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MY PAGE

Dear Friends,

India's trajectory towards becoming the 3rd largest economy by 2030 is a source of collective pride. Our nation is experiencing significant growth across financial, infrastructure, agricultural, and renewable energy sectors.

The 29th IPC in Ahmedabad underscores the expansion of IPA, reflecting increased awareness of water's critical importance. The conference appropriately touched subjects like Net Zero Water and 5 R's of Water Management.

Our country's development hinges on effective water management. Water audits, following the 5 'R's of Water Management, and fostering behavioural change towards water conservation are pivotal for ensuring a water-secure future.

Water delivery and treatment, along with sewage emissions, have a notable carbon impact. Each cubic meter of water used yields 10.6 kg of emissions on average. Calculating the carbon footprint involves multiplying water consumption by emission factors. Therefore, water and energy efficient plumbing systems are the need of the hour for efficient water and wastewater management.

Water audits in built environment identify usage patterns, inefficiencies, and conservation opportunities, promoting sustainability, cost savings, compliance, risk management, and long-term planning for efficient and responsible water management in various sectors.

February issue of IPT is focused on "Water Audit and its relevance in Built Environment". We have collated articles around the necessity for water audit and the ways of doing it. We hope you find them insightful.

IPA will be celebrating World Plumbing Day and IPA Founders Day on 11th March. There are various activities like regional webinars, seminars, painting and drawing competition at school and college level, social media contest starting from 27th February till 20th March. Please log on to www.indianplumbing.org to know more on the activities at your chapter level. Let us contribute to the Nation in whatever possible way to spread the awareness about water conservation.

Plumbex India 2024 is going to be held from 25th-27th April at the Jio World Convention Centre in Mumbai. This will be the largest exhibition of Water, Sanitation and Plumbing Products. Save the Date and plan your visit for this biggest show of your fraternity.

Feedback is the breakfast of champions, so please spare few minutes out of your valuable time and send your feedback on IPT to make it better and better.

With warm regards,

Dipen Mehta
Member, Editorial Board
Past Chair, IPA Ahmedabad Chapter

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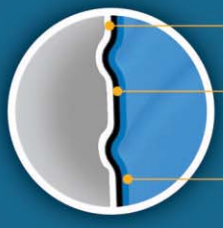

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Understanding Water Auditing: A Powerful Tool in Sustainable Water Management

- Dr. Snigdha Goel

1. Introduction

Water is the elixir of life, a fundamental resource that sustains ecosystems, agriculture, and human existence. Water stress and scarcity continue to be significant global issues in 2023. By the year 2025, it is projected that approximately 1.8 billion individuals will reside in nations or areas facing "absolute" water scarcity, defined as having access to less than 500 cubic meters of water per person per year. Additionally, two-thirds of the global population may experience "stress" conditions, with available water resources ranging between 500 and 1000 cubic meters per person per year. This scenario will be further intensified as rapidly expanding urban centers exert significant strain on nearby water reservoirs and supplies (FAO 2024[1]. The natural ecosystems that provide clean water and alleviate floods and other risks — such as forests, mangroves and wetlands — are degrading and disappearing at alarming rates. Alarming data from Aqueduct reveals that by 2050, $70 trillion in GDP, representing 31% of the global GDP, will be exposed to high water stress, a substantial rise from the $15 trillion recorded in 2010. Notably, India, Mexico, Egypt, and Turkey emerge as pivotal players, collectively accounting for more than half of the exposed GDP in 2050 (Kuzma et al., 2023). To avert such a situation, a 56% increase in global water supply or an equivalent reduction in demand by 2030 would be required (Lakshman, 2023). In India, there is a noticeable surge in water requirements across various sectors due to rapid shifts in both economic and demographic landscapes. The demand for water in India is also expected to grow at a 2.8% Compounded Annual Growth Rate (CAGR) from 2010 to 2030, facing a supply gap of 50% by 2030. With global warming-induced drought increasing, planning for effective water management and distribution is vital to ