The Hindon River, which is a **tributary** of the Yamuna River, originates in the Saharanpur district and flows across the industrial belt of Western Uttar Pradesh. Due to municipal, agricultural, and **industrial waste** which is being released without sufficient treatment into its waters, the Hindon is now one of the **most polluted** stretches in the Ganga basin.

key actors, including national and state government representatives, civil society, religious leaders, industry and academia. The momentum which was generated catalyzed cooperation between stakeholders. Following the Hindon Panchayat a few strategic Hindon leadership meetings were held in New Delhi, co-chaired by the State government's Principal Secretary Irrigation and the Water Man of India and facilitated by the 2030 Water Resources Group and India Water Partnership.

...reaffirms government as driver of a unique rejuvenation journey

Recently a number of initiatives have been initiated by the government to mitigate pollution and augment flows in the Hindon River basin. These include the closure of 40 major polluting industries, planned



construction of rubber dams, check dams and recharge ponds in the upper reaches. A zoning policy to allow sufficient space for the river to flow is now being considered by government agencies as well as an upgraded basin wide water quality monitoring and information system.

The Divisional Commissioner (DC) Meerut was appointed by the Principal Secretary Irrigation to chair a Committee to promote the rehabilitation of the Hindon River from an integrated perspective. The Committee first met in Meerut in September 2015, chaired by DC Meerut and convened by UP Irrigation Department as nodal agency. In January 2016 three sub-

groups (technical, community and media / information focus) were formed. A vision and work streams are being developed addressing topics such as water flows, pollution loads, solid waste management, industrial effluent and urban sewage treatment.

In March 2016, the Chief Secretary of Uttar Pradesh expanded the scope of the Hindon Committee to include other stakeholders under the chairmanship of the Divisional Commissioner Meerut to reflect a basin-wide approach including the Districts under Division Saharanpur and a wider inter-sectoral participation. An interdepartmental

Steering Committee for River Rejuvenation has been appointed at State level to evaluate the Hindon process as a participatory model to be replicated in other sub-basins in Uttar Pradesh.

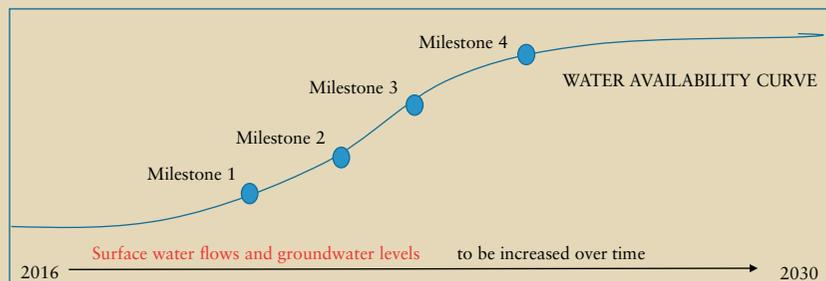
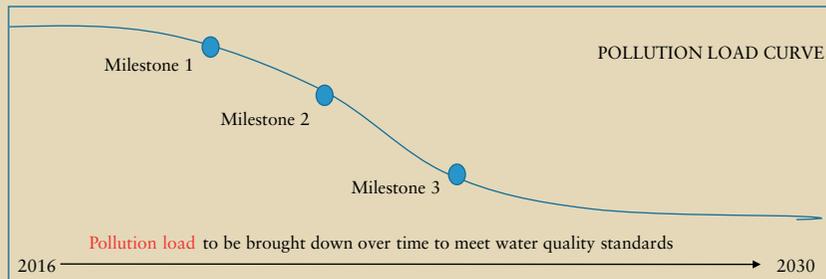
implementation. Building on the work already undertaken by the various government departments and others to date and after consulting with several stakeholders across the basin and water experts in Delhi, a working document with a draft vision for the rejuvenation of the Hindon by 2030 was presented in the Hindon Committee on 16th of May 2016.

The vision for Hindon is to achieve a naturally balanced eco-system consisting of both ground and surface water, which supports life for flora, fauna and people in the region. The Ganga basin policy principles of Nirmal Dhara (unpolluted flow) and Aviral Dhara (continuous flow) also apply to the Hindon River basin, with the exception that Hindon and its tributaries are non-perennial rivers, dry for parts of the year. The goal is to secure sufficient and safe water to support sustainable economic and social growth in the Hindon basin and safeguard current and future water needs of all water users (domestic, ecology, agriculture, and industrial) and eco-system by 2030.

With targeted interventions, the current highly polluted status of Hindon can be transformed towards surface water quality in compliance with national bathing water standards as set by the Central Pollution Control Board. With judicious water use and water conservation, groundwater aquifers can be recharged to reach sustainable levels.

Vision for Hindon: a healthy river basin by 2030

Goal setting: timeline, curves and milestones



First comes the vision...

In coordination with the UP Irrigation Department the 2030 Water Resources Group (2030 WRG) was tasked by the State government to develop a vision for the Hindon basin and a roadmap for



Surface water flow during dry season may however fall short due to zero discharge from industries/domestic sector.

The vision will require implementation guidelines to develop a roadmap leading to a series of projects for the Committee to sanction in order to work towards achieving the vision by 2030. It may require over 100 innovative projects to reach the targets. For the purpose of the Hindon Yatra Exhibition, about 20 projects from every corner of the Hindon basin have been documented, which together symbolize a movement towards achieving the vision for river rejuvenation.

“During the first year of the formation of the Hindon Committee, the government has initiated a number of new projects to revive the Hindon River basin. Now we have invited more government agencies and civil society partners to jointly address the multiple dimensions of the river rejuvenation process.”



*Alok Sinha
Divisional Commissioner
Meerut*

...followed by the action

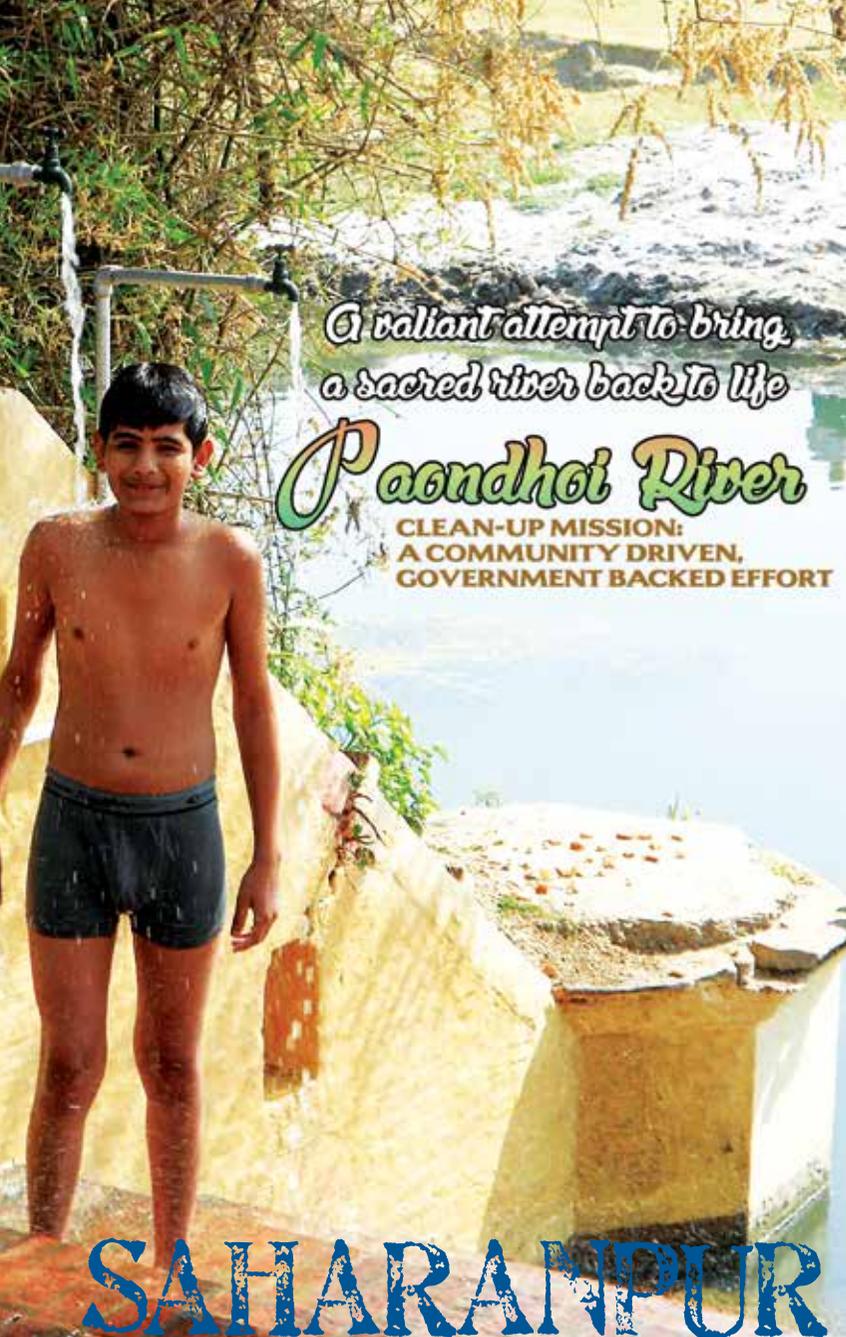
To support the work already underway under the leadership of the Divisional Commissioner Meerut, the 2030 WRG facilitates the identification of potential projects. These could scale up good initiatives so far undertaken by different groups of actors across the basin. The proposed projects could include conducting audits of existing sewage treatment plants in urban areas in the Hindon basin and bringing their operations up to global best practices, developing the market for waste water re-use and setting up primary level treatment facilities across the entire basin for sewage treatment.

On the industrial front, the focus could be on 100 small and medium sized enterprises (SMEs) in the paper, sugarcane and distilleries sectors that are major sources of pollution. With the support of Federation of Indian Chambers of Commerce and Industry (FICCI) , innovative low cost clean technologies can be identified that can help these SMEs to reduce their water consumption and discharge.

On the agricultural side, efforts are underway to find ways to increase efficient use of irrigation water by farmers and reduce non-point source pollution by agriculture.

Among the many successes showcased in the Hindon Yatra are also some innovative examples of public-private partnerships in the solid waste management sector. Although these example projects are not devoid of challenges, they do offer good lessons that can be leveraged to design an effective garbage collection and disposal system for all the towns and cities of the Hindon.

Last but not least, the rule of law is being used to prevent land encroachment on the banks of the Hindon. Only when the river zone can be retained, the river can reclaim its space to flow again, thus supporting life for flora, fauna and people in the region.

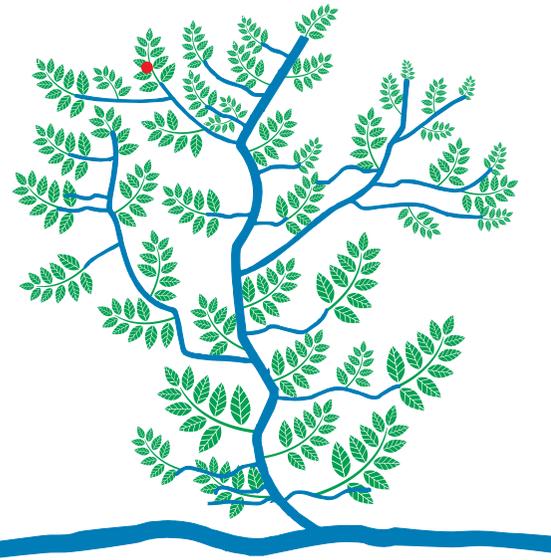


A valiant attempt to bring a sacred river back to life

Paondhoi River

CLEAN-UP MISSION:
A COMMUNITY DRIVEN,
GOVERNMENT BACKED EFFORT

SAHARANPUR



The Paondhoi originates in Sankalapuri village and flows through the city of Saharanpur before meeting the Dhamola River at the outskirts of the city. Legend has it that Baba Lal Das, an ascetic who lived in Saharanpur nearly 300 years ago, practised daily ritual bath in the holy Ganges in Haridwar before accepting any meals. Goddess Ganga, pleased with his devotion, granted his wish by appearing as a stream adjacent to his hut. This stream came to be known as Paondhoi Ganga wherein Baba Lal Das could bathe without the need to travel to Haridwar. Since then, locals have revered the river and the temple of Baba Lal Dass.

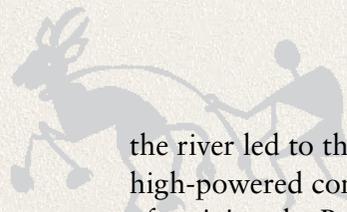
Paondhoi River Clean-Up **Mission** is a joint effort of **citizens** and **government** officials to **clean** the **sacred river** with a longer term **vision** of developing a river front.

Every year during Ramlila, the scene where Ram, Lakshman and Sita cross the river while returning from Lanka used to be enacted with a symbolic boat pulled across the river as thousands gathered on banks of the river to witness the spectacle. This tradition was discontinued for over 35 years because the river became unfit for this holy ritual. It was only when the river was cleaned in 2010 through the efforts of Paondhoi Bachao Samiti that the annual ceremony was restarted.

Non-political movement based on social support

Reviving the Paondhoi needed the combined efforts of district administration as well as the city residents; a hugely successful clean-up drive was led by the presiding District Magistrate (DM) Alok Kumar in 2010. A meeting held at the Collectorate office on 12th May 2010 to deliberate the revival of





the river led to the decision to constitute a high-powered committee for the sole purpose of reviving the Paondhoi River. In order to empower the committee to direct government departments for action, it was decided that the DM would be the Chairperson and Nodal Officer of the “Paondhoi Bachao Samiti” supported by Additional District Magistrate - Administration (ADM-A) as Secretary. Paondhoi Bachao Samiti comprised of equal representation from government specifically district and city administration as well as members from civil society. It was a unique and collaborative effort which had no special budgets allocated. However, existing resources available with Nagar Nigam were to be used for the clean-up drive. It was also agreed that financial support would be requested from the public as and when required.

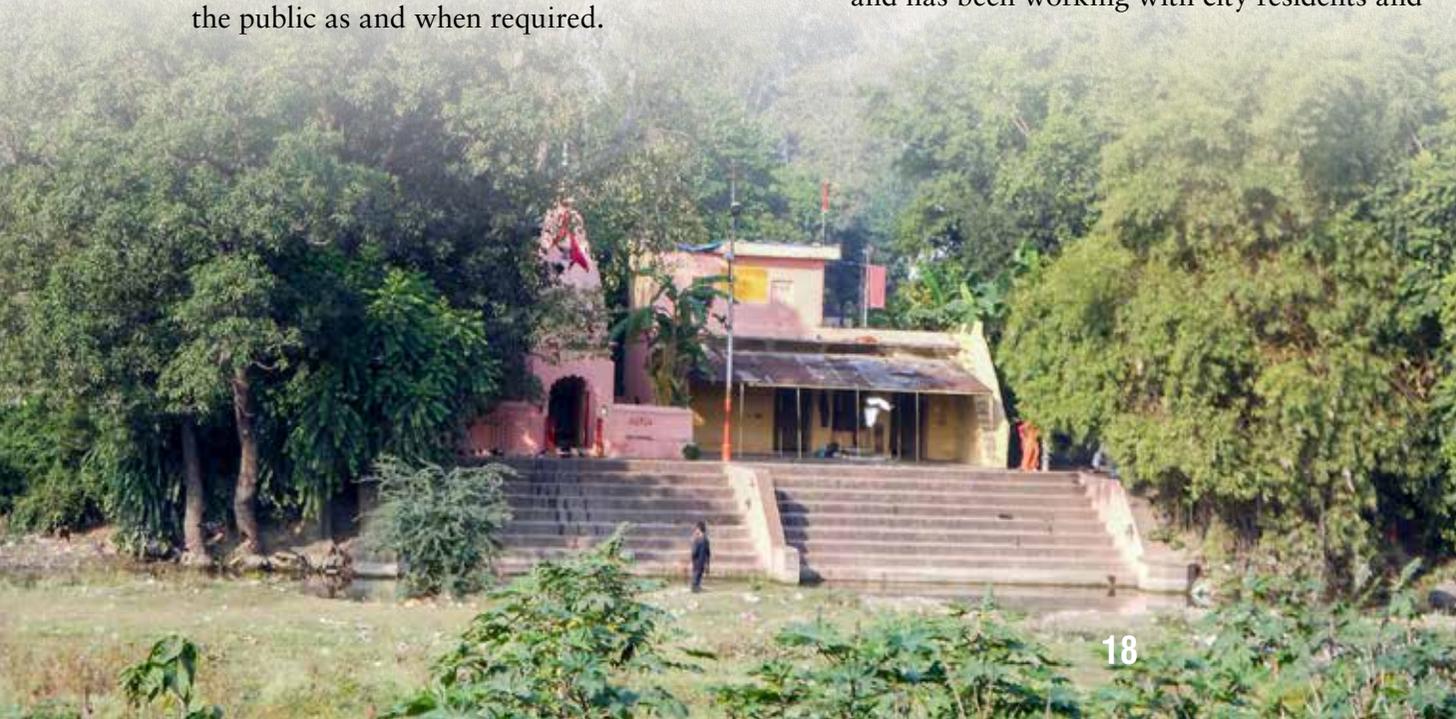
The cleaning drive began the very next morning at the Dhobi Ghat with the arrival of District Magistrate supported by his staff and other members of the Paondhoi Bachao Samiti. Even Samiti members were inspired by the DM’s personal attempt of using a shovel for cleaning by stepping into the river filled with knee-deep silt. Every day at 4 pm, members of the Samiti assembled at the Secretary’s office to chalk out a plan for the following day and assign responsibilities to different members.

Dr. S.K. Upadhyay, a retired Botany professor & HoD provided a scientific perspective to the clean-up drive apart from being the treasurer of Paondhoi Bachao Samiti. A retired Geography Professor, Dr P.K. Sharma served as the Deputy Secretary of the Samiti and has been working with city residents and



“We have seen the sacred river turn into a drain with an overflow of industrial effluents, sewage and garbage. Everyone knows the problem but passes the buck, expecting others to take the lead. Recent efforts to clean the river have revived our hopes to see the Paondhoi restored to its original glory.”

*Ajay Sharma,
Shopkeeper on the banks of the Paondhoi*



“The problems of the Paondhoi River call for cooperation from various government departments such as the Jal Nigam, Nagar Nigam, Pollution Control Board and Saharanpur Development Authority besides support from the general public. People who have led the movement have been emotionally attached to the campaign. Strong leadership and commitment will be required to make further progress on the Paondhoi’s revival.”

Sushant Singhal, Member, Paondhoi Bachao Samiti



villagers living along the Paondhoi River, raising awareness and taking the legal route for swifter action if required. This movement turned into a huge media campaign which included coverage by local journalists, creation of a website, and distribution of brochures as well as organizing street plays all in an attempt to encourage public participation with spiritual leaders also providing support. It was as if an entire city had woken up to revive the river and was ready to partner with the Nagar Nigam in strengthening their efforts. More than 10,000 truckloads of silt, sludge and other solid waste was removed from the river bed over the next few months.

Past attempts and the future

The Paondhoi Bachao Samiti movement wasn't the first attempt to revive the Paondhoi, previous attempts have been made

as early as 2007 with the Indian Industries Association, Saharanpur Chapter spending more than one lakh rupees on river cleaning. In 2009, activists and conservationists led by Sushant Singhal (later inducted as a member of the Paondhoi Bachao Samiti) had prepared an action plan which was shared with the residents of Saharanpur to seek their support. Some of the proposed short term actions included setting up of Nigrani Samiti or neighbourhood watch committees and diverting the open drains into sewer systems along with a longer term vision of waterfront development. A large part of the action plan was subsequently incorporated into the agenda and vision for the Paondhoi Bachao Samiti. At present, the river is being cleaned twice a year – once before monsoon to avoid flooding and another drive is conducted before the Dussehra festival. These efforts are being undertaken with the resources of the Ramlila committee, Saharanpur.

Way Forward

- This is an example of how river rejuvenation efforts can grow into an inspiring environmental movement bringing citizens and administrators together at the city/district level.
- While short term actions such as cleanup of solid waste from the river can be undertaken, medium to longer term plans should be based upon studies and research conducted on the river.
- As long as sources of pollution, be it solid waste or sewage are not eliminated, the impact of a cleanup drive can only be limited.

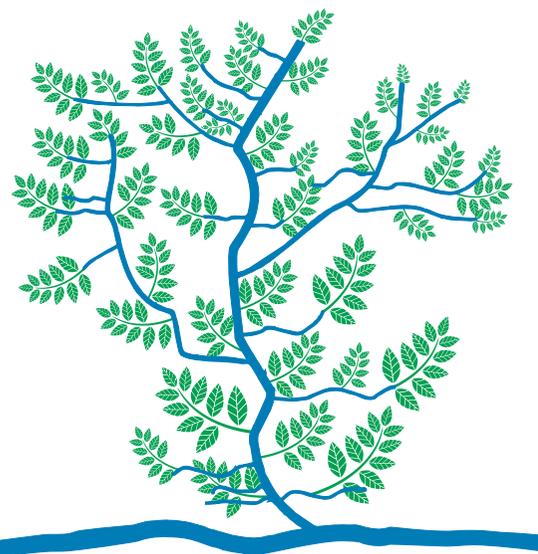
Dr. Veena Khanduri, Executive Secretary, India Water Partnership (IWP)

Irrigation & Water Resources Department Builds Recharge Structures in Hindon

State and district teams pool in resources to create structures for water storage

Recharge Structures

HINDON BASIN



Recharge dams, bunds and plantation efforts all tie in as preliminary **surveys** are carried out, **blueprints** finalised, approvals sought and **budgets** sanctioned partially for creating structures to **preserve** water.

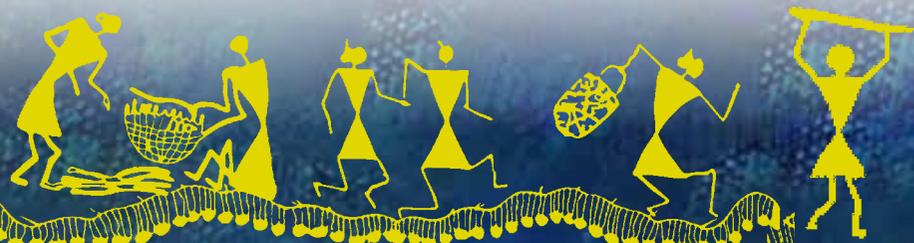
Groundwater recharge is an important field of expertise in water resources management. This measure helps increase the water reserve of underground aquifers and utilises surface water that would otherwise be wasted or contaminated. It also helps store water for future exigencies. Initial use of this methodology dates back to the 19th century and has since been adapted to suit present needs.

Building structures to store water for non-monsoon months

The river Hindon which originates from village Pur ka Tanda in Muzaffarpur block of district Saharanpur flows for

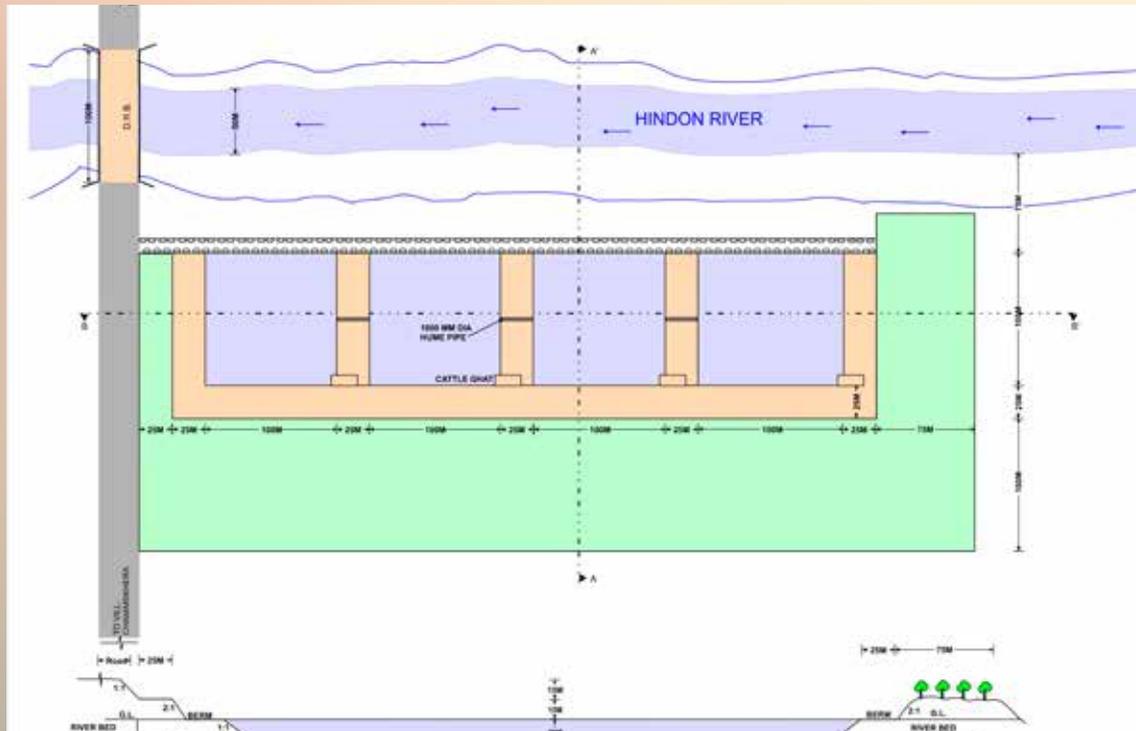
91 km through Muzaffarabad, Punwarka, Baliyakheri, Rampur and Nanauta blocks. The topography of the area is plain with ravines in upper reaches, and being a purely rain fed river with a catchment area of 7083 sq km, it creates a situation where there is least availability of water in the post monsoon period.

Numerous efforts are being taken by the state government to address issues related to water conservation, pollution of river bodies, rejuvenation of ponds and building new water reserves by planning construction of rubber check dams and bund structures. Mr CK Verma, Engineer in Chief, Head of Department of Irrigation & Water Resources in Lucknow: “a flow augmentation plan with several measures including recharge structures in Saharanpur District has been planned recently and a few have been sanctioned to augment the flow of the river.”



The Department of Irrigation and Water Resources, Uttar Pradesh has also drawn up a project for the construction of water augmentation structure (rubber dam) on the River Hindon near village Hasanpur in district Saharanpur. Based on geology, meteorology, and other allied data base information, a plan has been formulated for the construction of recharge structures such as bunds, check dams, ponds etc. On 25th November 2015, in the presence of irrigation department officials, members of the public and other government officials, the decision to build a rubber dam across the Hindon River was taken.

According to Mr AK Bansal, Superintendent Engineer, Irrigation Works Circle Saharanpur, UP Department of Irrigation & Water Resources, “implementing the recharge plan will help increase ground water expediency in Saharanpur area, to cater to the growing demand for domestic, drinking, agriculture, irrigation, industries and energy sectors.” He further informed that rubber dams that are in use in many countries are cost effective, convenient and do not require permanent structures. The inflatable flexible membrane dams bolted into concrete foundations help divert water, ensure water retention for aquifer recharge, supplement water needs of



Water augmentation structure (Rubber dams)

Measurement: 30 metre wide and 3 metre high

Cost: Rs30.73 crore

Storage: Use water upstream and monsoon water; have capacity to store upto 250,000 cubic metres of water

Status: Approval from state government received and work to commence once funds are released

4 Mud Bunds

Measurement: 2 bunds measure 90 metres and remaining 2 measure 50 metres in length

Cost: Rs 193.55 lakh

Beneficiaries: Five villages and 13,000 people

Storage: Upto 17,000 cubic metres of water

Status: Preliminary structures have been made; final structures to be ready by end of 2016

local populations and create space for aquatic life. Aquifer recharge is a way to store water underground in times of water surplus to meet demand in times of shortage.

The rubber dam is an inflatable structure built across a stream used for water conservation, flood control and regulating flow of water in the stream. When inflated, it serves as a check dam/weir and when deflated, it functions as a flood mitigation device and sediment flushing. The main advantage of a rubber dam is its ability to conserve water in a better manner, and to help control floods during excess runoff water flow. It also acts as a dam/reservoir for storing during scanty rainfall period (dry spells) so that supplemental irrigation can be provided to crops. This technology has potential to benefit farmers in rainfed agro-ecosystems. Main advantages of rubber dams are that they are adaptable to different side slopes, are constructed in a short period of time, are easy to maintain and repair. They are also earthquake resistant, adaptable to adverse conditions and environmentally friendly.

Constructing mud bunds to store more water

Few years ago five mud bunds that were 700 meters long were made to benefit the region. Unfortunately, in the floods of 2013, they got destroyed since they did not have a provision of weir (rubber dam). The area was once again surveyed and levels of starting and closing

benchmark were recorded before finalising a reconstruction plan at a distance of 150 meter, 300 meter, 475 meter and 625 meter. Work for these newly proposed bunds is yet to be initiated and will have an upstream and downstream slope. The main purpose of the project is to create storage of water at all time during dry weather, recharging of ground water in the nearby area of river Hindon, augmentation of water for agriculture, utilisation of saved water for increasing flow of river during non-monsoon period, enhancing revenue by rearing fisheries and correcting the overall biological balance.

Tank bunds are basically small sized earth dams and are of three types, namely homogenous embankment type, zoned embankment type and diaphragm embankment type. The tank bunds at Purka Tanda are of homogenous embankment type and will be constructed with soils from pits in the vicinity of the bund. For such smaller bunds, generally no seepage and stability analysis is carried out but the sections are designed on the basis of practical considerations and experience derived from success and failure of similar works. Alongside the construction of the rubber dam and mud bunds, a plantation programme has been launched for beautifying the site and to replace the large scale Eucalyptus trees with tree species, shrubs and bushes that are more suitable for the area and which will help prevent soil erosion.

REFLECTIONS

1. The effort related to water storage and aquifer recharge in the Hindon basin will have a great impact on the livelihood of the people, hydrological cycle, and flow condition of the river in lean season.
2. The project seems to be technically sound as the detailed plan is made based on the geological and hydrological data of the area. The rubber dam is a state of the art technology for a small project like above and offers a low cost but effective solution.
3. The technology is effective in flash flood management which are annual event of high frequency in the area. In other parts of the Shivalik foothills which have the same feature, the technology has potential of replication.
4. Bunding has proved to be an effective and low cost way of recharging aquifers and supplying water for local use. Although it is an old and widely accepted method, the plantation of species with the purpose of integrated watershed management makes it a unique effort.

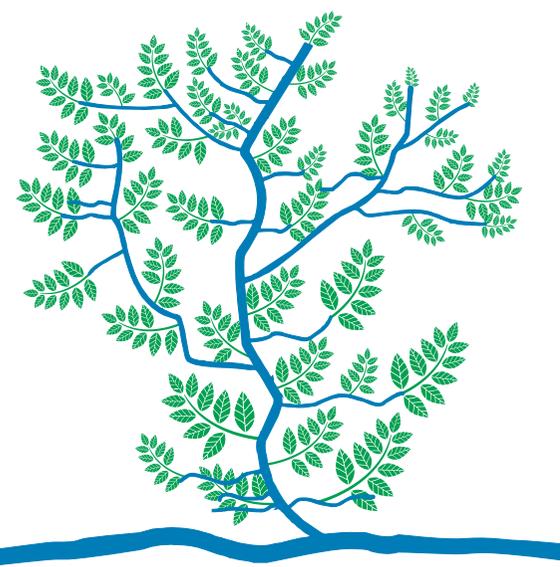
Dr. Vivek Kumar, Assistant Professor Paper & Pulp Department, IIT Roorkee



A Step Forward
Paper Mills Complying with
Charter for Water Recycling

Companies Invest in
Effluent Treatment
Plants

HINDON BASIN

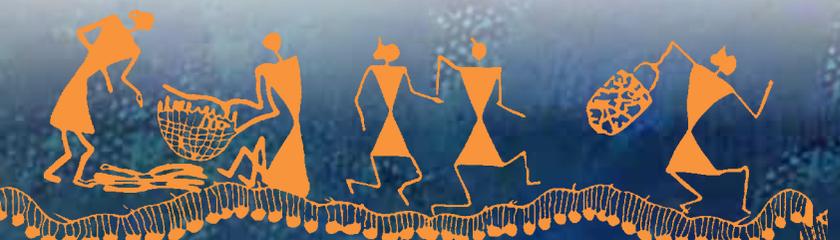


*Bindlas Duplex in Muzaffarnagar, Maruti Papers in Shamli and Star Paper Mills in Saharanpur are examples of **paper mills** in the **Hindon basin** which have **optimised water usage** in their manufacturing processes. They have **invested** in waste **water treatment** technologies and are moving closer to desired **zero liquid discharge** standards.*

Adopting the Charter Approach

Paper manufacturing is a highly capital, energy and water intensive industry. It is one of the 17 most polluting industries identified by the Ministry of Environment, Forest and Climate Change. The Central Pollution Control Board (CPCB) in 2013-14 formulated a 'Charter for Water Recycling and Pollution Prevention in Pulp & Paper Industries'. This was done in consultation with experts from Pulp & Paper industries, Central Pulp & Paper Research Institute (CPPRI), Saharanpur and Department of Paper Technology, IIT Roorkee.

The Charter follows a clustered approach and was initially introduced in the Ganga River Basin in five identified clusters of pulp and paper industries located in Uttarakhand and Uttar Pradesh. It envisages the upgradation of the status of pulp and paper industries in process technology, practices and environmental performance. It also targets substantial reduction of fresh water consumption and wastewater generation. This may be achieved by reducing, recycling and reusing effluent streams with and without treatment for different endpoint uses; end of pipe treatment for existing units with retrofitting of recycle and reuse options; and



continuous monitoring. The aim is to attain desired levels of environmental protection which are meeting objectives of the National Mission for Clean Ganga.

Impact assessment of the Charter has shown improvement in the environmental status of pulp and paper industry in the identified clusters. This is an encouraging trend that will see the Charter implementation extending to all pulp and paper industries in the Ganga River Basin States, reducing pollution levels along the Hindon River and beyond.

Medium to large paper mills making efforts to comply

Bindlas Duplux Limited in Muzaffarnagar is an agro residue and waste paper based

company that has two state-of-the-art mills. It produces approximately 70 tonnes of paper a day. In order to combat the problem of pollution due to discharge of black liquor, the company has invested in the non-conventional Chemical Recovery Plant. The caustic soda used for pulping is recovered as sodium carbonate and sold to the Glass and Soap industries. The discharge effluent post the installation of Chemical Recovery Plant are amenable for treatment in Effluent Treatment Plant (ETP) and the norms set in the charter are complied. Moreover, the mill has also installed online monitoring system that is constantly monitored by the authorities which is a positive sign of investing in technology ensuring improvement in the quality of the effluent being discharged.



Maruti Papers Limited aims to achieve zero discharge of wastewater from its plant. Adjoining to the factory is a specially created green field of over 230 bighas of land where 10,582 different trees have been planted. All the treated water released from the ETP is used to irrigate part of this green area which is expected to earn revenue besides serving as a place for employees to stroll around. The quantity of the water generated from the plant is not sufficient and has to be supplemented in part by fresh water. Their next project is rain water harvesting, which shall be started very soon. The slogan “*Jal Hai Toh Kal Hai*” (Where there’s water, there’s a future) coined by them 4 years ago for a water campaign is a positive reminder of the need to preserve depleting water resources.



Reflections and Way Forward

This project reflects a success story of a participatory approach and is a great example of Government-Academia-Industry partnership.

Pulp and Paper units especially SMEs need to be supported by capacity building, sharing best practices as well as providing technical guidance to achieve reduction in freshwater consumption/effluent generation and reducing operational costs. This is necessary to scale-up implementation by other pulp & paper units in this sector.

The good progress made in the implementation of the Pulp and Paper charter can serve as an inspiration for other industrial sectors. However, a Cost Benefit Analysis needs to be carried out for adopting the water efficient practices/technology in the interested industries along with an appropriate financing mechanism for SMEs in those sectors.

Dr. RK Jain, Director ex-officio of the CPPRI, Saharanpur, Dr. Vivek Kumar, Associate Professor, Department of Pulp and Paper Technology, IIT Roorkee Karishma Bist, Joint Director, Resource Conservation & Management Division, FICCI

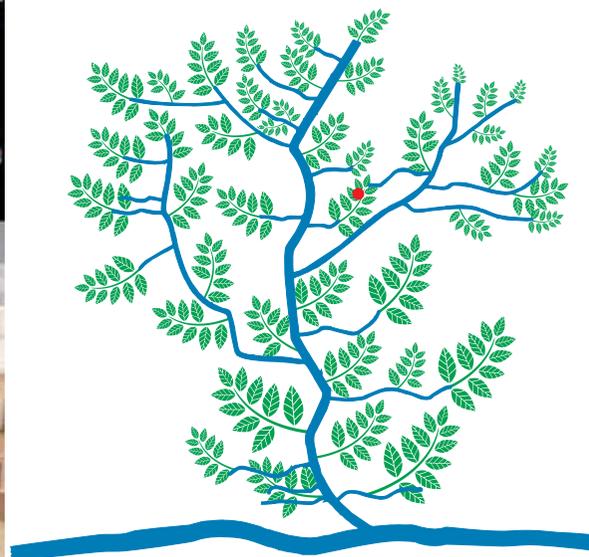
Maruti Papers Limited, a 26-year old company in Shamli district of Uttar Pradesh is one of the leading manufacturers of quality Kraft paper in the state. It manufactures approximately 300 tonnes of unbleached variety of packaging grade paper a day, employing recycled waste paper. The company has been constantly improving its efficiency in multifarious directions aiming towards conservation of raw material, energy, water while upgrading its ETP. This has helped achieve the stipulated norms with respect to the pollution parameters resulting in compliance with the charter. Maruti Papers has upgraded its technological processes by installing equipment such as showers in the paper machine to reduce consumption of water on par with global best practices; from 25 cubic metres to a minimal 4 cubic metres per metric tonne of paper.

The Star Paper Mills, incorporated in 1938, adopted an Energy Policy in 2001

and was awarded a Certificate of Merit for energy conservation by the Indian Paper Manufacturers Association in 2005. It has taken numerous measures to comply with latest environmental standards, including the Charter. The company follows ethical norms with respect to discharge of treated water into the Hindon through metallised drains. According to Mr. IJ Singh, Chief General Manager (Works), "Quality of water is important for product quality and reducing consumption of paper making chemicals." Most of the water released by the ETP is consumed by farmers for irrigation, leaving minimum water for discharge in the river. In summer months, this effluent becomes a critical source of irrigation for farmers. As part of CSR activities, it conducts awareness programmes for local farmers on agro economics and use of quality samplings. It also provides opportunities for students of IIT Roorkee to undertake specialised research on pulp and paper.

A Paper Mill Partners with MIT-Tata Center to Explore Eco-friendly Innovations

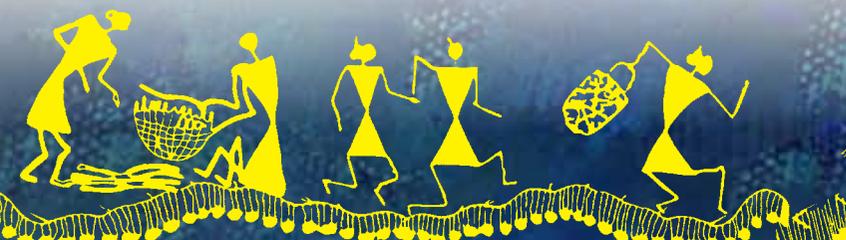
Bindlas Duplux Paper Mill invests in research on clean technologies to reduce carbon footprint and develop sustainable solutions for industrial waste.



A private sector company in a small city **partners** the one of the world's most prestigious educational institutions to study water and industrial **pollution**, coming up with **prototypes** to **cut energy**, turning **waste** into **products** and saving costs

Globally, industrial waste water represents the one of main sources of water pollution with the pulp and paper industry being a key polluter. Even agro-residue and recycled fibre based units are not exempt, since they consume high volumes of fresh water, bagasse and wheat straw with chemicals such as sodium hydroxide and sodium sulphide. Paper mill effluents are resultantly marked by dark brown colouration, adsorbable organic halides and other toxic pollutants adding to deteriorating water quality.

While majority of the 800 odd paper mills in the country gear up to invest in upgraded equipment and effluent treatment plants to comply with the revised Central Pollution Control Board (CPCB) norms, Bindlas Duplux Paper Mill in Muzaffarnagar has gone a step further by investing in research. They have seen an opportunity in tying up with the MIT Tata Center for Technology + Design making available their premises, resources and laboratories to conduct research for new products that reduce carbon footprint while finding cheaper and more sustainable solutions for dealing with industrial waste.



After three years of dedicated research, one of their projects is now reaching the final stage of testing before transitioning to production using a pilot plant with the aim of expanding to the rest of India.

Eco-BLAC Bricks, the next big innovation, serving sustainable masonry from industrial waste

Muzaffarnagar has more than 200 traditional kilns, where red clay bricks are fired. Growing demand from the construction industry is causing severe environmental consequences such as topsoil depletion from harvesting clay and greenhouse gas emissions due to massive energy demands of kilns. Meanwhile, paper mills are burning cheap raw materials

to produce energy, generating over 80,000 tonnes of waste ash daily. Most of this ash is unusable and sent to landfills, occupying valuable farmland at great expense to paper mill owners as well as potentially leeching from the soil to the groundwater. The MIT-Tata Center team studied both problems and used industrial ash to develop Eco-BLAC bricks which are cheaper and more environment friendly as opposed to red clay bricks. The brick employs alkali-activation technology which is a low-energy process compared to traditional bricks which are kiln-fired at 1000°C consuming huge amounts of fuel. The eco-BLAC brick can be cured at ambient temperatures, massively reducing energy requirements while ash waste get recycled, alleviating the burden of land filling.

Win-Win for all

Pankaj Aggarwal, Managing Director, Bindlas Duplux Ltd, Muzaffarnagar: Working with MIT Tata Center for Technology + Design has thrown open a whole new world of opportunities and creativity. While we are working on few research projects, even if one of them proves successful, it will be a game changer. Eco BLAC bricks are cheaper to produce, light in weight and allow us to use the waste that we are currently dumping.

Thomas Poinot, Post-Doctoral Associate at MIT: "As researchers, we benefit immensely from research partnerships like the one we have with Bindlas. For, we then have full freedom to implement a pilot plant, have someone believe in us, provide support and financial backing."

The bricks have gone through several rounds of testing, including compression, durability as well as water absorption showing promising results. The team is confident that the brick will perform as well or better than the kiln-fired variety. This solution is scalable all over India, as there are factories producing boiler ash throughout the country. According to Mr Aggarwal, "If the ash bricks project is successful, this will prevent huge amounts of ash from being dumped into landfill and ensure ground water quality does not suffer which is what the Hindon basin desperately needs."

The Eco-BLAC Bricks was an award-winning finalist in the 2015 MIT \$100K Accelerate Entrepreneurship competition, and was named as one of the top innovations of 2015 by Mashable.

Wastewater treatment method selection for small-scale pulp and paper mills

Black liquor, a toxic by-product from the kraft pulping process in pulp and paper mills, is traditionally treated by being passed through multiple effect evaporators and burned in recovery boilers to produce energy and recover chemicals. However, traditional treatments of black liquor are



not viable for small-scale kraft paper mills such as the ones in Muzaffarnagar, due to low alkali and total solids concentration of their black liquor. The study explores alternative treatment methods including low temperature incineration and membrane filtration to determine effectiveness and economic viability for industrial scale black liquor treatment. The researchers are hopeful that with the help of the CPCB, this method selection guidance will serve small-scale pulp and paper mills in their wastewater treatment planning, encouraging them to select the most effective method that minimises cost of treatment and overall reduce emissions of black liquor across the country.

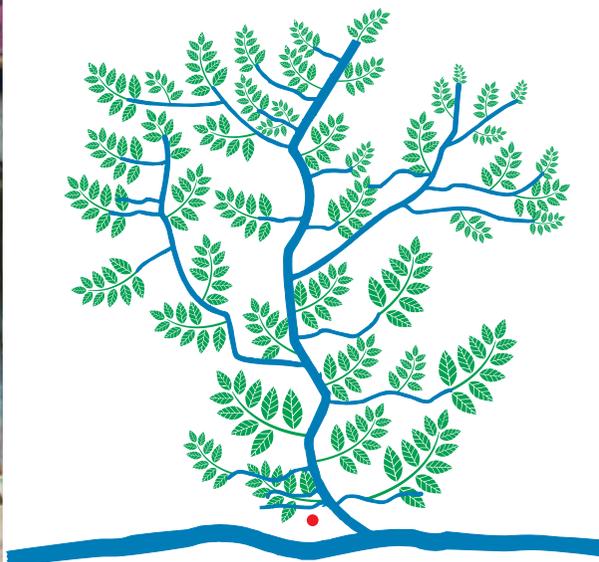
Mr Aggarwal has turned the tables on critics who lament the highly polluting nature of the paper industry. Indeed, Bindlas Duplux Paper mill's innovative partnership with MIT Tata Center along with other local colleges is testimony to how the corporate sector can use its resources to further its goals while fulfilling its larger social responsibility.



Reflections and Way Forward

Stopping of black liquor discharge will result into huge reduction of pollution load into the Hindon River. After life cycle analysis, if Eco-BLAC brick making is found sustainable, it can be replicated not only in paper industry but also in other industries. This case study is a good example of an industry changing to sustainable production system through technology; this can be adapted for other industrial sectors, where instead of controlling pollution through end of pipe treatment, first it must be reduced by adopting sustainable production processes.

Dr. Vivek Kumar, Associate Professor, Department of Pulp and Paper Technology, Indian Institute of Technology Roorkee



A water management project among **textile suppliers** in and around Noida demonstrates how **efficient** resource management can **achieve** substantial **environmental** improvements and **financial** gains.

The Indian textile industry is one of the largest industrial water users and is facing serious growth limitations due to increasing shortage in freshwater availability. With the aim of reducing water, energy and chemical use in their supply chains, Sweden Textile Water Initiative (STWI) initiated the Sustainable Water Resources (SWAR) programme. This pilot project was carried out between 2013 and 2014 as a joint initiative between Swedish fashion brands such as Indiska, KappAhl and Lindex and their Indian suppliers, Stockholm International Water Institute (SIWI) and the Swedish International Development Cooperation

Agency (SIDA). SWAR was co-financed by the brands and SIDA, in a public-private partnership that linked business and international development goals. Implemented in India with the support of cKinetics as local consultants, factories saved seven per cent of their total annual water use, 360 million litres; average of three per cent of their energy costs and three per cent of their operational costs.

One of the participants in the SWAR programme was Global Mode and Accessories Pvt. Ltd. (Global Fashion India), a garment manufacturer based in Noida, specializing in supplying high fashion retailers in Europe. Mr. Promod Mehra, Founder & Chairman said “We were aware of the importance of water and energy but due to our routine busy life we had not paid enough attention to the need for conservation of



these two vital sources. When Indiska made us aware of Programme SWAR, I knew we had to participate in it and start with at least one of our manufacturing plants.”

In 2014, a variety of measures/projects were carried out under the SWAR programme at their C-54 unit based out of Sector 58 at Noida. Water meters were installed at major points in the textile unit; creating awareness among staff as well as regular resulted in reduction of water usage. Their Effluent Treatment Plant (ETP) was optimized thereby improving both quality and quantity of treated effluent. Leakages in the tanks were plugged and regular water taps were replaced with spring loaded taps realizing savings of at least 10-20%. Overall, the textile unit had saved water resources amounting to 1,185 kilo litre (kl) per annum.

Cumulative resources saved through SWAR and STWI programmes at Global Fashion India	2014 (SWAR)	2015 (STWI)
Electricity (kWh per annum)	42,515	1,33,387
Water (kl per annum)	1,185	9,360
Chemical (kg per annum)	3,763	3,427
Financial (INR per annum)	717,943	19,44,521
Source: Global Fashion India		

Global Fashion India continued their engagement with STWI under a follow up global programme launched in 2015. The STWI programme was executed at their B-2 unit, Sector 65, Noida. Many of the successful interventions previously implemented under the SWAR programme

were replicated in this unit, including installing water meters and monitoring consumption as well as fixing leakages in the tanks.

In addition, improvements were made in the ETP system such as changing the chemical dosage, installing bar screens and reuse of treated water. Reducing fresh water usage in

“For me, the key drivers were costs and environmental impact. One can make substantial saving in energy & water consumption at nominal cost and thereby help not only protect the environment, but also create an environmental friendly surroundings at work.”

*Promod Mehra, Founder & Chairman,
Global Mode and Accessories Pvt. Ltd.*



“Our team is now gearing up and looking forward to operating in a more sustainable way, we have brought about management level change of view on how such a program improves the unit’s efficiency. We are also investigating and experimenting with how this could help engage brands and buyer groups more closely for a better business assurance”

Vikas Kapur, Director, Radnik Exports



the boiler unit was accomplished by sending condensed steam back into the boiler, this in turn helped the factory to reduce the fuel requirement in the boiler system. Re-using the R.O. reject water for domestic purposes such as flushing also reduced the fresh water consumption of the factory. All these measures led to achieving water savings of 9,360 kl per annum. Global Fashion India continued its association with the STWI programme in 2016 with new measures such as rainwater harvesting being considered for implementation.

Another textile manufacturer, Radnik Exports which has been manufacturing high end fashion apparel for over two decades, participated in the SWAR programme. They were introduced to a wide range of optimization solutions and environmental impact reduction areas along with a practical approach towards execution. Three major initiatives were implemented:

1. Installing an energy and water monitoring system
2. Building standard operating procedures and checklists for ensuring compliance with best practices.
3. Subject specific training through workshops and interaction with industry peers to exchange implementation best practices.

Post execution of these interventions, their textile unit at D-144 Sector-63 Noida reduced water consumption from 15.5 litres/piece in 2013 to 5.5 litres/piece in 2015 along with an overall water savings of 22741 kl per annum. The organization intends to reward employees who take steps towards resource conservation apart from extending the campaign beyond the factory by encouraging employees to adopt water and energy saving practices at their homes.

REFLECTIONS

The SWAR programme provided a holistic approach towards resource conservation. During the SWAR programme, different manufacturers shared their experiences in implementing measures through meetings and workshops which gave the participants the impetus to execute them in their own premises.

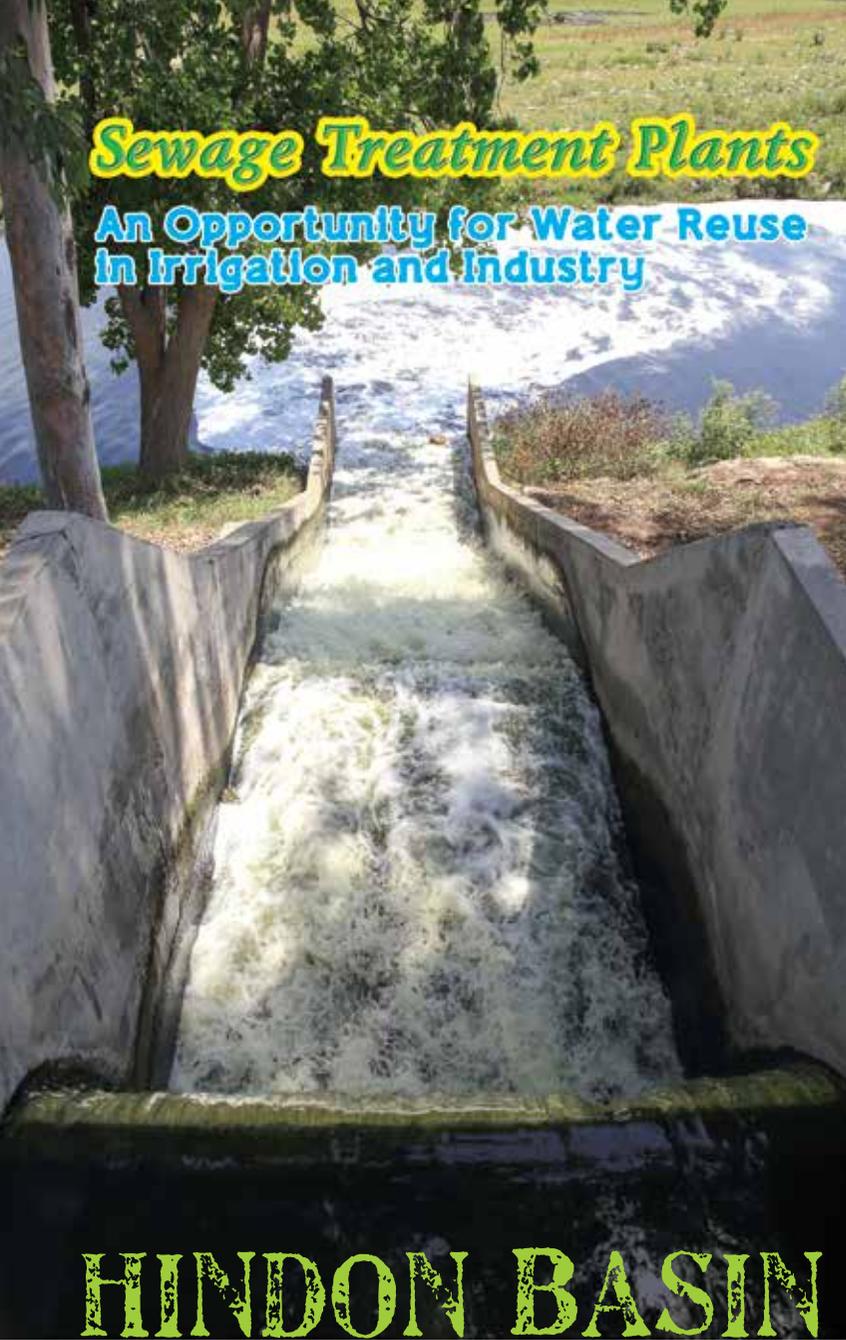
An individual manufacturer may shy away from consulting experts due to the high costs. However, programmes such as SWAR where the costs are shared, enables many manufacturers who are keen to adopt environmental friendly measures to participate in the programme. These programmes also proved that major savings can be achieved with minimal investment. The important thing is for organizations to set the right priorities along with the will to work in this direction.

To achieve further improvements, the textile units also need to adopt new technologies like Cold Pad Batch dyeing (which consumes about 40-50% less water than conventional dyeing process); Counter-current washing; Chemical Recovery system; Zero Liquid Discharge (ZLD) etc. An appropriate Effluent Treatment Plant (ETP) with Reverse Osmosis (RO) Technology and Multi Effect Evaporator (MEE) is imperative to reuse its wastewater so as to achieve ‘Zero Liquid Discharge’ and reduce to its specific water consumption.

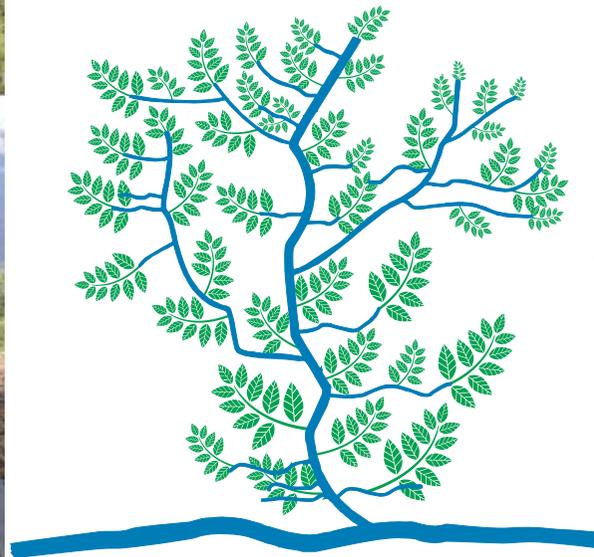
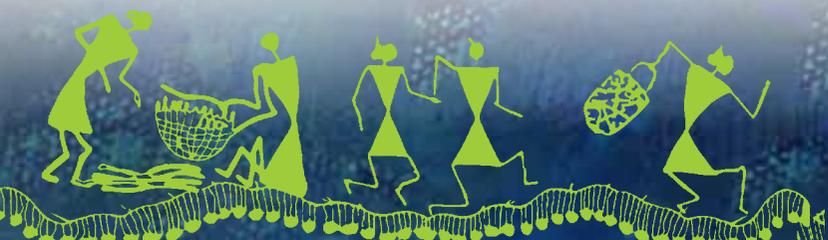
Karishma Bist, Joint Director, Resource Conservation and Management Division, FICCI.

Sewage Treatment Plants

An Opportunity for Water Reuse
in Irrigation and Industry



HINDON BASIN



Hindon River, a tributary of Yamuna, originates in Saharanpur District and finally meets the river Yamuna in Noida after traversing a distance of ~300kms. In cities/towns falling within the Hindon catchment, **sewage treatment facilities** were constructed to **prevent** release of **untreated wastewater** into the **river**. Having fulfilled their intended purpose, all of these treatment facilities offer huge **potential** for **augmentation** and **upgradation** for **water reuse**, which is the need of the hour in order to **conserve** fresh **water** resources.

Pollution caused by domestic wastewater which is also referred to as 'sewage' is one of the primary causes for degradation of water resources. The situation gets progressively worse when cities and towns experience growth as a result of planned as well as unplanned expansion making it critical to have a functioning Sewage Treatment Plant (STP). The challenge lies in not just bridging the widening gap between sewage generation and treatment capacity but to go beyond. Effectively, this means developing facilities to divert treated sewage for different purposes such as in irrigation to utilise nutrient value of sewage as well as industrial production

thereby reducing burden on fresh water use. The existing Water (Prevention and Control of Pollution) Act 1974 recognises its importance and permits states to do. Along the Hindon's route in Uttar Pradesh, there are two STPs located upstream of the river at Saharanpur and Muzaffarnagar which are 16 years old constructed under Yamuna Action Plan-I (YAP-I) while the STP at downstream Greater Noida is relatively new and part of a more organised town planning effort. The primary objective of all three STP's is to ensure that sewage collected at the plant is treated effectively for conventional pollutants so as to comply with current discharge norms.



Resource Recovery from Saharanpur STP

A 38 MLD STP based on UASB+PP technology was constructed in year 2000 under YAP - I at Saharanpur. The project was executed by Uttar Pradesh Jal Nigam and is being run by the Jal Kal Nagar Nigam, Saharanpur. The primary objective of the STP was to reduce pollution level in the river Dhamola which is a tributary of Hindon that finally meets the Yamuna River.

The Saharanpur STP continues to function well while operating at full capacity even after a period of over 15 years. The UASB technology requires no process energy for operation of the plant. Interestingly, the STP is self-sustainable to a certain extent by producing sufficient bio-gas to run its own operations. The STP has a dual fuel generator (180 KVA) that is technically equipped to run with a ratio of 70% bio-gas and 30% diesel for five hours. This can be a model for STPs

that are constrained on account of frequent power outages, leading to faulty operations and treatment inefficiency.

An upgradation proposal including an additional 600 kms of sewerage pipelines under the Amrut Yojana has been submitted. This will be serviced by two new treatment plants at Nazirpura and Badshahpur increasing the total capacity to 84 MLD with completion expected by 2020. The existing treatment plant will also see a switch from the current UASB to an advance treatment technology in order to comply with proposed stricter discharge norms.

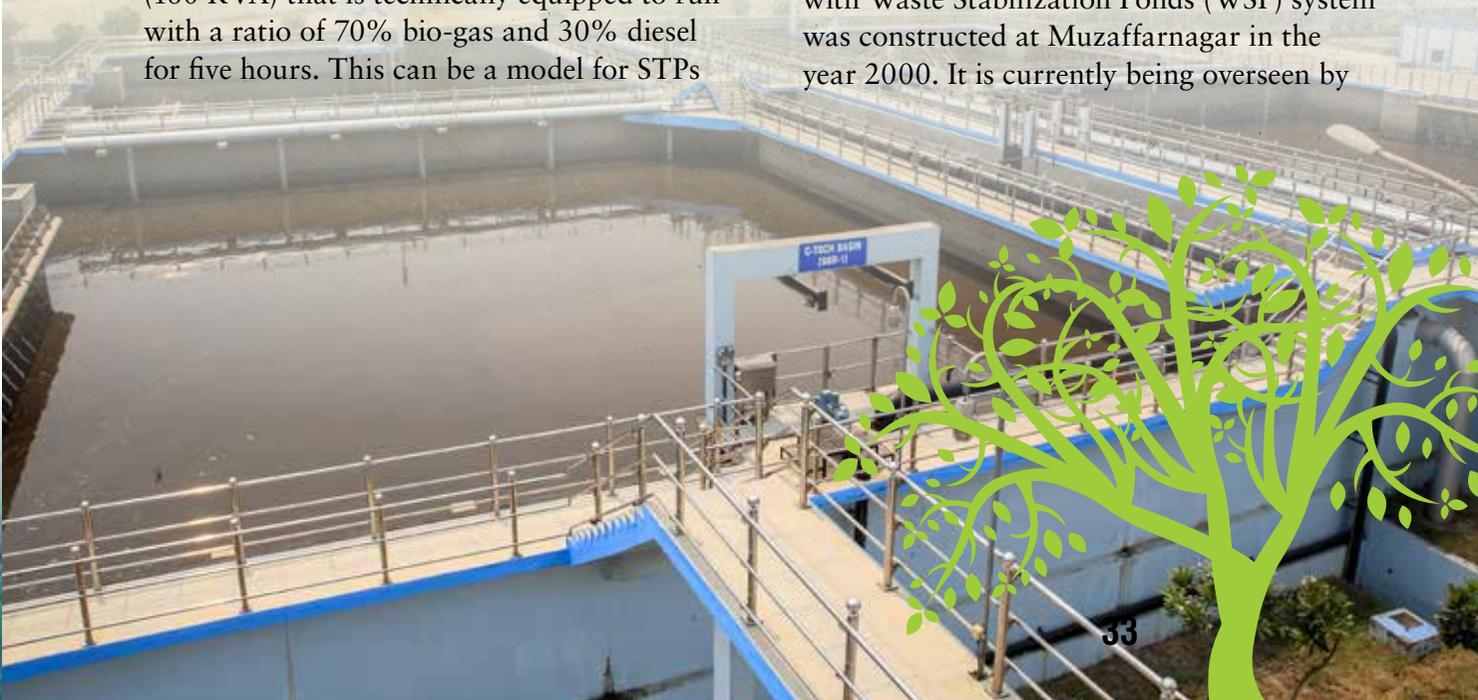
Converting Existing Ponds to Constructed Wetlands for Water Quality Improvement

Under the YAP-I, a 32.5 MLD capacity STP with Waste Stabilization Ponds (WSP) system was constructed at Muzaffarnagar in the year 2000. It is currently being overseen by



“If Saharanpur has to be a Smart City under the Government of India mission, the upgradation of the STP will be a key component along with capacity building of the Nagar Nigam”

*PK Gupta, General Manager,
Jal Kal Nagar Nigam, Saharanpur*





the Muzaffarnagar Nagar Palika. The WSP system comprises of anaerobic, facultative and maturation ponds in series that works on the natural process of degradation. Improper operation & maintenance of the STP due to constraint in funds and the lack of qualified personnel has resulted in WSP system not meeting the discharge standards. On a positive note, a proposal to upgrade the STP is currently under evaluation with the UP Jal Nigam which is an urgent requirement for the fast growing city of Muzaffarnagar. The WSP system can be easily converted into Constructed Wetlands as this technology involves media and vegetation at shallow depths to produce a very fine effluent quality. This proven technology doesn't require highly skilled personnel and has relatively lower maintenance cost. Under the Indo-Euro bilateral program on water technology, a demonstration scale Constructed Wetlands has been developed at Aligarh Muslim University for water recycling and reuse.

An efficient STP to help Greater Noida achieve “zero discharge city” status by 2021

When planning an STP, the complexities of the city growth patterns needs to be taken into account. Noida, a city known for its urban planning has 81 villages that are zoned by their panchayat but utilize civic facilities

provided by the Noida Authority. Therefore, the challenge is not so much about the water treatment per se, rather the collection and transport of sewage to the STP without leakages. The STP in Greater Noida is a joint partnership between Noida Authority and HNB Engineers Private Ltd., Pune. It is a 35 MLD plant based on SBR technology that was operationalised in 2012. In the case of Greater Noida where land is expensive and not so easily available, compact systems like SBR or MBR are suitable.

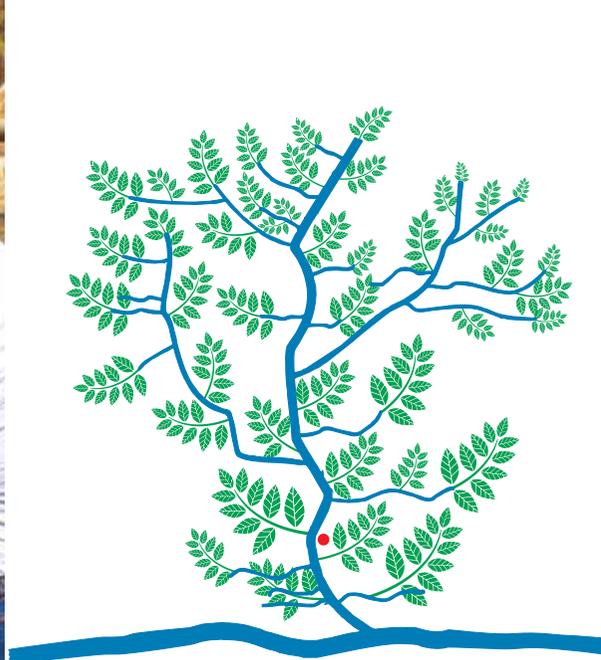
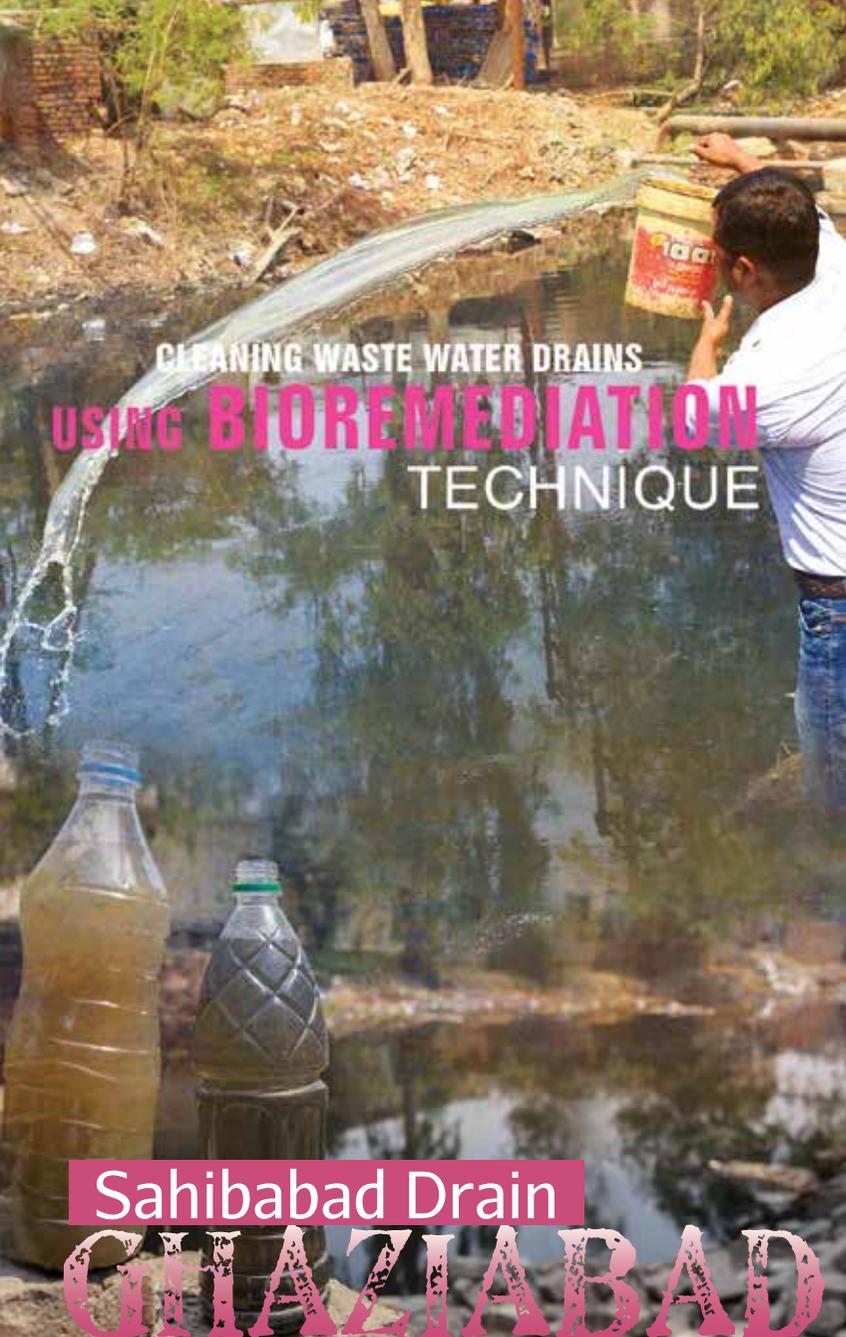
Interestingly, although Greater Noida was formed in 1991, the city did not have adequate sewage treatment facilities which meant that all untreated wastewater was discharged into the Hindon until a few years ago. This state-of-the-art plant ensures treated water is released into the Hindon River. A portion of the treated effluent is sold to real estate developers in Gautam Budh Nagar. The STP also has a demonstration ultra-filtration unit which treats water to standards fit for human consumption; however, perception issues on STP treated water prevent it from being scaled up. According to the Noida Master Plan for 2021, six new STPs are being planned to support the growth of the Greater Noida with the aim to use 100% of treated sewage for different purposes.



Reflections, Challenges & Way Forward

Hindon is a heavily polluted river with many complexities; made severe by the fact that it is rain fed river. While some efforts have been made in the past, strong will and vision is needed to adopt a holistic approach to deal with the pollution of the Hindon River involving communities, farmers, industry as well as government. The approach includes water reuse for agricultural purposes and by the industry.

*Dr. Nadeem Khalil, Associate Professor
(Environmental Engineering) in the
Department of Civil Engineering,
Aligarh Muslim University*



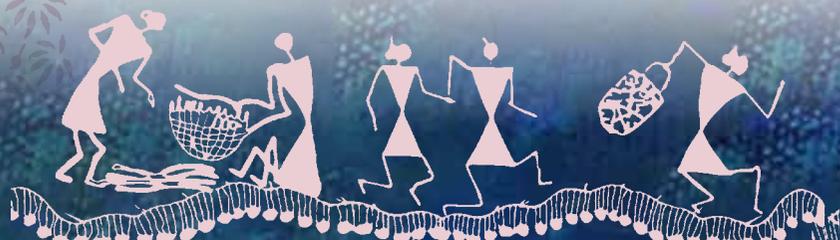
In search of easy to implement solutions

Not just humans, but drains need oxygen too for there to be life on its periphery. Residents living in the vicinity of the Sai Baba drain in Sahibabad area of Ghaziabad were pleasantly surprised to see the rare sprouting of flowers and hovering of dogs and birds on the bed of the drain. An accelerated bioremediation plan implemented by a private company at the behest of an MCD Corporator and social worker and members of the Resident Welfare Association (RWA) is being evaluated as a possible solution to clean not just this drain but other drains and water bodies in Ghaziabad.

Bioremediation is a water pollution control technique involving use of nutrients to remove/neutralise pollutants from a contaminated water body. The so-called “Nualgi” technique can mitigate impact of vast amounts of untreated sewage discharged into a river or open drain.

Residents from Sahibabad’s Brij Vihar approached Mr Vinod Choudhary, Corporator, East Delhi, Municipal Corporation of Delhi to visit Sai Baba Drain, which starts from Apsara border and flows through residential colonies of Rampuri, Alaknanda and Brij Vihar. This public combined sewer with a flow of 25-35 million litres per day (MLD) contains domestic waste from proximate colonies and industrial waste from industrial clusters upstream. It is also a bypass drain for the J Point Sewage Treatment Plant (STP).

Houses along the stretch facing the drain raised slopes leading to their homes, increasing height of their gates and putting heavy curtains as a veneer. Alas! These were feeble attempts to keep the smell, mosquitoes and flies at bay. Further, noxious fumes penetrated these barriers and destroyed not



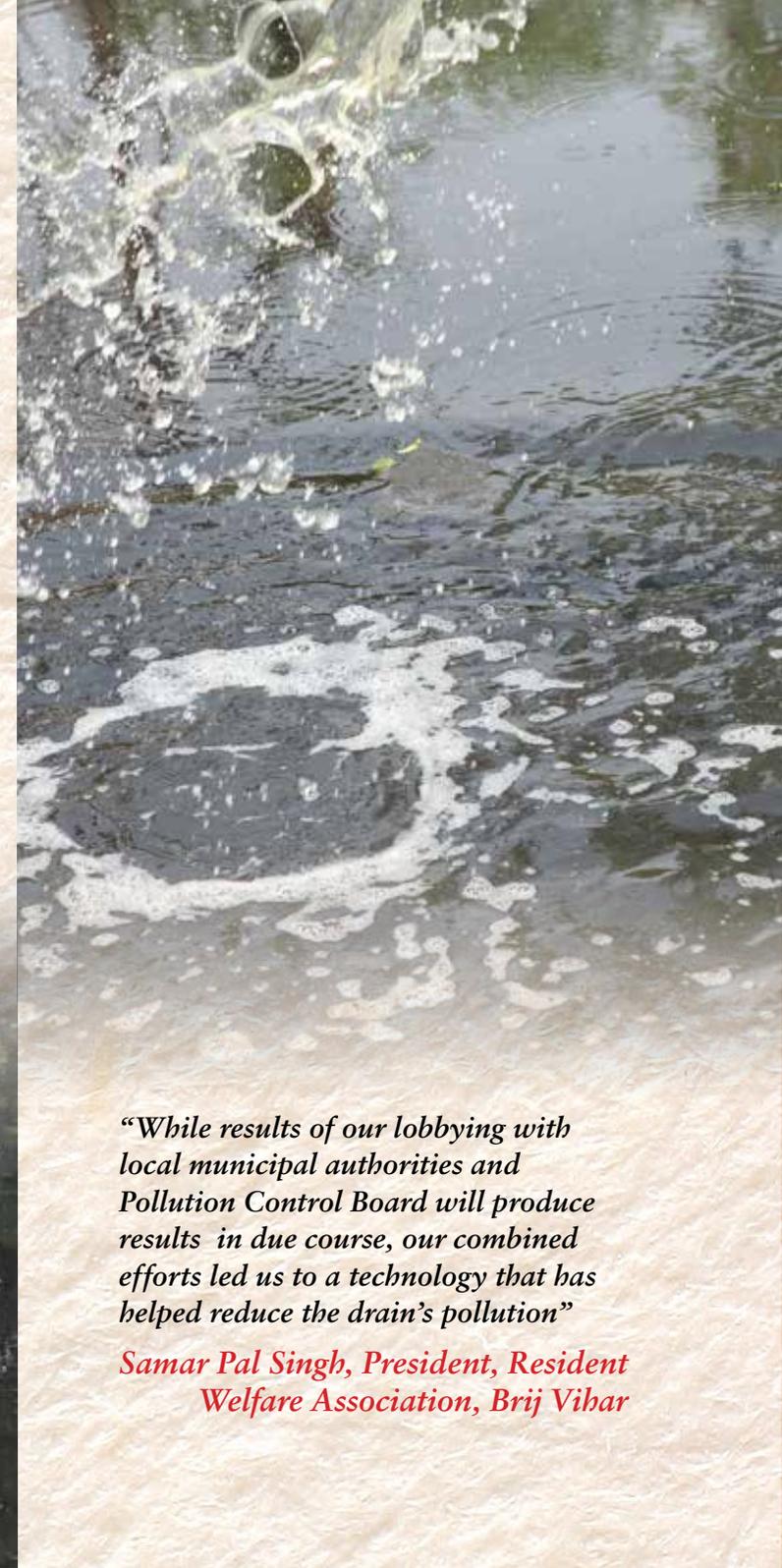
just their health but also the copper tubing and wiring of domestic electrical appliances. Complaints of gastro and vector borne diseases increased, primarily due to bad water quality.

Mr Choudhary, who by no means was unfamiliar with waste management systems, scouted for a viable solution to alleviate problems emanating from the Sai Baba drain. His recce led him to Gurgaon based JS Water Energy Life. After discussion and site visits, an accelerated bioremediation plan was implemented with 6-8 dosings of Nualgi and bio augmentation material in the 1km stretch that flowed through the colony over a four-week period. 'Nualgi' is a research product that can grow diatom algae on any water surface. The inorganic product (30grams of nutrients for 2-4 million litres of water) drives organic processes of water and reduces biochemical oxygen demand (BOD) and chemical oxygen demand or COD (5% or

more in 3 months of dosing). A pilot project was undertaken at a cost of Rs 60,000 funded from Mr Choudhary's personal funds. Necessary approvals from the Municipal Corporation were obtained and the piloting was executed in October 2015.

Impact of dosing on water quality

Within 20 minutes of the dosing, bubbles of oxygen were seen rising to the surface and creating ripples in the water; dissolved oxygen concentration in the drain was increased. This was not just localised, but effects were seen downstream with sludge from the bottom of the flowing water body breaking into smaller particles, rising up to the surface and flowing out with the water downstream. The colour of the water changed from a dark ominous grey to a lighter gradient and the waters' flow intensified, getting lighter in weight, further helping aeration processes.



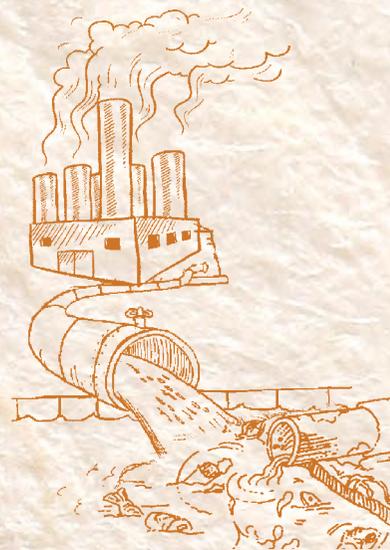
“While results of our lobbying with local municipal authorities and Pollution Control Board will produce results in due course, our combined efforts led us to a technology that has helped reduce the drain's pollution”

Samar Pal Singh, President, Resident Welfare Association, Brij Vihar



“Before we implement this low cost, simple technology, huge mounds of polythene, construction material and garbage must be cleared from water bodies. Unless residents and local authorities ensure that no solid waste will enter water bodies, interventions like ours will have limited impact.”

*Sunil Nanda, Managing Director,
JS Water Energy Life Co. Pvt. Ltd*



The biggest relief was suppression of stink. Other benefits noted by water experts was reduction in thick layers of algae that were earlier present over the water surface. Aeration and the enhanced impact of Nano bubbles helped release vial oxygen into the water body at all levels, including at sediment interface. The water level of the drain dropped by nearly 10 inches with sludge disintegrating in less than a month, reducing risk of flooding during monsoon. Although the technique could not achieve the effect of heavy metal reduction, it recorded significant reduction in organic pollution loads pronouncing the initiative a success.

Taking it to other water bodies

Seeing the success of Nualgi on the 1km stretch of the Sai Baba drain, the Ghaziabad Nagar Nigam is likely to replicate this with other drains flowing down to the Hindon river. According to JS Water Energy Life the National Mission for Clean Ganga is also considering bioremediation for cleaning up parts of the river.

Added advantage: Slashing massive cost and inconvenience of dredging

The so-called Nualgi bioremediation technique helped remove sludge which otherwise would have been done conventionally using expensive hydraulic and mechanical means that are labour intensive and uneven. Average cost of mechanical removal is Rs 660/cubic yard. Dousing Nualgi with bio augmentation makes bio dredging possible while waiving costs off.

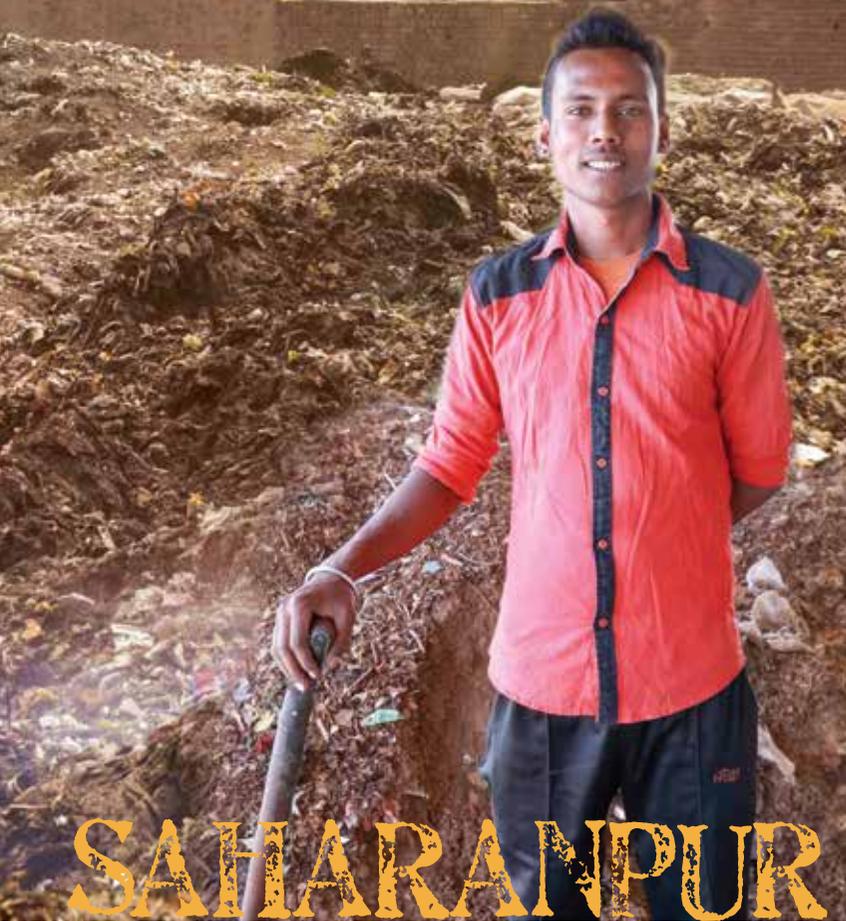
REFLECTIONS & WAY FORWARD

The efficacy of this technique (Nualgi) can be endorsed on the basis of authentic scientific evidence and published peer reviewed references. A potential replication of the Sahibabad example in other drains in Ghaziabad (or elsewhere) would therefore require a scientific monitoring and evaluation component. It is recommended to involve a reputed technical institution as an integral part of proposed pilot projects.

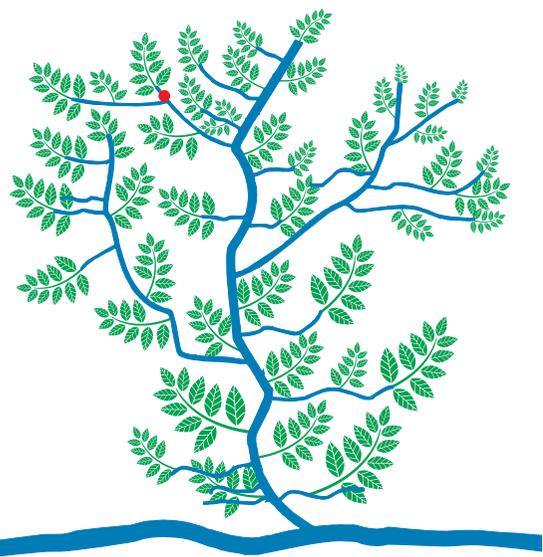
*Dr. Nadeem Khalil, Associate
Professor (Environmental
Engineering) in the Department
of Civil Engineering, Aligarh
Muslim University*



A public-private-people
PARTNERSHIP MODEL
TO REDUCE SOLID WASTE
POLLUTION IN RIVERS



SAHARANPUR



24-year old, Jayrool Haqhas is a waste collector in Saharanpur. He earns Rs 6900 at Muskan Jyoti Samiti, a Lucknow based national NGO also working in Saharanpur. The NGO works on municipal solid waste management. Haqhas covers approximately 250 households a day, collecting garbage before handing it over to the segregation and processing team for recycling and turning into organic compost. Although he studied till class VII, Haqhas chooses to be in this profession. He feels a sense of pride at being part of a sanitation movement that is making his city cleaner.

Debunking common harmful practices and enlisting support

Muskan Jyoti's efforts at organising the garbage disposal system in the city have been managed with efficiency and profit. With over two decades of experience, they began their work in Saharanpur in 2006 by entering into a Public Private Partnership with ITC, who has since supported them with funding and infrastructure.

Their door-to-door garbage collection follows a systematic low cost, labour intensive approach. Waste collectors heap garbage atop hand carts which are then transferred to the composting sites. Here, primary sorting of organic and inorganic waste (cardboard, paper, plastic, rubber, leather, fabric, metal, glass, etc.) is carried out and material which can be recycled is collected separately. A bio-compost site has been created in the open with a series of pits where dry compost is produced in 45 days. This manure is packaged for sale to households, nurseries, corporates and hotels. While the income is not enough to make the NGO sustainable, it gives them the satisfaction of creating awareness amongst locals on the role they can play in



cleaning their environment. To push the bar on profitability, they have recently leased a plastic factory and are recycling plastic into plastic granules which is a step forward in the zero waste economy.

In spite of not being a pleasant task, turning it into a collective project

Supervising different steps in garbage sorting and processing has its own constraints. Challenges of cleanliness and hygiene remain. They do weekly sprays for mosquitoes and flies but this is clearly not enough. An independent industrial consultant visited Muskan Jyoti recently and gave them ten parameters around which they must upgrade their facility. This includes a better fire safety system, drainage, enhanced medical and accident insurance cover for their workers etc. The NGO is exploring ways of recycling their current use of water, so it can be pumped

back and reused for washing plastic and thus becoming more water efficient. In spite of limited resources they are aware they must upgrade their systems and HR practices since their Saharanpur operations alone employ 110 people directly and another 110 indirectly. The network is further expanded with rag pickers and part-time garbage collectors drawn in from the informal sector.

Demonstrating success but many miles to go still

As the initiative gains momentum, the vision is to move to the stage where other local bodies like Resident Welfare Associations (RWA), mohalla committees push for segregation and make women, children, schools, householders more aware. Additionally, more commercial establishments, hotels, hospitals and bus stations need to join the movement. The



Wealth from waste

As of 2015-16, the NGO covers 21,000 households, generating revenue of Rs54,00,000 through 2,32,330kg of waste collected, producing compost for Rs16 lakh.

Apart from household collection, it clears municipal dumps too. From 3,68,215kg of waste collected from these dumps, it produces 1,61,985kg of manure.



It is tough to make profit from garbage since there is a critical viability gap which must be filled by corporates, local governing bodies and others, before we can reach desired scale of coverage.”

*Sunil Dutt Trivedi, Senior Project Manager,
Muskan Jyoti Samiti, Saharanpur*



NGO has plans of reaching wedding venues and processions/public morchas/congregation sites to clear their waste and garbage with prior planning and intimation to agencies like theirs. Eventually, they aim to cover all households in the city which are about 100,700 approximately.

“It is a brave effort but given the size of the city, our work is a flash in the pan”, says Maidul Islam, Dy. Manager for the plastic factory. Not wanting to rest on the visibility and appreciation they have received for their work, Muskan Jyoti wants to see people’s behaviour change towards waste so they can segregate garbage at source into solid and liquid waste categories. They feel enforcing a stringent regulatory system, having a community driven ‘shaming’ policy that runs parallel to commemorating champions and pushing for more active involvement of the municipality, RWAs and media, would be necessary before the vision of a clean, disease-free city is visible on the horizon.

Why Municipal Corporations should adopt this model

- Use of organic compost improves soil health and water retention capacity. It helps in water conservation by reducing irrigation requirement for crops
- Recycling plastics stalls percolation of harmful chemicals in underground water
- Saves crores of rupees on transportation of waste
- Creates employment
- Prevents landfills
- Generates profit from waste, is self-sustaining, replicable and scalable.



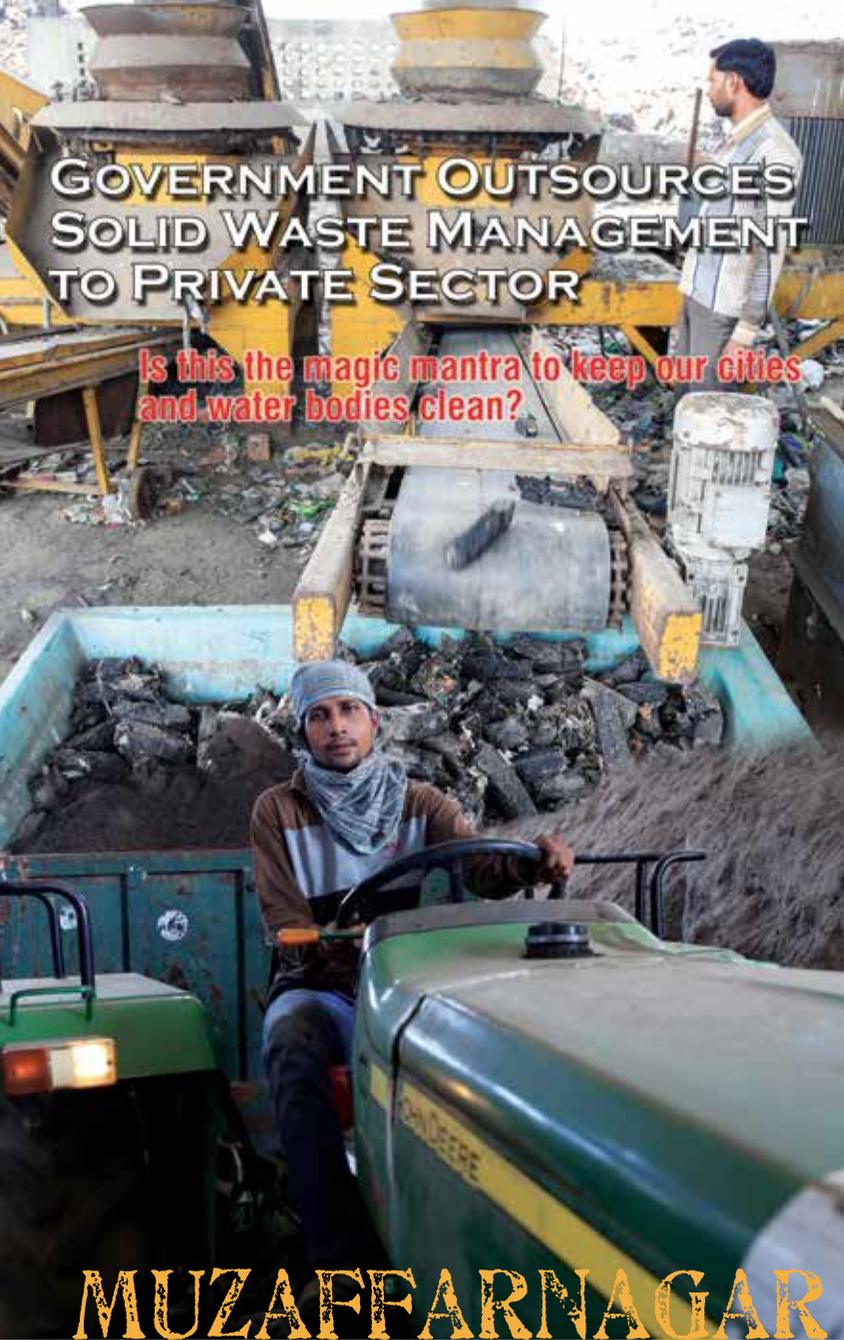
WAY FORWARD

- NGOs like Muskan Jyoti Samiti can raise awareness at household level for segregation of waste into organic and inorganic waste. They can provide training on managing, reducing and recycling their waste by preparing compost at home and knowing hazardous waste and its impact on health and environment. This will help change behaviours and ensure better waste management, preventing drains from being clogged and ultimately clearing rivers from plastics and other polluting solid waste.
- New revenue models must be adopted for scaling up efforts of NGOs like Muskan Jyoti such as converting non-compostable waste into briquettes which can be used as fuel and sold to generate revenue.

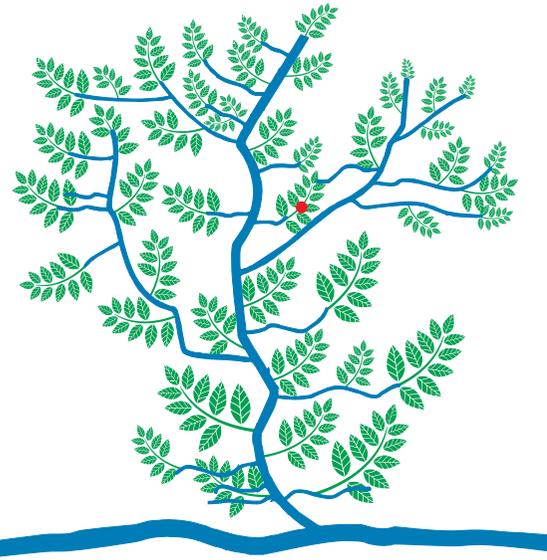
*Dr. Veena Khanduri, Executive
Secretary, India Water Partnership
(IWP)*

GOVERNMENT OUTSOURCES SOLID WASTE MANAGEMENT TO PRIVATE SECTOR

Is this the magic mantra to keep our cities and water bodies clean?



MUZAFFARNAGAR



Contractual arrangement between Municipal Corporation and **A2Z Waste Management Services** saw marked **improvement in cleanliness** but unless waste **generates revenue**, sustainability will always be questionable

Solid waste management in urban areas is the responsibility of Municipal Corporations. However with burgeoning pressures of development and a callous approach towards sanitation and hygiene; the task of garbage collection, segregation and disposal remains complex. Constrained by lack of expertise and resources, most municipal corporations are ill equipped to carry out the task. Given the sheer volume of waste generated, the model of public private partnership (PPP) has been adopted quite successfully in many cities in the country.

With Muzaffarnagar facing the mounting pressures of domestic and institutional waste, city authorities recognising the need for a more intense and efficient intervention made the decision to hire a professional solid waste management firm.

Bringing some method to the madness of garbage collection

Entering into a contract with an established player in solid waste management (SWM) sector seemed a logical decision. A2Z Waste Management Ltd. was already in the business and had similar working arrangements with

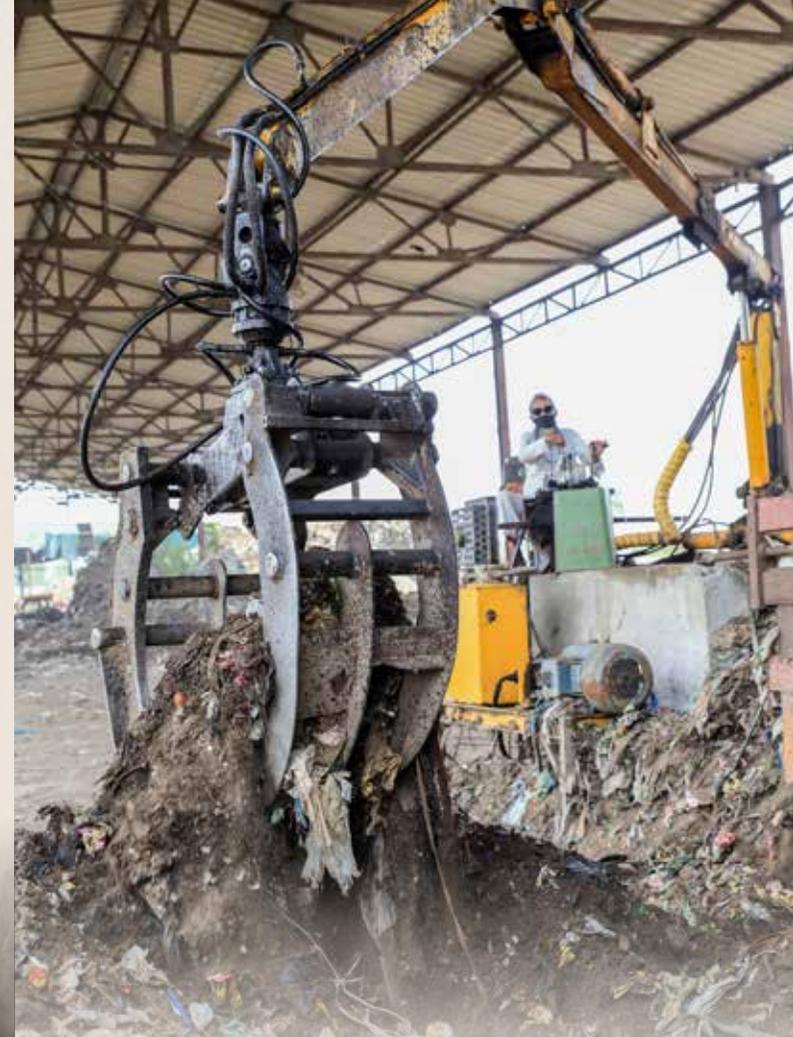


cities including Aligarh, Meerut, Kanpur and Varanasi. The initial estimated project cost was Rs. 657 lakh, they began by undertaking a city mapping exercise and drawing up an efficient route plan. Investment was made in new trucks and rickshaws along with training programs for garbage collectors so as to ensure zero garbage is dumped in drains and water bodies.

The USP of A2Z lies in following an integrated model wherein they manage end-to-end operation of garbage collection and transportation (C&T) as well as processing and disposal. The scale is huge with garbage collected from over 80% of the city's households covering 40 wards. Their operations begin at 6 am with 200 safai mitras hitting the streets, blowing their whistle and announcing their entry into the locality. They

arrive at every doorstep, collect garbage and take it to the nearest garbage collection point. The process of primary collection is completed by 11 am which effectively means that the city is clean by noon while secondary collection is complete by 7 pm. Approximately 120-130 metric tonnes of garbage is received by the processing plant every day.

Garbage brought to the plant is weighed and sent for segregation with team of 30 staff guiding the next round of activities. Following a 360 degree approach, the company focuses just as much on collection, segregation and recycling as they do on pushing the bar on hygiene standards. In order to raise awareness, they have campaigns on cleanliness, hygiene and garbage disposal in schools and colleges, resident welfare associations as well as slums.



“Apart from taking lab readings and measuring weights we have our own monitoring system. Photos are taken daily on the spot showing the collection, loading and the completion of tasks. These are shared over the phone with the Chairman Nagar Palika, Executive Officer Nagar Palika, City Health Officer, corporate office of A2Z and other company officials.

Ravendra Singh, Manager C&T



Constraints in conducting smooth operations

When the company started operations in Muzaffarnagar in February 2011, they met with opposition from existing street sweepers/rag pickers who protested claiming ownership over the turf and refused to give it up to an outside third party. Although the company had a legitimate contract with the Municipal Corporation, they faced protests and non-cooperation in many locations, halting their operations and causing delays. Gradually, the company won them over by including them in their end-user collection plan and provided training on segregation and other aspects of SWM. Approximately 20% / 10,000 households are still excluded due to the street sweeper community unwilling to relinquish their hold.

The plant location is in a residential area on the outskirts of the city and therefore not only face the challenge of bringing in garbage laden trucks but are also subjected to power outages. However, the biggest challenge is receiving timely payment as per their contractual obligations with the Municipal Corporation. With delays in implementing yearly increments in payment as per contract, their operations are on the verge of making loss if not already. In addition, staff wages, vehicles and equipment maintenance costs



continue to grow while collecting user charges of Rs. 30 per household still remains an uphill task.

Profit from waste, only way to stay invested in the business of SWM

Wanting to create a model of excellence and being committed to making each dump point zero waste garbage, A2Z was willing to make garbage collection twice-a-day activity. In the absence of financial resources, they are unable to take this task up even though they have the technical capability to do so. The only way out for private companies like A2Z is to generate a pipeline of waste-to-wealth products. They are using at least 100 metric tonnes of collected garbage to make briquettes which are sold to paper mills and boiler plants while they are unable to market the compost to open up additional revenue streams. These efforts need to be taken to scale, market linkages established and new avenues such as producing energy from waste need to be explored.



REFLECTIONS & WAY FORWARD

Promoting and marketing use of compost is important and can be made mandatory by law. Urban local bodies must use their own composts for their parks and public buildings.

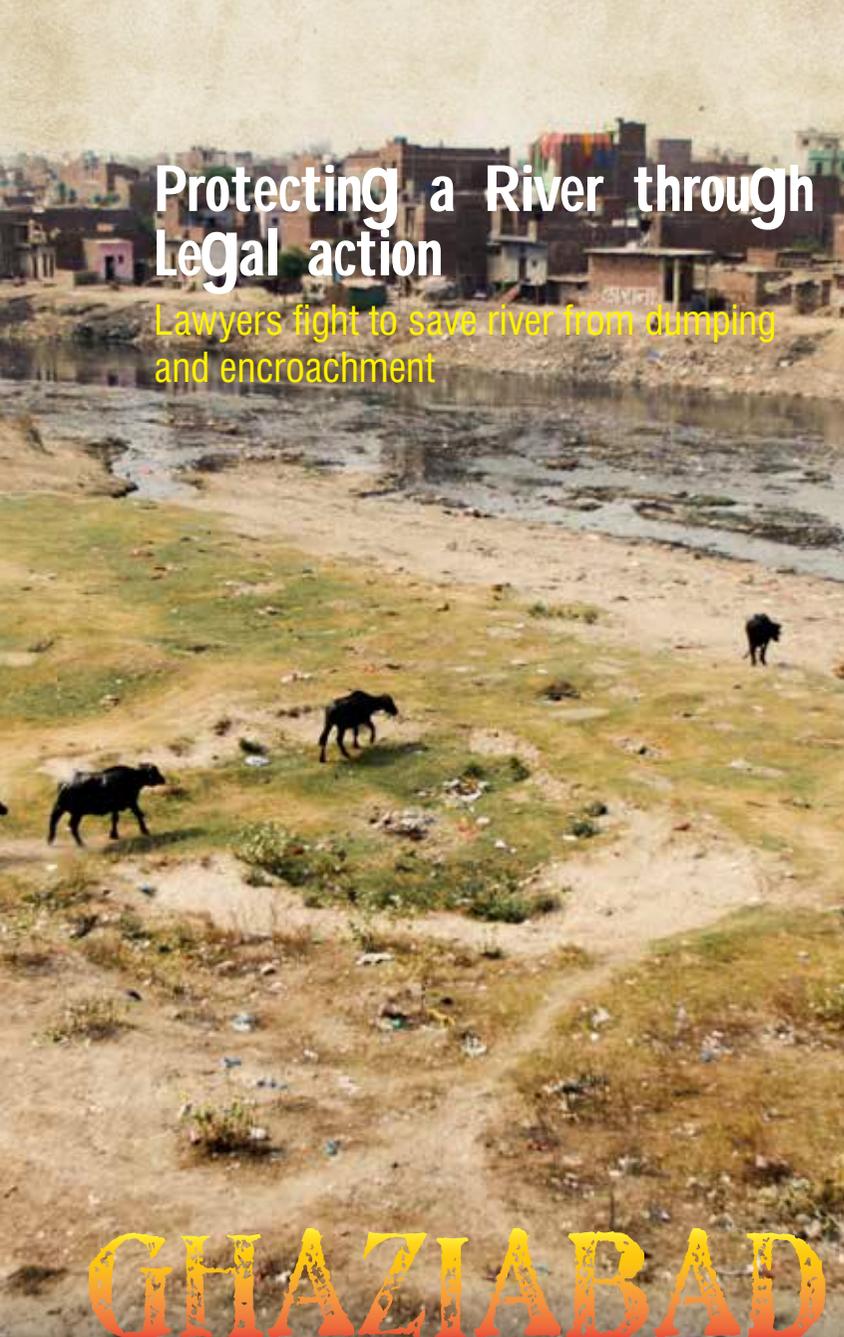
Solid Waste Management charges could be added alongside Municipal Corporation annual bills such as 'Property Tax'. The collection of annual SWM charges will support timely payments to the contractor. Progressive increase by say 5-10% every year on the SWM charges would help in ensuring sustenance.

There are also opportunities for knowledge sharing from solid waste management PPP models in other cities such as Nagpur which have been operating for a longer time period and adapting practices as appropriate.

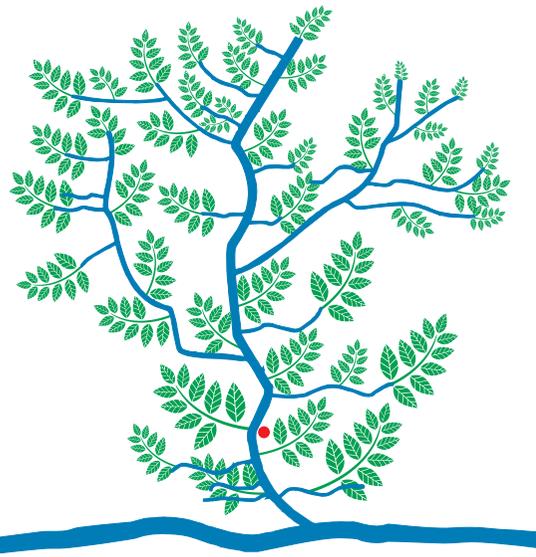
Karishma Bist and Mohan Patil, Resource Conservation & Management Division, FICCI.

Protecting a River through Legal action

Lawyers fight to save river from dumping and encroachment



GHAZIABAD



Vikrant Sharma, a lawyer by qualification and an active environmentalist, has utilized Right to Information (RTI) act and legal instruments apart from mobilizing like-minded volunteers and activists to protect the Hindon River which has come under threat from urbanization.

Post a meeting with Rajendra Singh (Waterman of India) in 2004 during a padyatra, Vikrant decided to use his legal knowledge to revive and rejuvenate the Hindon which was facing the three main issues of industrial and urban pollution, depleting water levels as well as widespread encroachment. Dipesh Choudhary, an

A demonstration of how to apply knowledge of the legal system against violators can result in a dent on some of the injustices that continue unabated on the river bed.

advocate practicing in the National Green Tribunal (NGT) joined hands with him, filing as many as nine petitions on the issues related to the Hindon River without charging any legal fees. Vikrant takes it upon himself to carry out with field work that would generate evidence and along with fellow Hindon supporters has filed over 100 RTI applications to substantiate their arguments in the court of law.

Prohibiting the dumping of solid waste in the river

Managing solid waste from fast growing urban areas is turning out to be huge challenge. The Nagar Nigam's indiscriminate dumping of solid waste on the banks of the Hindon near Raj Nagar





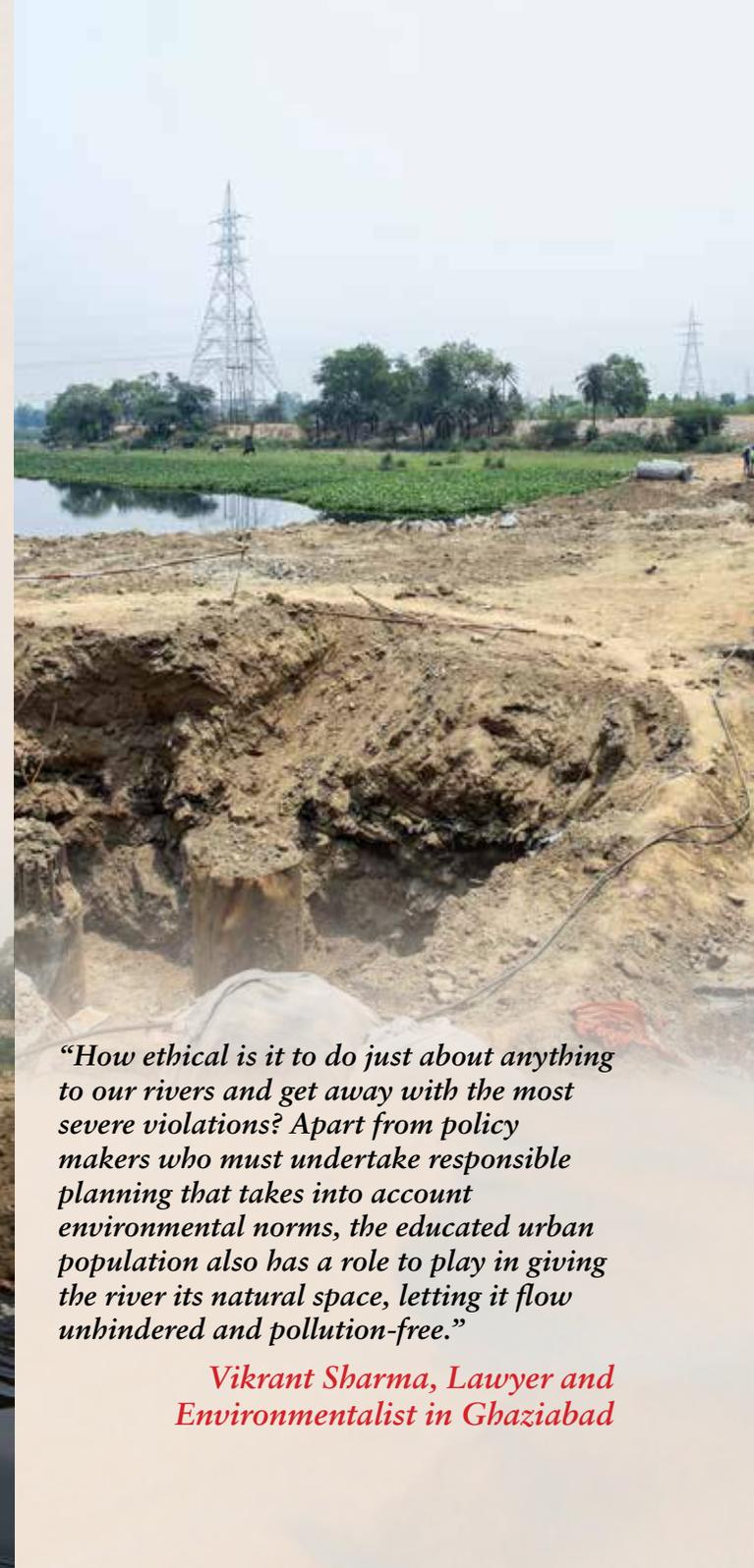
extension road in Ghaziabad had led to waste falling straight into the river. A case was filed in the matter of “Krishan Pal Vs. Union of India & Ors” with the NGT.

The NGT in its order dated September 1, 2015 asked the Nagar Nigam to submit a complete and comprehensive proposal for the collection and disposal of Municipal Solid Waste (MSW) in the entire city of Ghaziabad and directed that “any person, authority or official shall not throw, dump and/or burn any MSW or other waste anywhere in the district Ghaziabad, particularly on the bank of the river Hindon and the road adjacent hitherto”. The Nagar Nigam was also instructed to place appropriately sized dustbins and transport the garbage to an identified site meant the purpose for dumping upon segregation. It stated explicitly that

violators were to be fined Rs. 20,000 as environmental compensation. While this was a landmark judgment, its implementation continues to remain a challenge.

Faulty bridge construction on flood plains of the river jeopardizes residents

Vikrant Sharma and residents of Karhera village situated on the banks of Hindon filed another legal case (Vikrant & Anr. Vs. Union of India & Ors.) drawing attention of the officials to the construction of an approach road that leads to the bridge connecting the Hindon Expressway with Karhera Road, in what is a high flood level zone. By filling earth across the middle of the main river stream, the natural water flow was being obstructed. Residents feared that this would make the village vulnerable to floods besides being an



“How ethical is it to do just about anything to our rivers and get away with the most severe violations? Apart from policy makers who must undertake responsible planning that takes into account environmental norms, the educated urban population also has a role to play in giving the river its natural space, letting it flow unhindered and pollution-free.”

Vikrant Sharma, Lawyer and Environmentalist in Ghaziabad

ecological hazard in the area. According to the residents, no environmental clearances were sought by the executing agency for the project. They managed to get an order from the NGT dated May 15, 2013 proposing a solution to construct additional pillars on either side of the bridge ensuring that approach road does not fall within the flood plain of the river.

Locking horns with the Delhi Metro Rail Corporation

There has been indiscriminate dumping of soil on the banks of the Hindon near GT road where the Delhi Metro Rail Corporation (DRMC) is constructing pillars for the 9.41 km metro project. In April 2016, Vikrant lodged a written complaint with the DMRC's Chief Project Manager in Delhi stating that filling the banks of river Hindon with soil on both sides' amounts to obstructing the flow of the river; this would lead to pollution and damage of ecology with greater risk during monsoon. The complaint was filed in parallel with the city authorities in addition to a copy being forwarded to the Chief Minister, Uttar Pradesh before approaching the NGT. The case (Vikrant Vs. State of U.P. & Ors.) is up for hearing with the tribunal.

Regardless of the success rate of his petitions, Vikrant continues to play the role of a Devil's Advocate. The path he and his associates



have chosen will most certainly not be smooth and they must not lose patience, in the face of adversity, failure and even threat to their lives. He is however grateful that many advocates and lawyers from across the region are pledging support to him and offering pro bono services.

Vikrant is also an active member of the Hindon *Jal Biradari*, Ghaziabad chapter which has been organizing an awareness *padayatra* since 2005 passing through villages and farms on the banks of Hindon River on a regular basis. The *yatra* sees participation from various sections from civil society comprising of advocates, doctors, professors, retired government officials as well as students. As the *yatra* travels through the villages, wall art has been successfully used to share messages related to the state of the Hindon and urges community not to remain silent on these issues. Over the course of many *padayatras*, *Jal Biradari* have collected over 10000 signatures as part of a campaign towards river conservation. Vikrant's strong belief in fighting for the cause of the river is reinforced through his interactions during the *yatra*.



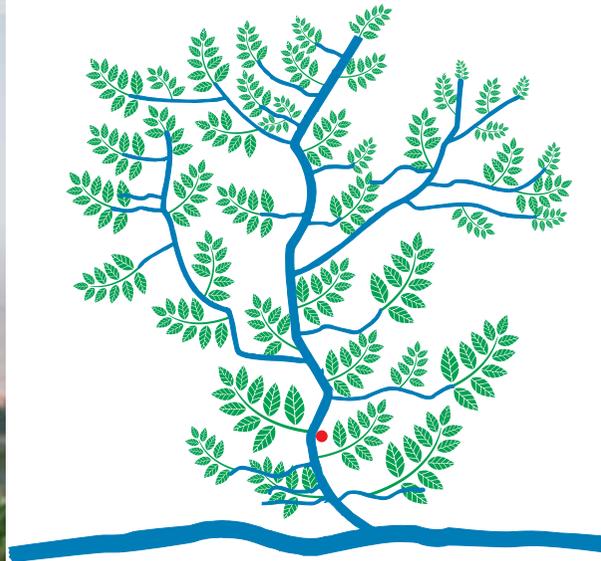
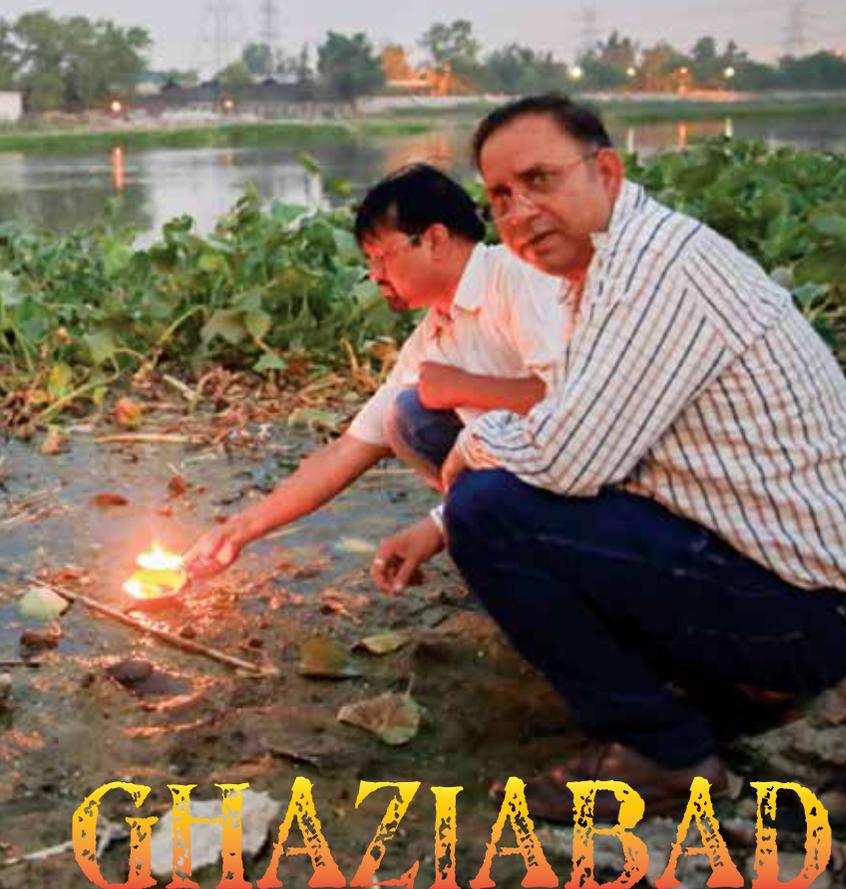
Way Forward

This case is motivation for the responsible citizen and acknowledges the efforts of many fighting for protecting the rivers in our country. However, it also shows the dark side where the authorities who are custodians of the country's natural resources abstain from their duties. The purpose of filing a petition should not be to bring a particular case to the notice of decision makers but to discourage others from carrying out similar activities in the basin. A monitoring arrangement need to be setup to ensure the enforcement of existing regulations and judicial orders at all levels.

Dr. Veena Khanduri, Executive Secretary, India Water Partnership (IWP)

COMMUNITIES REVIVE AN
EMOTIONAL CONNECT
WITH THEIR RIVER

...through "aartis",
"charchas and chaupals" (discussions),
and river pond rejuvenation



Popular festivals provide platform to create awareness

This year marks the third consecutive celebration of Ganga Dussehra and Dev Deepawali on the banks of the Hindon. Sanjay Kashyap and Sudeep Sahu are advocates, Navneet Singh is an engineer and Ankit Giri is involved in the real estate business. These four men serve as office bearers of the Namami Harnande Mission. They, along with members drawn from different parts of Ghaziabad have used the cultural and religious route to bring folklore, rituals and mythological stories connected with rivers, once again to people. Inspired by Dev Deepawali

*"The only way to **save the Hindon** is through the participation of the people who live around it". This is the motto of **driven individuals** who belong to NGOs and civil society groups that keep issues related to the Hindon alive. The Namami Harnande Mission (Harnandi Jagriti Abhiyan) established in the year 2013 has motivated similar groups to take up the cause of the Hindon; be it through **advocacy, community events, river pond rejuvenation** or **water conservation** efforts.*

festivals held in Varanasi, they held their own Dev Deepawali event on the Hindon river bank in 2013. The celebrations saw prayers, processions, discussions, speeches and lighting of diyas (oil lamps) on the bank of the river.

In 2014, a bigger event was organized with people from adjoining villages joining in. The year 2015 saw the event scaled up with over 500 people attending and more than a thousand diyas being set afloat on the waters, resplendent as they glowed with the hope of the people. The advocacy effort blossomed into a serious initiative as more people joined in giving suggestions, outlining strategies and creating linkages to officials in ministries and government committees.



The awareness effort developed a strong arm of campaigning including Mayors, Members of Parliament and other groups in Ghaziabad which began to consolidate their activities. Twice-a-month aartis began to be performed with entire communities participating in the event. This poignant coming together of people from all backgrounds for a common cause was on the initiative of Dharma Yatra Mahasangh, Sharda along with the NGO, Pehla Kadam.

Getting communities to realize that water is a precious resource

Choudhary Trilok Singh is a resident of village Garhi which is 1.5 kms from the Hindon in Rajapur block. He teaches English at Saraswati Vidya Mandir School. Eight years ago, he noticed that people were

completely unaware and callous in their water use. An inner urge told him that if they knew the implications of their actions, they would be willing to make the necessary shift in their behavior towards water conservation.

He started campaigning, going from one village to another, taking the message of water conservation. Today, he is a familiar face in more than 80 villages. The moment he approaches a village, children run to close dripping taps. He holds chaupals (gatherings) in the centre of the village, with the help of the sarpanch (village Headman). His words of wisdom are wrapped around folk tales, mythological stories and traditional wisdom. The impact sometimes is so profound that villagers indulge in impromptu playing of the dhol (drum) repeating messages on water and enacting street plays on the theme.



Finding Courage to speak up

“Hindon area getting a metro station was good news since connectivity would improve but when we heard that the station would be named Rajnagar Extension, we insisted that it be named Hindon Bank similar to Yamuna Bank. The suggestion is being considered.”

*Sudeep Sahu, Member
Namami Harnande Mission*



From awareness to action: Reviving encroached river ponds

Once the process of mobilizing people gained ground, mass events like Dussehra and Dev Deepawali institutionalized and conversations around water getting more visibility, work began on not only identifying but also finding ways to save river ponds which were in close proximity to Hindon. Many of these river ponds had been encroached upon illegally; converted into agricultural fields, godowns and in one case even construction with plans for setting up a residential colony. Sushil Raghav, RTI activist and Sanjay Kashyap who also runs an NGO Aranya Eco together with volunteers set about their task of locating these river ponds in Ghaziabad Nagar Nigam area. Their search led them to the site of 30 river ponds. While 17 of them were taken to

National Green Tribunal and revived, others are being tackled through RTI and PILs resulting in activities on these encroachments being stopped.

It was a matter of time before other social groups such as Environmental Awareness Society, Hindon Jal Biradari, Hindon Vahini, Pawan Chintan Dhara, Sadhit Foundation and Samvardhan Trust joined the movement. According to Sanjay Kashyap, “There is room for all our partners to work on different aspects of the Hindon be it individually or collectively since the end goal is the same.” While the movement has gained traction in the Ghaziabad region, their next step is to reach out to similar groups in the neighboring districts of Baghpat, Meerut and Shamli encouraging them to take up water issues in their own region.

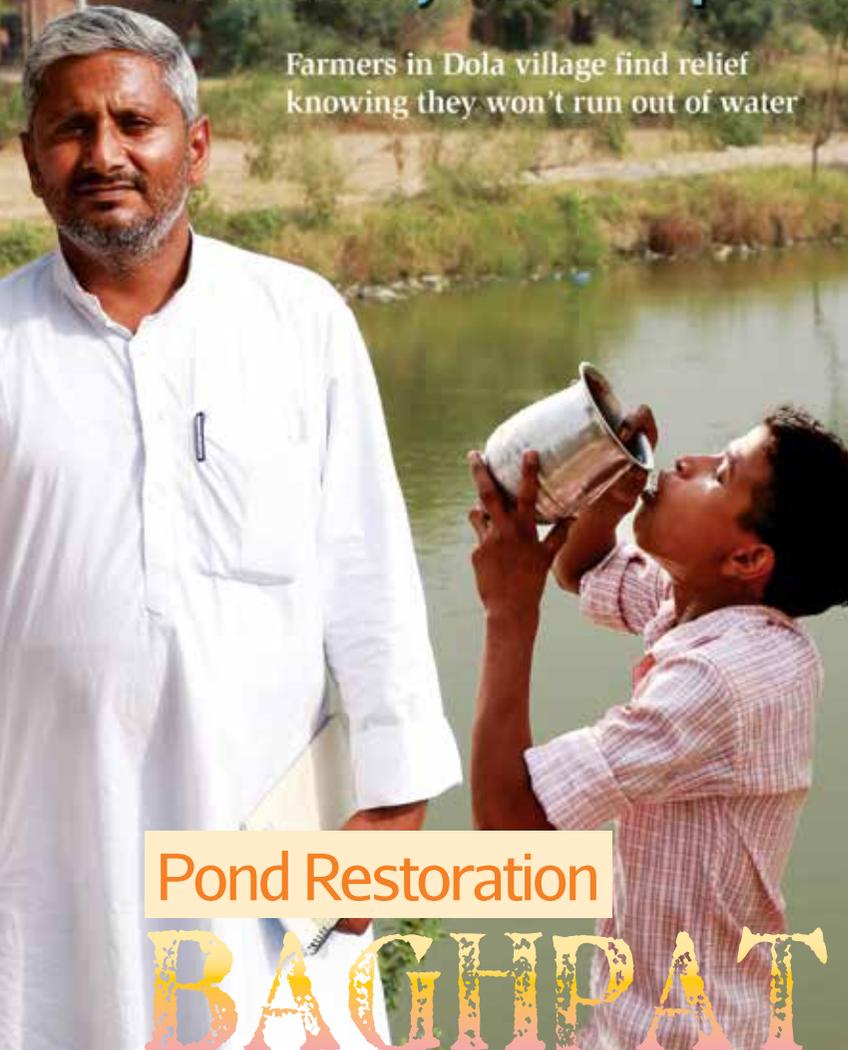
WAY FORWARD

- Sanctity of the river and river ponds must be maintained by inculcating spiritual faith for rivers in the hearts and minds of people living around them, like our ancestors who safeguarded these life giving water bodies for many years.
- There should be a continuum for advocacy against exploitation of river ponds and river flood plains by land encroachments.

Dr. Veena Khanduri, Executive Secretary, India Water Partnership (IWP)

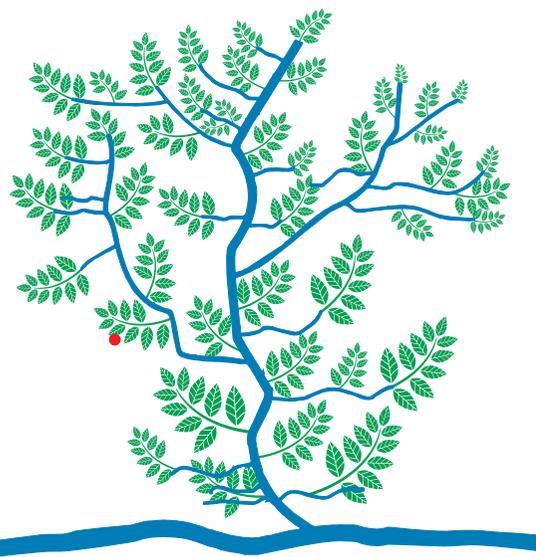
A Model Village in Baghpat District Rejuvenates 17 ponds

Farmers in Dola village find relief knowing they won't run out of water



Pond Restoration

BAGHPAT



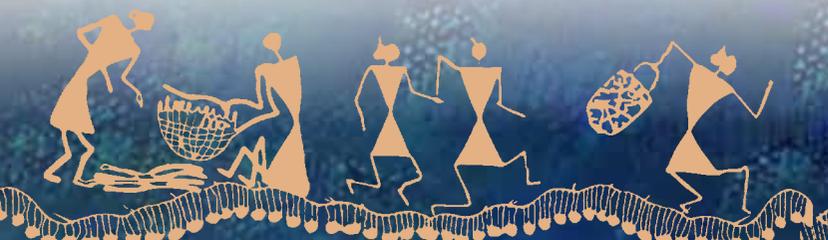
Baghpat district is largely agrarian. The Hindon River forms the eastern boundary while the Yamuna River forms the western boundary of the district. Most of the areas are under tube well irrigation which has led to declining groundwater levels. According to a Central Ground Water Board (CGWB) report in March 2009, five out of the six blocks in Baghpat district have been categorized as “Over exploited”.

A proactive **community** and a **responsive** district administration set a water **agenda** for themselves. Supporting each other in **reviving** as many as **17 ponds**, they have enlisted help from different quarters, scaling up their own **capacities** to undertake the task of **rejuvenation**.

Community takes initiative to build its capacity for pond rejuvenation

A group of concerned farmers realised they had to address the problem, lest be faced with a situation jeopardising their agricultural productivity and existence. Krishan Pal Singh, coordinator for the Jal Biradari network's¹ Northern Uttar Pradesh chapter and Chairman of the NGO, Grameen Awwam Paryavaran Vikas Sanstha in Baghpat district is a resident of Dola village. He was familiar with issues related to water conservation and had been following the pond revival work carried out in Alwar district, Rajasthan by Ramon Magsaysay

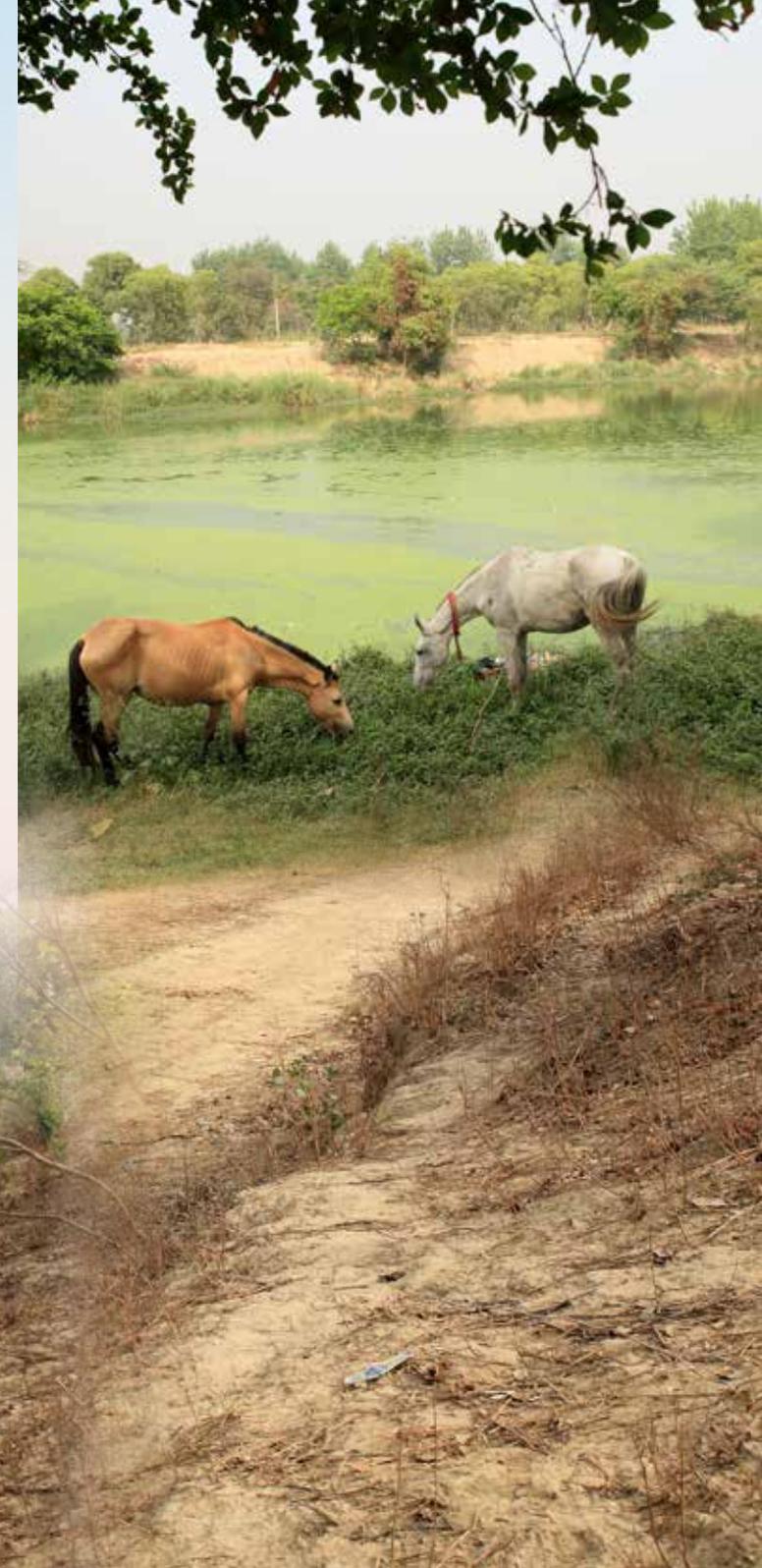
¹ Rashtriya Jal Biradari is a network of like-minded individuals, CBO's, farmers groups, NGO's, research institutions, social scientists and water experts who have deep interest in issues related to water



Award winner Rajendra Singh also known as the “Water Man of India. Krishan Pal along with the village Sarpanch and few volunteers undertook an exposure visit to Alwar district urging Rajendra to help them find a solution to their water crisis. Rajendra needed a proof of intent and told them to undertake a community project before he could commit his resources to helping them develop a larger program on pond rejuvenation.

Dola village is known for its ponds, in fact there is a pond for every community. In the days of yore, access to ponds was restricted based on caste; while today even though they still are referred to by the name of the community, the water belongs to everyone. Krishan Pal and his group of “water warriors” first set about reviving the “Harijan talaab” which had long been dead. Being a

community led initiative, they requested all village residents to make donations ranging from Rs. 5 to Rs. 500 despite the villager’s scepticism. With an initial sum of Rs. 5000, they began by cleaning the pond with help of shramdaan (Contribution in the form of labour). When the monsoon arrived, the pond gradually started filling up and hesitant residents began pledging their support to the group. Enthused by their initial success, Rajendra Singh along with his NGO Tarun Bharat Sangh (TBS) decided to act as a partner and donated Rs. 20 lakh with a large portion coming from his Ramon Magsaysay Award prize money. In 2004, Krishan Pal, the community along with TBS drew up a Pond Rejuvenation plan by identifying the ponds in the village with support from the district administration. The smallest pond





was 4-5 bigha (measure) of land while large ponds were 60-70 bigha of land. With the help of a consultative process between district administration and the village community, pond encroachments were addressed to a large extent. By the end of 2006, seventeen of these ponds were revived with their water used for irrigation and livestock; neighbouring villages started adopting this approach.

The pride of Dola is the Gossain pond which is the oldest in the village, it has sufficient water for up to 6 months post monsoon. A walking track has have been laid around the pond inviting families to visit in the evening. Village resident who lives in the vicinity has been tasked with maintaining the pond, discussions are ongoing with district administration to further develop this pond as a recreational spot.

District administration provides direction, support and an enabling environment

Overall, the Baghpat district administration has been very supportive and even appreciative of the way the community has stepped forward to play a major role in pond rejuvenation. The current District Magistrate, Hriday Shankar Tiwari Tiwari has taken the work of his predecessors forward by coming up with a proposed action plan of shortlisting ponds for revival in each of the 46 Nyaya Panchayats in the district. This will be a people's project involving local community, religious leaders and village sarpanch(s) together with district administration providing funding. The initiative is expected to begin with 5 ponds being chosen and work scheduled to be completed before the monsoon season begins. In addition, a prayer campaign is being planned in schools that extols the virtue of water with clear do's and don'ts. This would raise the awareness levels among children which in turn would spread to their parents.

Baghpat district's success in restoring as many as 17 ponds that had been encroached upon or forgotten by harvesting rainwater is now being seen as an example that can be emulated even in neighbouring districts. The success has translated into a larger campaign across Western Uttar Pradesh linking people to ponds as well as rivers such as the Hindon.

REFLECTIONS

Initiatives such as the rejuvenation and restoration of village ponds needs to be encouraged.

However, if the purpose is to arrest the ground water depletion, then these initiatives alone cannot achieve the purpose. Promoting ground water recharge is essentially supply side management and not the demand side management. No matter the amount of ground water recharge, it will continue to deplete so long as the ground water withdrawal is more than the recharge (which is the case today in most of the places). One also needs to appreciate that ground water storage does not necessarily follows the village boundaries, it follows the ground water aquifer boundary which may spread over very large area covering many villages. Therefore, key to sustainable ground water management is to demarcate the ground water aquifers and ensure that water uses for various purposes put together in any given aquifer is such that the balance between ground water recharge and water withdrawal is not disturbed. This would require a comprehensive ground water balance study at the aquifer level and not the village level.

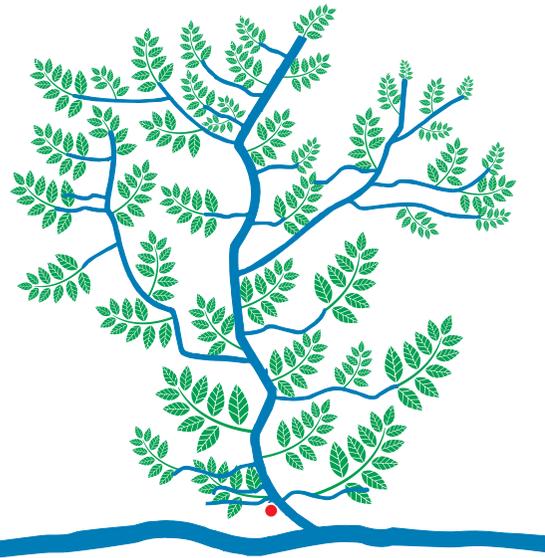
R.S. Pathak, Consultant, Senior Water Sector Specialist

Mission Pond Rejuvenation through Multi-Stakeholder Participation



Local bodies, communities and district officials join hands to revive 240 ponds

NOIDA



At a recent meeting with Akhilesh Yadav, Chief Minister, Uttar Pradesh, the Prime Minister tweeted, “use of latest technology and community participation can play a key role in effective drought management for planning of water conservation and recharge.” While farmers and parched fields across western India await showers eagerly, special committees have been formed in the districts along the Hindon basin to urgently identify, dig up, desilt and restore village ponds, so they can be ready to brim with clean rainwater. Much hope hinges on the monsoon of 2016.

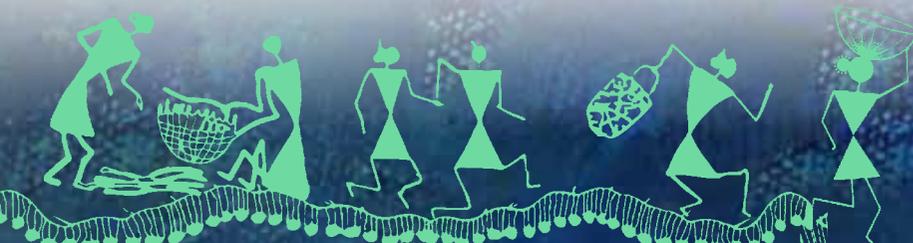
“Ground water is receding rapidly. If we continue this exploitation we will be without water very soon. Ponds can be the lifeline of both villages and towns.”

Rajesh Kumar, Additional Divisional Manager, Finance and Revenue for Gautam Budh Nagar, Uttar Pradesh

Target driven Pond Rejuvenation Plan

The Gautam Budh Nagar district administration will use the upcoming monsoon as an opportunity to strengthen water conservation and recharge efforts by undertaking desilting, building of check dams, recharging of rivers and other water storage mechanisms.

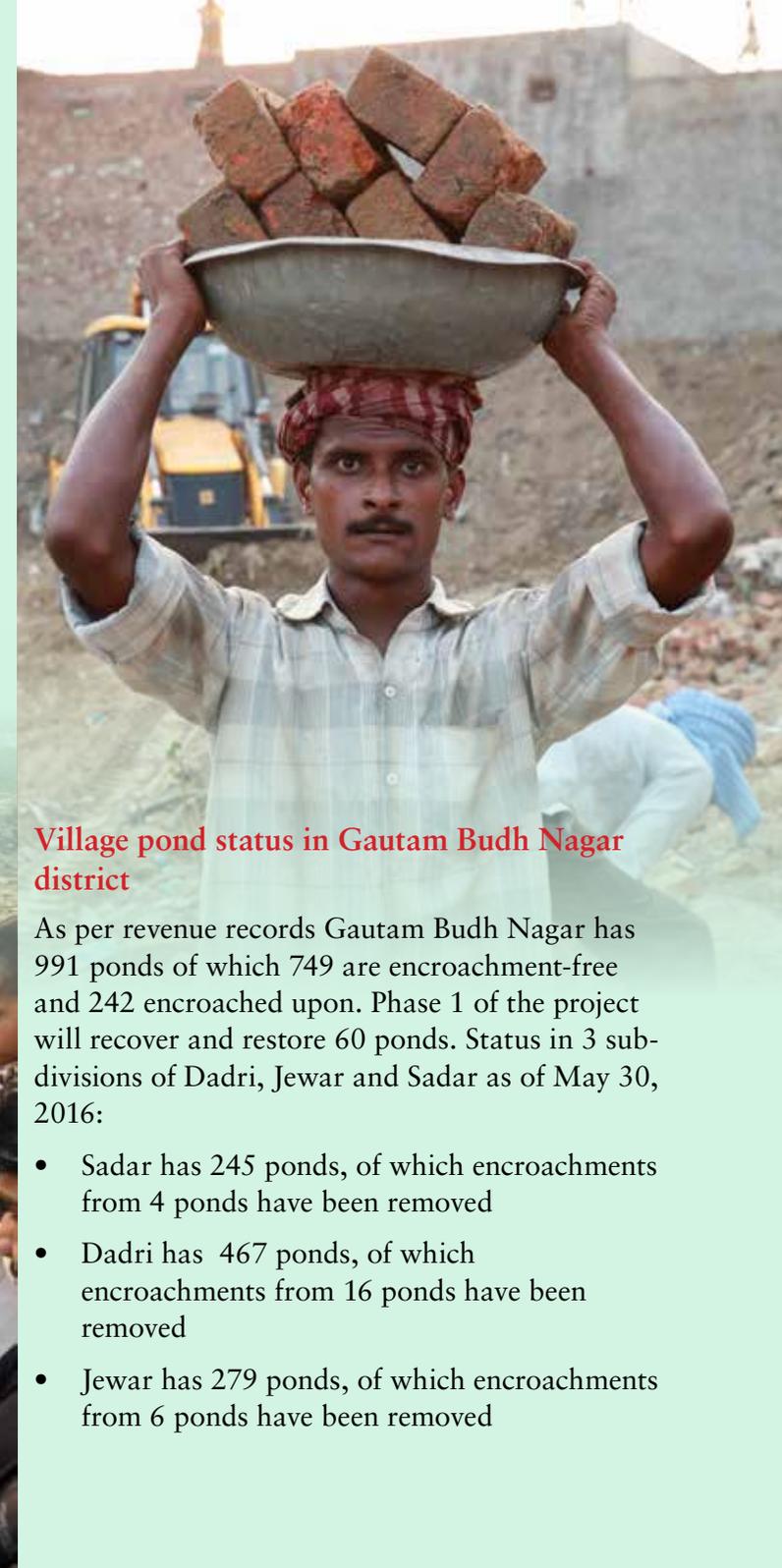
According to Rajesh Kumar, Additional District Magistrate (F/R), the district has plenty of ponds but no water. Most have been encroached in different forms. The process of identifying them in itself was a huge challenge. For instance, revenue officials discovered places where families had built brick and mortar homes and were living there for years. The District Administration is taking the help of local NGOs, industry and community members to rehabilitate these dispossessed families.



Replenishing ponds, a major strategy for efficient use of natural water resources

A status report on groundwater by the National Capital Region Planning Board (NCRPB) has drawn attention to dipping ground water levels in and around the capital. With population growth, rapid urbanisation, an upward looking economy and rising standards of living this is only going to get worse. In the absence of a broad framework for rainwater harvesting and a plan to save the disappearing of ponds and lakes, the

Planning Board identified 45,000 recharge structures that are expected to yield approximately 1 bcm of groundwater annually. This can be done by desilting ponds and creating artificial recharge structures in both urban and rural areas. Identified locations include areas in the Aravali ridge, abandoned quarries, encroached village ponds, flood plains of Yamuna, Ganga and Hindon, in addition to institutional and residential buildings.



Village pond status in Gautam Budh Nagar district

As per revenue records Gautam Budh Nagar has 991 ponds of which 749 are encroachment-free and 242 encroached upon. Phase 1 of the project will recover and restore 60 ponds. Status in 3 sub-divisions of Dadri, Jewar and Sadar as of May 30, 2016:

- Sadar has 245 ponds, of which encroachments from 4 ponds have been removed
- Dadri has 467 ponds, of which encroachments from 16 ponds have been removed
- Jewar has 279 ponds, of which encroachments from 6 ponds have been removed



Innovative strategy for funding pond reconstruction activity

The Pond Rejuvenation Plan of Gautam Buddh Nagar covers both urban and rural areas. Major construction activity is being undertaken in the urban areas of Greater Noida. Builders and construction companies are being requested to undertake cost of digging up abolished ponds as part of corporate social responsibility. Corporate houses, public and private organisations, Resident Welfare Organisations and individuals with a philanthropic bent of mind are being approached to fund the task and support it with related activities like organising talks, awareness programmes on water conservation. In some places, soil will also be sold and money pumped back into the pond rejuvenation effort that entails using of earth moving equipment, water sprinklers and labour.

Ponds in rural areas will be funded by local bodies and in some cases community themselves. Once the pond is ready, it will be used for irrigation purposes, cattle grazing and in some cases where there is more than

one pond in the village, leased to fishermen. The money earned from the arrangement will go to the village fund for development work.

Communities to take charge for maintenance of freshly recharged ponds

For maintenance of the ponds the district administration is envisaging active participation by the community. A Land Management Committee has been formed headed by the village pradhan with a revenue department official represented on it.

The town Jewar has a pond that is 3 metre deep, covering an area of 3220 square metre. Digging work began on 25th of April 2016 and is on track for completion before monsoon. Funds have been released so that the mud that is being dug up can be transferred to low lying areas in the village. The Committee is simultaneously working with the forest department to build structures and plant trees. Awareness sessions are being held with schools, Mahila mandals and adolescent groups on pond maintenance, management of solid waste and garbage disposal, open defecation and air and water pollution.

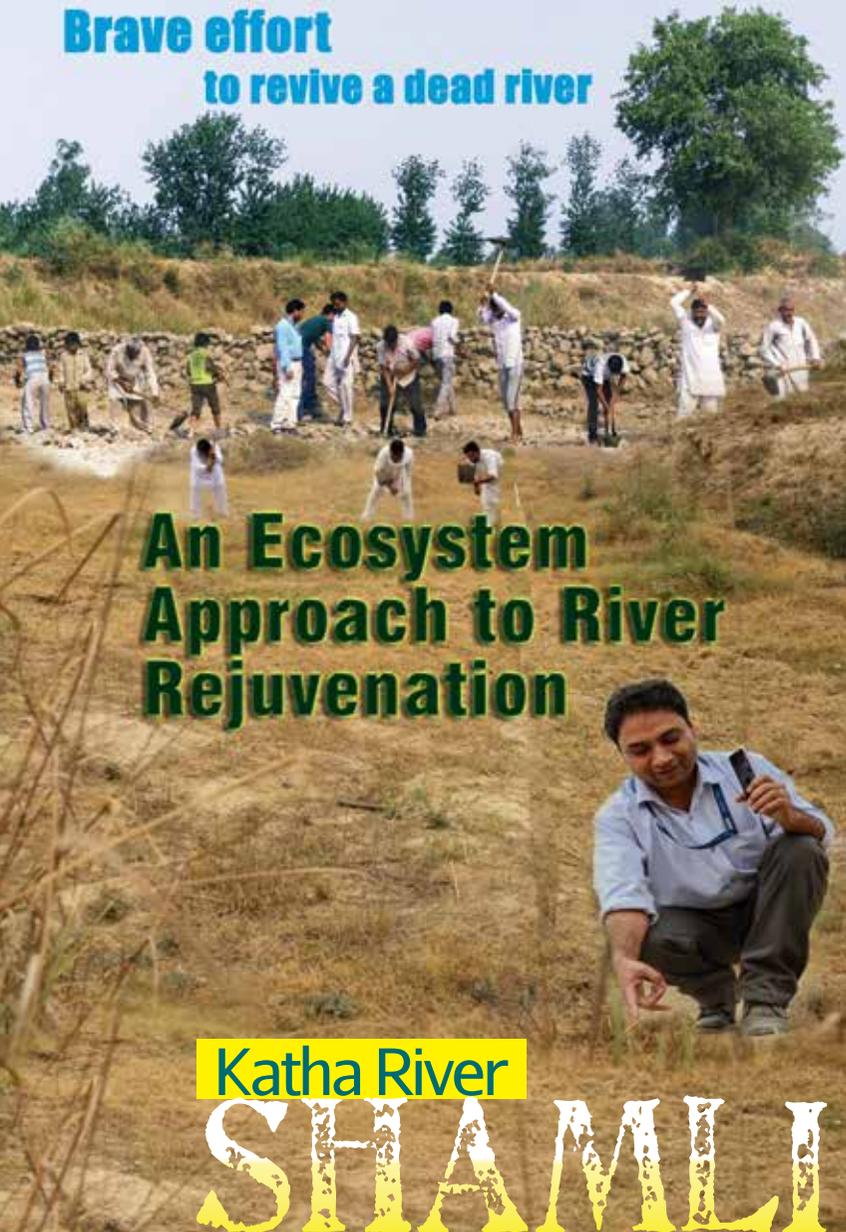


REFLECTIONS

The Pond Rejuvenation Plan is a commendable initiative of the District government. To optimise such rain water harvesting structures, information on the catchment area and existing drain infrastructure would be important design considerations. Once water is stored in the ponds, potential pollution from household drains and sewage disposal may raise new problems. Gravity could also bring septic tank overflow into the ponds. Experience shows that pond areas are often used to dispose of solid waste by local inhabitants as well. To ensure that the revived ponds will stay healthy a Pond Maintenance and Solid Waste Management Plan would be recommended to be developed with involvement of the community in each village or town. Only then the restored ponds will continue to fulfil multiple social and eco-system services to sustain life for people, flora and fauna.

Nitin Verma, SustainAsia and Dr. Veena Khanduri, Executive Secretary, India Water Partnership.

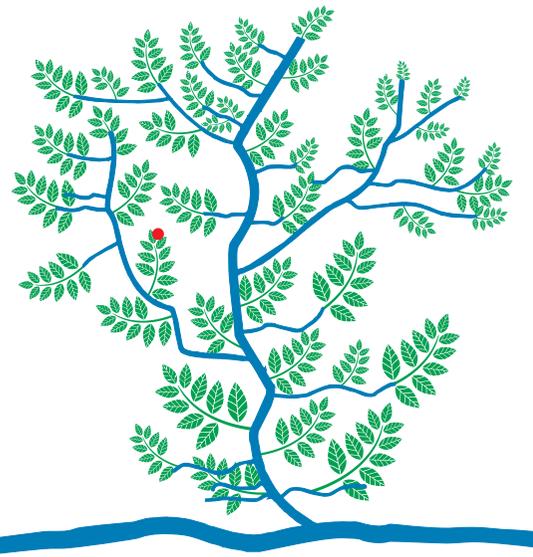
**Brave effort
to revive a dead river**



An Ecosystem Approach to River Rejuvenation

Katha River

SHAMLI



*A community funds **revival** of the Katha River with a “**One house, One pot**” **water donation** movement and a commitment to build **check dams**, dig **ponds** as well as **reviving** the adjoining **ecosystem**.*

The Katha River, a tributary of the Yamuna that originates in Saharanpur district and merges with the Yamuna near Ramra village has remained a dry channel for a long period of time. Communities living around the dry river bed were resigned to not seeing it come alive till a simple non-violent and collaborative effort under a wildlife scientist’s leadership made them active participants in a 5-year project that will conclude with ecosystem restoration. The Katha River Eco Restoration Programme (2016-21) will revive a 100 km stretch of the river

by undertaking rain water harvesting thereby recharging both surface and ground water, biodiversity restoration, lotus lake ecosystem development along with village tourism.

A plan that brings community into action

When Professor Mohd Umar Saif, a Shamli based wildlife scientist and head of the Natural History Research and Conservation Centre (HIFEED campus) asked residents of Malakpur village, Shamli district to participate in the revival of Katha river by bringing a pail of water and pouring it in the dry river bowl; this became a symbol of collective action to drive home the message of



being part of a movement that would bring together people from adjoining villages to undertake rejuvenation of the river, its flora and fauna. The launch of the restoration programme on 12th February, 2016 witnessed participation from district administration and civic authorities. Moreover, this would not be a one-off event but a 5-year dedicated project.

Once mobilisation of community and department officials were completed, Prof. Saif's team began mapping the course of the river using Geographical Information System (GIS) together with field surveys. Following discussions on solutions and strategies that could be adopted, it was decided to divide the river into 100 sections instead of starting

work on the entire length. A small 1 km stretch which ran through Malakpur village was taken up with a plan to build check dams and ponds along the bank of the river to harvest monsoon water. At present, in the absence of check dams, the rain water flows into the Yamuna. According to Prof. Saif, "Katha presently functions as the drainage pipe of the Yamuna. Every monsoon, the water flows and drains that into that river. To prevent this, the team decided to first work with a 1 km stretch of the riverbed and revive it, before moving ahead." He explains that creating a model example would encourage and motivate people living further downstream. As of date, the first check dam is



"Biggest challenge has been the lack of awareness and the fact that no one realized they have a chance to revive the river. The success of the initiative is built upon being completely driven and owned by the community with full support of multiple stakeholders including government, in a way that has been peaceful as well as non-confrontational."

*Prof. Mohd Umar Saif
Wildlife Scientist, Shamli*





REFLECTIONS & WAY FORWARD

ready and the second is nearing completion. A schedule has been drawn up and monitored by the village to ensure timely completion of the work ahead of the monsoon.

Breathing life in and around the river with flora and fauna

The Katha River Eco Restoration programme has a broader objective and goes beyond just bringing water in the river. As part of the “Green UP Clean UP” programme, the U.P. Forest Department is planning a large-scale plantation drive in July 2016 throughout the state. This event will be used by villagers to sow about 20,000 plants on both sides of the Katha River. The programme also envisages an Eco-Diversity park which will host a

butterfly conservatory in partnership with the local Eco clubs.

This model of revival of the river has generated a lot of interest. The voluntary spade-work carried out by the village folk may soon be brought under MNREGA. Meanwhile, the Katha River Rejuvenation foundation has gained traction through the increasing support from a growing number of organisations such as Himalayan Community College, Jadeed Foundation Trust, Kartavya Shikhsan & Sewa Samiti and Navchetan Satyabhash Group as well as government bodies namely Village Panchayat Malakpur, Zila Panchayat Shamli, Irrigation Department and Central Zoo Authority of India amongst others.

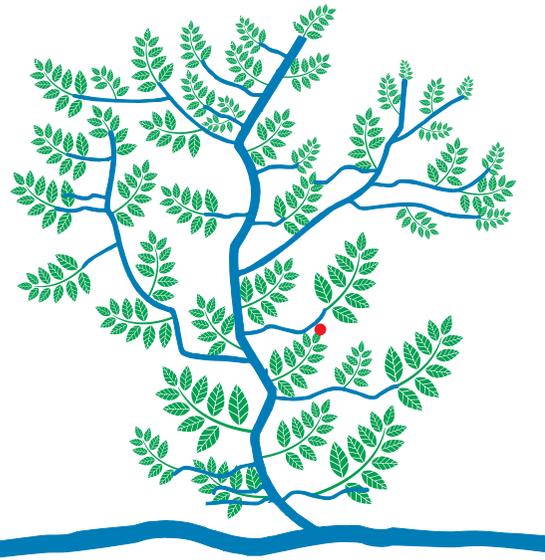
This laudable community supported initiative is worthy of replication since Indian rivers, with the exception of Himalayan rivers, do not have a perennial source and face similar problems due to excessive anthropogenic pressures.

Identification of the factors that caused Katha River to disappear and survey of geo-hydrology of the river basin would be useful exercises to undertake so that the entire rejuvenation effort could be based on an integrated watershed approach that takes important water quality concerns also into account.

V. Rajagopalan, Former Secretary, Ministry of Environment, Forest and Climate Change, Government of India

“Talaab Bachao – Talaab Banao”

Sustainable agricultural practices promote water efficiency



Progressive farmers in Meerut district are adopting an **integrated approach** to farming that comprises of pond **creation/rejuvenation** enabling fish farming, **organic agriculture** through **composting** and **dairy farming** linked with **bio-gas** plants.

shape. The ponds which were once the lifeline of the villages have led to health problems. Once a water rich area of the state of Uttar Pradesh, the Upper Doab region is beginning to stare at a water scarcity situation.

The Upper Doab region between the Ganges and Yamuna has traditionally been extremely fertile with many rivers and their tributaries flowing in this region. Over the last decade, this belt has started facing water shortages along with contamination of water bodies. At the root of this problem is the disappearance and stagnant village ponds. The growing population in the region has resulted in the encroachment of the ponds while those remaining are dirty and in poor

One of the first to realize the gravity of the situation was a Meerut based NGO named Neer Foundation who began a “talaab bachao – talaab banao” (Save Ponds, Make Ponds) campaign as early as 2004. This campaign not only encourages the creation of new ponds but also the revival of existing dead ponds. Over the years, this campaign has had hundreds of ponds freed from encroachment while dozens of new ponds have been built. As part of the campaign, the foundation has nominated Jal Dhoots (Water Ambassadors) who take up issues related to ponds in villages

MEERUT



and encourage as well as motivate farmers to build new ponds. The Jal Dhoots also provide technical and financial assistance to farmers in digging ponds while also arranging for water from the canal to fill the ponds.

Rearing a new breed of 'Water Farmers'

Their efforts have translated into many success stories emerging from the region and one that stands out is Satish Kumar, who has been a Jal Dhoot for 10 years and happens to be sarpanch of Karnawal village in Meerut district. He is a prosperous farmer owning 25 bigha (measure) of land and was growing sugarcane like most others in the region. When he became self-aware about the long term sustainability of the sugarcane crop,

he built three large ponds with guidance from the foundation which brims with water today. The ponds are recharged daily with water released in the canal. He uses the pond to nurture two cycles of marketable fish which he plans to sell commercially. During the offseason, the pond will be dried and the bottom silt will be removed to maintain its recharge capacity; the silt can be used in a compost. He also has a full-fledged milk dairy with the dairy feed refuse channelled to the pond for the fish to feed. Finally, a biogas plant has been operational that generates sufficient electricity for domestic as well as commercial use. This pond is clearly at the centre of his farm enterprise which is linked with other aspects. With the help



Devinder Singh

A farmer in Dola village of Baghpat district has three lots of 50 bigha land each. Working closely with Rashtriya Jal Biradari network he has turned into an organic farmer. Although he is yet to bring his entire land under organic farming, he is gradually increasing his basket of organic crops by finding new avenues to market his produce for better prices.

of the foundation, Satish has been able to leverage government schemes which offer grants/subsidies for agricultural farmers and has become the pride of the village. He is now providing consultancy services to other farmers who are interested in adapting his example. Recently, ground water levels have been recorded by the foundation as a baseline so that recharge levels can be monitored over a period of time. According to Satish, you do not need large land holding to build your own pond, even a 1.5 to 2 bigha plot can have its own pond.

Combating climate change by changing the practice of burning the crop residue

Ending the environmentally degrading practice of burning agricultural residue that leads to emission of greenhouse gases, the Neer Foundation developed a project to provide farmers with an alternate composting technique that can help increase the soil fertility by the use of the compost generated. In a pilot demonstration conducted in 2014, eight farmers in Meerut district were chosen for demonstration of the LR Compost technique on the basis of their willingness to move towards organic inputs for their crop. Post training of the farmers, construction of the pits were completed in a few months.

The pits were started up with cow dung, field soil, organic matter, waste leaves and water. Initially, farmers began using the liquid manure extracted from the pits in their fields and gradually started noticing improvement in the colour of their crops along with a reduction in pests; similar results were observed with the solid manure which takes longer time to produce. Feedback from the farmers in the pilot have been positive, the technique being simple to use and maintain has the added benefit of disposing the waste off their fields. By making their own manure, they are saving on costs usually spent on buying products from the market.

Analysis of the liquid and solid forms of the manure were carried out at ICAR-CPRI, Meerut to understand composition. While the impact of manure on the soil depends on the rate of decomposition of manure which on an average is a 3 year period, the results of soil nutrient analysis has shown a positive trend at the end of the one year pilot. The pilot study outputs have been shared with an Agricultural university in Meerut for further research. In the meantime, the initial success of the LR compost pit technique is being taken to different villages through Jaivik panchayats where benefitted farmers share their experiences.



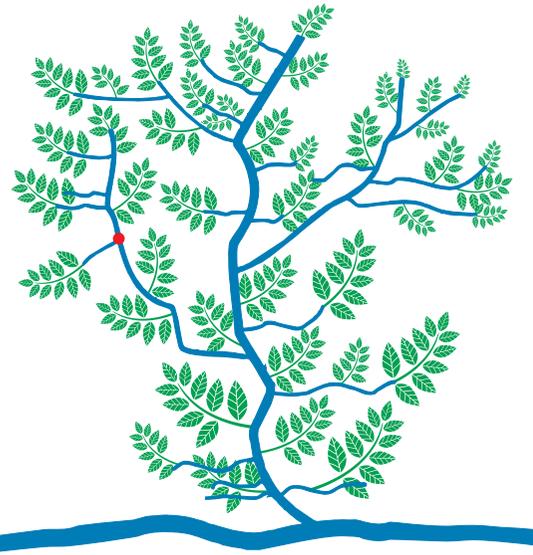
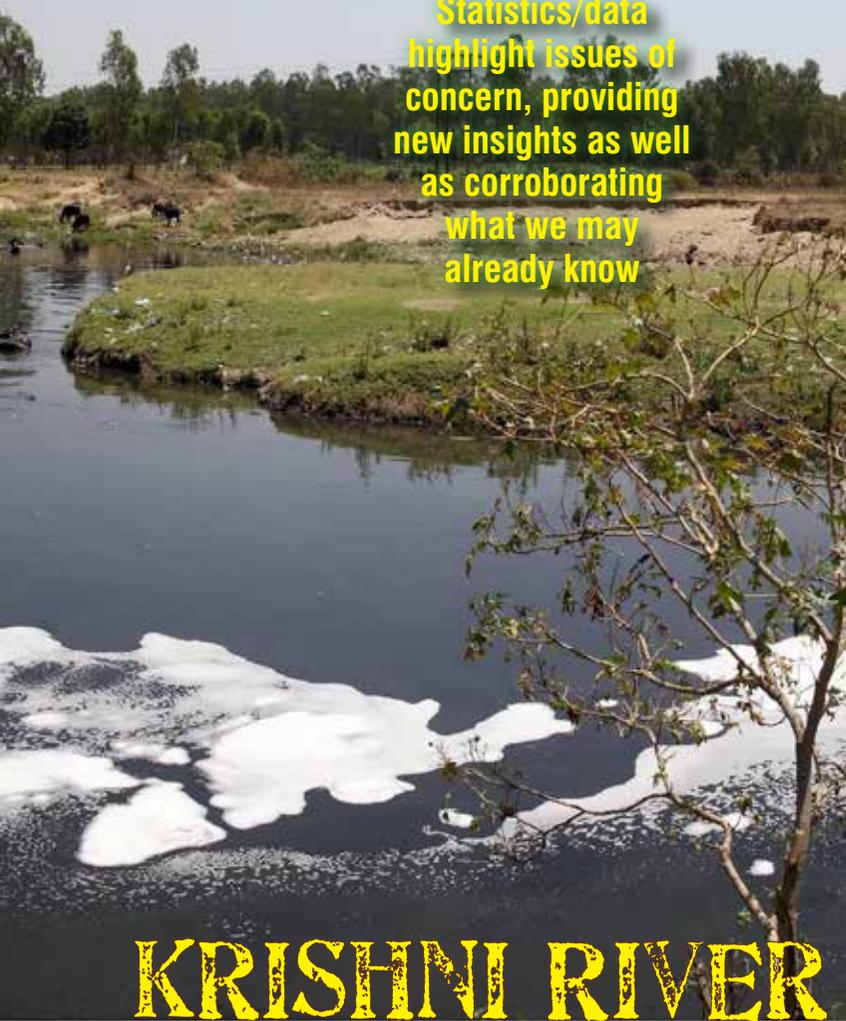
REFLECTIONS

- Initiatives such as the promotion of an integrated model of creating fish ponds along with dairy farming and bio-gas generation should be commended.
- The logic of saving every drop of water at the farm/village level looks very tempting. However, any sustainable water resource management will have to be looked in the overall context of the river basin and a comprehensive water balance study considering both surface as well as ground water resource as a unitary resource would be required in order to achieve the stated objective.

*R.S. Pathak, Consultant,
Senior Water Sector Specialist*

Generating Evidence through Mapping Exercises and Scientific Research

Statistics/data highlight issues of concern, providing new insights as well as corroborating what we may already know



Faculty and Students from institutions such as **IIT Roorkee** are conducting research and publishing **studies focused** on the Hindon river/basin. Elsewhere across the basin, CSOs and NGOs are carrying out **mapping exercises** to generate **evidence** to guide/support their actions.

Impact of Pollution in the Krishni River on Ground Water

The Hindon basin can be characterized by indiscriminate usage of ground water across all sectors, contaminated rivers and groundwater due to natural as well as anthropogenic causes, low level of sewage/effluent treatment and below average water use efficiency particularly in the agriculture sector. The Indian Institute of Technology in Roorkee due to its proximity to the basin has built up a repository of published papers/reports on issues related to the Hindon basin primarily focused on pollution. Recently, two studies were performed on the tributaries of the Hindon that flow in the upper part of the basin, namely Krishni, Paondhoi and Dhamola rivers.

A study by Rinku Kumar, a Master's student at IIT Roorkee on the topic of "Impact of Pollution in River Krishni on Ground Water: Dynamics of natural filtration" was carried out at Chandena Mal village, Thana Bhawan tehsil of Shamli district over a six month period in 2013-14. Investigating the effects of polluted River Krishni, the study looked at how the treated/partially treated/untreated effluent discharged by sugar, distillery and cardboard industries located upstream impacted the quality of water in the river as well as the ground water abstracted from different depths.

The results of the field work show that both ground and surface waters at Chandena Mal village were found adversely affected due to



pollution in River Krishni. The quantity of trace organics showed a correlation with the chemicals used by the industries in the area. Most of the hand pumps abstracting ground water from shallow aquifers were found to deliver polluted water in terms of colour, organics and presence of coliform bacteria. Groundwater to the depth of about 55m was also polluted though water quality improved as the distance of hand pump increased from

the river. The 130 m deep tube well with screens placed below 66m also showed better water quality, suggesting that clay layers in the aquifer (60-65m) may have prevented the entry of pollutants. The conclusion indicates that natural river bank filtration as well as deeper aquifer layers may provide short term relief to affected villagers seeking potable water while long term pollution issues are being addressed.



Waste and Wastewater Mapping in the Upper region of the Hindon basin



Methodology used in the study

An ongoing study led by Dr. Vivek Kumar along with Ph.D. scholars at IIT Roorkee focused on “Water and Wastewater Mapping in the Upper region of the Hindon River Basin” began in December 2014. The objective of the study is two-fold: Map the water quality of tributaries of the Hindon namely Krishni, Paondhoi and Dhamola as well the ground water in adjacent villages; Prepare a water budget based upon the current and future water demands for Agriculture, Domestic and Industrial sectors apart from other uses. In addition to physio-chemical parameters, heavy metals, insecticides and pesticides were also included as part of the analysis with sampling carried out during pre as well as post monsoon periods.

Preliminary results from the study indicated that the concentration of heavy metals such as Arsenic, Cadmium, Iron, and Selenium in groundwater at many places in the Upper Hindon basin is higher than the acceptable limits prescribed for drinking water. The water samples also contained many organic chemicals of pesticide origin. The presence of the above contaminants is confirmed by the prevalent skin diseases, bone deformation, kidney disorder and cancer cases in the study area. The probable source of contaminants and distribution of contaminated sites indicated that no single activity is responsible; it maybe as a result of geological conditions and multiple anthropogenic activities including industrial, domestic and agricultural practices. The detailed results of the study will be published in a journal later this year. Excessive use of water in irrigation was observed in both canal and tube well irrigated areas and there is no prevalent practise of water budgeting in the region. However, awareness about modern scientific irrigation practices is increasing among farmers and many of them have started using micro irrigation and laser leveller technique.

Social mapping and qualitative inputs

Many of the CSOs, NGOs and activists working in and around the Hindon basin

have undertaken social mapping of villages, documented anecdotal evidence and recorded test results from water samples collected from the tributaries. These are compared over a spatial as well as temporal scale to arrive at some substantive conclusions. Organizations have realized the merit of generating evidence to build a stronger case for policy and programmatic interventions. In some cases, the data also guides and supports their own actions.

As part of a project for providing an alternate source of safe drinking water for households in Dabal Village in Meerut district, a Meerut based NGO conducted a socio-economic survey at the household level as well as performing analysis of the water quality of personal household hand pumps to determine the degree of treatment required. The Rashtriya Jal Biradari network has undertaken many padyatras (walks) interacting with communities to understand their relationship with the Hindon and the problems they faced as a result of pollution thereby gathering anecdotal evidence. As activities in the basin gather momentum, gaining the attention of the state and district administrations, a consolidation of these studies in a format that is acceptable to the scientific community would be a step in the right direction.



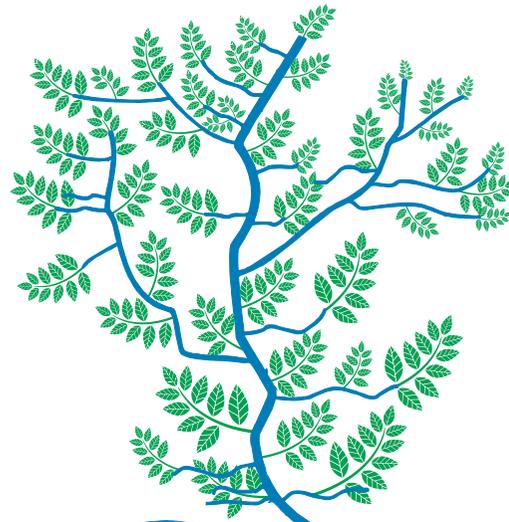
The case study provides valuable evidence of the linkage of pollution arising from industrial as well as communal activities and the contamination of surface and ground water bodies. Going forward, it would be useful to understand the pollution contribution from point and non-point sources which would be helpful in determining the exact sources of pollution so that appropriate control measures can be devised and adopted.

Another important aspect that should be researched and put into practice are the tests or analysis that can provide early warning signals using consumer technologies that can not only be deployed quickly but provide useful inputs for the administration to prioritize their activities for swift action.

Nitin Verma, Partner and Managing Director, SustainAsia Pvt. Ltd.

Comprehensive Water Quality

Monitoring System for Hindon is Emerging



Water *quality* monitoring measures the *health* of a river and *impact* of pollution *control* measures

expanded significantly, but at the same time the water quality in many of our country's water bodies has deteriorated significantly. The case of Hindon River is no different, in fact Hindon is one of the most polluted rivers in the country.

Efforts are currently underway for a well-designed comprehensive Water Quality Monitoring Systems for the Hindon River along with transparent data sharing that can provide higher quality data and analysis for better spatial coverage and understanding of longer term trends.

For many years, the pollution of the Hindon River has been widely studied and results have been documented. Studies under national programs as well as independently have been undertaken; however, on a closer look the data clearly shows limitations. Hindon River water quality monitoring data has had temporal and spatial limitations due to limited number of sampling points and low testing frequency. While the available datasets indicates that the river has become more polluted over the last many years, there exist data gaps in terms of missing values of

About four decades ago, clear provisions for monitoring, compliance and penal action to prevent and control water pollution were stipulated with the advent of the Water Act (1974). Since then the water quality monitoring network has

HINDON BASIN



key parameters and inconsistencies in data interpretation.

A recent survey conducted by India Water Partnership of various stakeholders (community/farmers, industry, administration and academia) reveals that while everyone agreed to the fact that Hindon was a highly polluted river, there was little cohesion amongst the stakeholders. Often, discussions based on available datasets led to conflicting opinions and disputes over proposed actions. From the Hindon basin, it is learned that stakeholders have started adopting social

mapping, documentation of anecdotal evidence and installing/recording data findings from various samples collected along the tributaries.

The need for real time monitoring

Real time data networks are being adopted for water management. There is a growing acceptance that traditional grab sampling is unlikely to provide a reasonable estimate of the spatial and temporal variability in water quality at a particular site. Traditional sampling and analysis techniques result

in delays of days to weeks for analytical results to be available, and results in a real loss of high frequency information content that can greatly enhance understanding the water quality behavior of the river. Fluctuations can only be detected through high frequency real time ‘continuous’ measurements, with a much higher sampling frequency, that have the capability to capture most natural variability and measure sporadic concentration peaks. It is therefore, necessary to support the automatic monitoring systems with manual sampling.



‘A reliable water quality monitoring system in combination with pollution load assessment of all drains discharging in to the Hindon forms the basis for planning targeted interventions to improve water quality, along with judicious water use and water conservation, paves the way for river rejuvenation.’

*V. Rajagopalan, Former Secretary,
Ministry of Environment, Forest
and Climate Change (MoEF)*

The manual sampling also helps as a quality assurance of the performance of the automatic monitoring stations and vice-versa.

From recent discussions with State Government officials from the Irrigation and Pollution Control Board (PCB) departments, it is learned that the increased efforts are being made to better map the water quality in the Hindon river basin. The water quality monitoring points are being increased from about 10 to over 50 sampling points which would definitely provide greater insights into the various causes of pollution and devising appropriate solutions. The increased vigor and focus is noticeable at all levels, clear directions and support are being provided by the administration as apparent from a vision set by the Chairman of UPPCB, Mr. Sanjiv Saran, who is personally spearheading the efforts of installing a world class automated Water Quality Monitoring and Information management system based on global best practices. It is only a matter of time when a comprehensive water quality monitoring system would form the backbone of the decision making tools for planning and

designing pollution control measures and sustainable development practices are adopted to ensure a water secure growth in the Hindon basin. The improved data quality and quantity enhances the ability to conduct accurate mathematical modelling of water quality trends at local, watershed and regional scales.

A team of global and national water quality experts have partnered with the UP PCB to develop a comprehensive water quality monitoring system with the support of the 2030 Water Resources Group. The key components include:

1. A Snapshot Assessment of the Hindon and its tributaries to collect data relating to both the river water quality and the pollutant loads in the river system.
2. A comprehensive WQMS utilizing global best practices and technologies that would have a mixture of both automated and manual water quality sampling stations as well as a robust and transparent information management system.



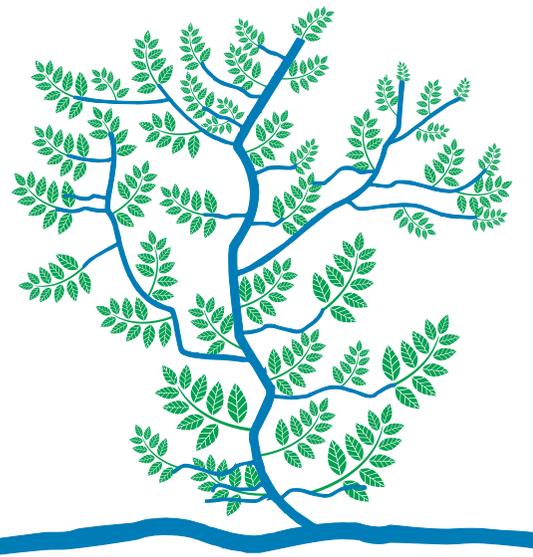
GOING FORWARD

1. The proposal to combine manual and real-time monitoring is appropriate and in fact necessary since reliable real-time sensors are not yet available for heavy metals and pesticides.
2. Considering health concerns arising from possible contamination of nearby water bodies with the highly polluted Hindon water, parameters monitored should also include heavy metals whose concentrations have been reported to be very high as well as pesticides chosen based on toxicity and usage in the basin.



Climate Change Adaptation for Agriculture

Establishing multi-stakeholder platforms - Ramganga and Ganga Mitras to help adapt to threats arising from climate change



WWF – India aims to demonstrate a **framework** for **climate adaptation**, incorporating climate **smart** agriculture and **sustainable** water management **practices** to **reduce vulnerabilities** of people and **improve** base **flows** in the river.

The overall approach of the Climate Change Adaptation pillar under the WWF Rivers for Life Programme focuses on community empowerment, leading to community ownership, management and control of their life choices for the river's restoration and enhancement of livelihood options. The programme is operational in 40 villages across 6 districts of Uttar Pradesh- Bareilly, Bijnor, Fatehpur, Kanpur, Moradabad and Shajahanpur to demonstrate ecosystem based climate

adaptation practices. The interventions focus on re-building the soil health by promoting integrated pest, disease and micro-nutrient management. As a part of these initiatives, use of locally developed organic fertilizers and bio-pesticides called Amrit Pani and Amrit Khad are promoted to reduce chemical applications; to reduce input costs across a crop's life-cycle and increase crop productivity. To enhance the adaptive capacities and to restore ecosystem health, it was envisioned that such climate smart approaches would eventually be integrated into district plans which is currently an ongoing process.



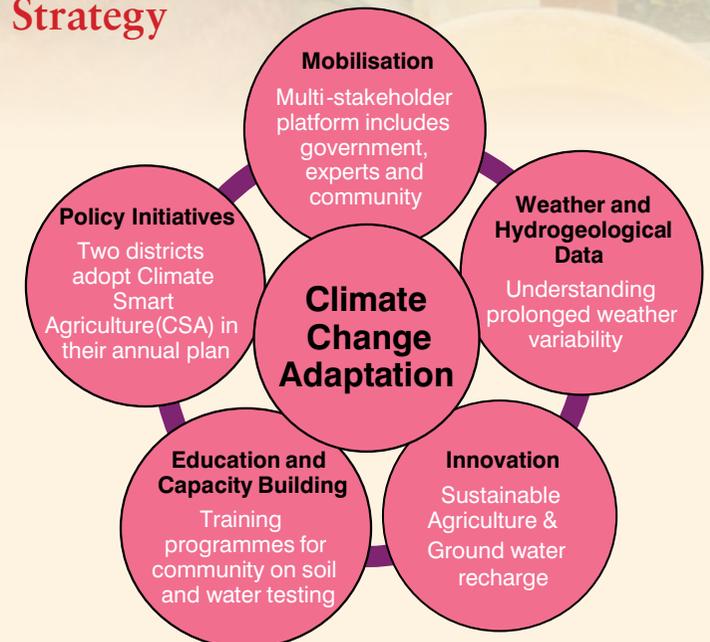
Climate Change Adaptation Model

Joint working groups were formed with senior government officials of various departments and WWF-India. These groups conducted threat mapping exercises in consultation with communities and government officials in six districts (Bareilly, Bijnor, Fatehpur, Kanpur, Moradabad and Shajahanpur) through Participatory Rural Appraisals (PRAs) which highlighted the community's perception of threats to the river and possible solutions in 40 riparian villages spread across the aforementioned districts. The findings of these PRAs were formally collated in the form of a Gram Sabha resolution that paved the way for an inclusive approach towards agriculture and water management leading to benefits for both community and the river.

To build the capacity of these farmers to address these threats, training sessions were facilitated by WWF-India, wherein agricultural experts demonstrated the use of Best Management Practices (BMPs). These BMPs included the use of micro-nutrients to provide a balanced supplement to crops to enhance production, in addition to bio-manure (Amrit Khad), bio-pesticides (Amrit Pani) and Package of Practices (PoPs) for paddy, sugarcane and wheat. These practices are designed to optimize or reduce the use of chemical fertilizers such as Urea and Di Ammonium Phosphate (DAP) without compromising on the productivity of crops. The reduction of chemical compounds in the agricultural runoff would also reduce the pollution load on the river. Beneficiary farmers have reported a decrease in input



Implementation Strategy



cost by 40%, a saving of 385 liters of water per hectare and a subsequent increase in production by 30% during the cropping season of wheat.

Given the critical nature of engaging policymakers at every stage in the process to ensure ownership, sustainability and replication of initiatives, a series of village level sensitization meetings were conducted with the support of the district administration. Multi-stakeholder groups known as Ramganga and Ganga Mitras (Friends of the River) comprising farming communities, government officials and health volunteers were formed in all the targeted villages, they anchor the programme activities.

Results and Final Outcomes

Since June 2014, the programme has reached out to over 10000 farmers who have taken steps to adopt smart agriculture and water practices in reviving the ecological health of the river. In wheat crop, the usage of urea has declined from 60 kg per acre to 20-25 kg and similar is the reduction in the quantity of DAP. In many places, the usage of chemical pesticides has been replaced with bio-pesticides i.e. Amrit Pani. One of the many advantages of collaborating with the Government is that opportunities

existing within the government schemes were identified to leverage funds for the Climate Change Adaptation (CCA) initiatives. For instance, in many villages, wetlands identified as key sources of groundwater recharge, were taken up for rejuvenation as part of the MNREGA (Mahatma Gandhi Rural Employment Guarantee Act). WWF is currently working with the district administrations of Moradabad, Bareilly and Shajahanpur districts to incorporate climate smart practices in their respective district plans.

Sedan, a Ramganga Mitra from Goharpur Sultanpur has played a key role in community mobilization. Having internalized the larger goal of practicing sustainable farming, Sedan has been able to bring community members together to acknowledge their responsibility towards maintaining the ecological health of the river and take action. Sedan does not hesitate to speak up and is often witnessed encouraging other women to share their experiences of adopting the practices so that everyone can discuss the process and compare learning. Sedan's husband is one of the farmers who has adopted PoPs for paddy, sugarcane and wheat while her children have been trained to conduct River Health Assessments highlighting how change can begin at the household level.

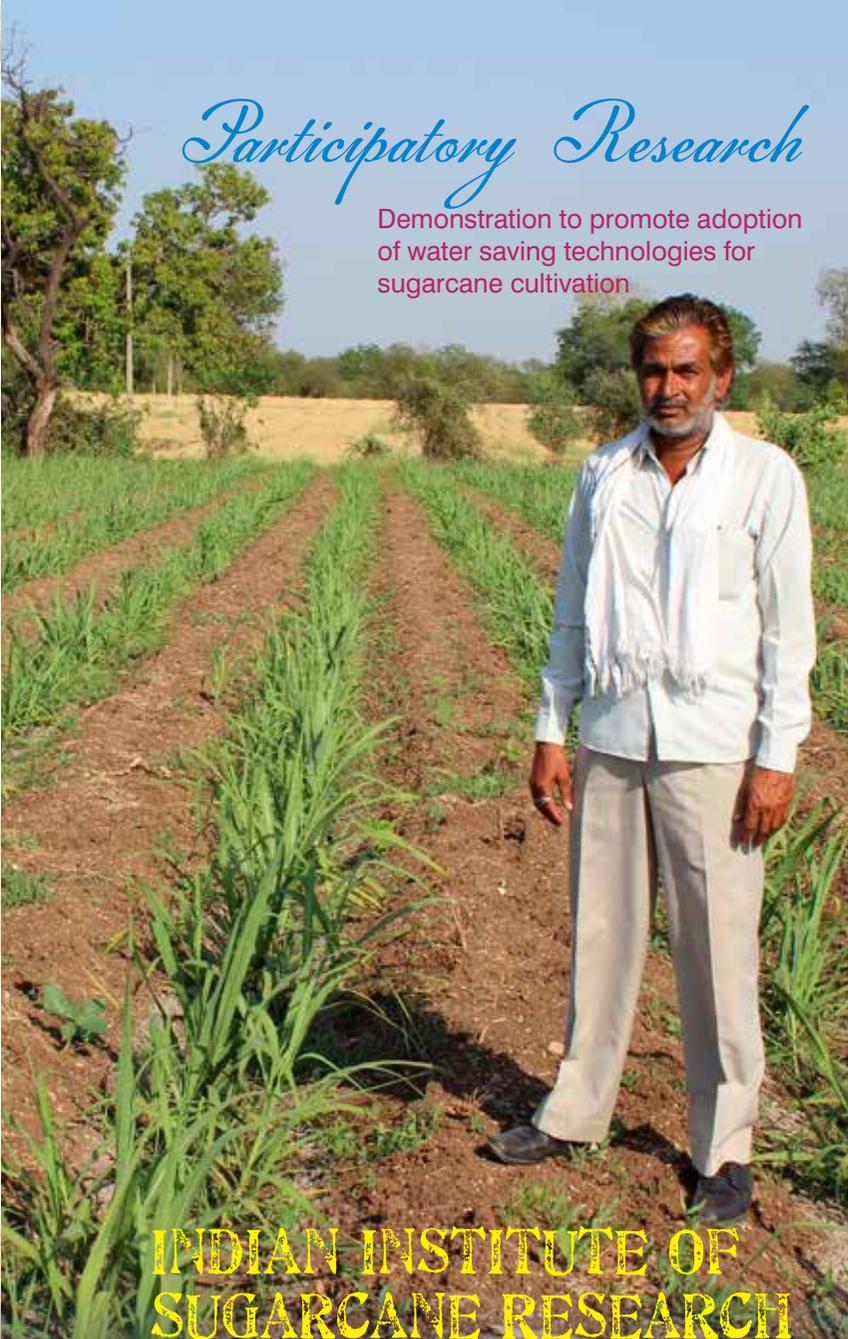


WAY FORWARD

The current momentum gathered by the programme is indicative of the potential to embed this adaptation model in annual plans of different government departments like Rural Development, Agriculture etc. The expansion from few hectares to an entire agricultural area over a period of time would then demonstrate a tangible enhancement in the adaptive capacity of people and the ecosystem. So far, this programme has worked with the farmers and government machinery. The next phase of the programme would be to engage with markets and financial institutions.

Participatory Research

Demonstration to promote adoption of water saving technologies for sugarcane cultivation



INDIAN INSTITUTE OF SUGARCANE RESEARCH

Sugarcane is categorized as one of the crops having high water requirement. The need of the hour is to promote large scale dissemination and adoption of technologies that can enhance water use efficiency and water productivity in agriculture.

Participatory research demonstrations, unique approach to analyze sugarcane cultivation

The Farmer Participatory Research (FPR) is a “learning by doing” approach, which encourages farmers to engage in experiments in their own fields so they can learn and adopt new technologies before sharing it with other farmers. A study was initiated by Rajendra Gupta, T.K. Srivastava, Kamta Prasad, A.K. Sah and K.P. Singh from the Indian Institute of Sugarcane Research, Lucknow in the backward districts of Barabanki and Sitapur in Uttar Pradesh, with the objective of enhancing on-farm irrigation water use efficiency by demonstrating water saving technologies to sugarcane growing farmers; refining technologies as per their need for sustainable adoption and enhancing their profitability and knowledge. A selection of farmers who

could be part of the on-farm trials was based on their knowledge about farming and willingness to share their experience. They had to have a minimum of one hectare area under sugarcane cultivation with experience of growing sugarcane for at least 4-5 years.

As many as a hundred participatory research demonstrations on irrigation water saving technologies spread over three cropping seasons (2008-9, 2009-10 and 2010-11) were conducted. These experiments used four water saving technologies: Ring-pit planting, Skip-furrow irrigation, Trash mulching and Irrigation at Critical Growth Stages (ICGS). These were then compared with existing farmer practices.

How the on-farm experiments fared

Sugarcane yield data reveals that yield was considerably higher under demonstrated technologies as compared to that under farmers’ practice. Ring-pit system of planting and skip-furrow method of irrigation yielded significantly higher production of sugarcane as compared to the farmers’ practice and other demonstrated technologies.

Saving in irrigation water varied from 17.8 to 30.8%. The increase in irrigation water use efficiency (IWUE) was recorded highest in



ring-pit method of planting (142.6%) over the conventional method. Overall, results revealed that the farmers participating in demonstrated technologies registered a significant increase in sugarcane yield, irrigation water saving and irrigation water use efficiency (Table 1).

Effect of demonstrations on knowledge and adoption level of beneficiary farmers

Table 1: Effect of demonstrated technologies on yield, saving in irrigation water and irrigation water use efficiency in sugarcane

Technology	No. of demos 2009-11	Sugarcane Yield (t/ha)	Increase in cane yield over farmers' practice (%)	Irrigation water applied (ha-cm)	Saving in irrigation water over farmers' practice (%)	IWUE (kg cane ha ⁻¹ -mm ⁻¹)	Increase in IWUE over Farmers' practice (%)
Ring-pit method of planting	16	125.28	96.4	54.56	19.1	236.7	142.6
Skip-furrow method of irrigation	32	88.54	38.8	54.15	17.8	164.8	68.9
Trash mulching	28	80.18	25.7	47.93	27.1	168	72.4
ICGS	24	81.76	28.2	45.41	30.8	180.7	85.2
Farmers' practice		63.8	-	66.01	-	97.6	

Technology and result demonstrations conducted at farmers' field led to increase in knowledge level and support to the farmers in the form of supply of critical

inputs culminated in enhanced adoption of sugarcane technologies by the farmers. The demonstrations also helped farmers to get information from different extension agencies related to scientific cultivation of sugarcane, marketing, availability of inputs and subsidies. Highest knowledge enhancement (96%) was observed in ring-pit method of

planting. However, the highest adoption (86%) was for skip-furrow method of irrigation. Considerable increase in adoption of water saving technologies clearly indicates farmers'

Table 2: Effect of demonstrations on knowledge and adoption

Technology	Increase in knowledge levels from pre to post demonstration (%)	Increase in adoption of technique from pre to post demonstration (%)
Ring-pit method of planting	96	81
Skip-furrow method of irrigation	86	86
Trash mulching	62	47
ICGS	83	85

satisfaction with performance of these technologies under their resource conditions (Table 2).

Joint effort of scientists & farmers creates a model for replication

Feedback from farmers expressed satisfaction with increase in sugarcane yield and savings in water use. The ring-pit planting technique produced higher germination which resulted in higher density of mother shoots but required higher inputs of labor and cane sets. The skip furrow method helped farmers report lesser weed growth and crop lodging.

With trash mulching, farmers observed good bud sprouting when ratoon is initiated during winter months. Farmers were trained in identifying stages of crop growth critical for irrigation, adoption of this technique resulted in saving water without sacrificing yield.

As compared to formal field trials, the farmers' participatory research experiment

can improve effectiveness of technology development, raise adoption rates, strengthen farmers' experimental capabilities and increase the payoff to agricultural research. The findings reinforce the fact that the irrigation development alone cannot produce optimal results unless the irrigation system as a whole, from the source of water unto the farm level is well managed.

Different planting/irrigation techniques used as part of the study

Ring-pit planting technique: In this planting technique, the field was marked in squares with side length of 120cm, leaving 1m wide strip along the field's periphery. Pits of 90cm diameter and 45cm depth were made at the centre of each square. In every pit, farm-yard manure, urea, DAP, MoP and zinc sulphate were mixed uniformly before placing the setts for planting. Light irrigation was given soon after planting to accelerate germination. Post 30 days of germination, 2nd dose of urea was applied in pits with half the remainder soil filled back in the pits. At the end of tillering phase, 3rd dose of urea was applied, remaining soil filled back and pits were interconnected with small channels for irrigation.

Skip-furrow method of irrigation: Instead of irrigating all furrows and inter-row spaces, irrigation was given in alternate furrows with sugarcane planted on flat beds.

Trash mulching: After harvesting the plant crop, a thick blanket of sugarcane trash (dried leaves) @10 t/ha was spread in inter-row spaces at ratoon initiation stage. Effectiveness of irrigation is augmented as the evaporation losses from soil surface are considerably reduced.

Irrigation at critical growth stages (ICGS): Critical stages for sugarcane irrigation are emergence, 1st order of tillering, 2nd order of tillering and 3rd order of tillering which is the most critical stage. In areas of limited water supply, ensuring irrigation at critical stages and deferring at somewhat less critical period can improve yield and water use efficiency.

Farmer's practices: Farmers of the selected villages plant sugarcane at 75 cm row to row spacing. They did planking after planting and divided the field in 15 to 20 m wide borders for irrigation. Farmers irrigate the crop as and when their turn for canal water arrives; irrespective of whether the crop needs it or not.



REFLECTIONS AND WAY FORWARD

This study would contribute towards reducing the water footprint for sugarcane which is vital considering India is the second largest producer in the world. The results of the research should be incorporated as part of the Comprehensive District Agriculture Plans (C-DAP) and other Krishi Yojanas to ensure dissemination and implementation at a wider scale. Similar farmers' participatory research studies should be conducted for other water intensive crops such as paddy and wheat.

*Rajendra Singh, Chairman,
Tarun Bharat Sangh*



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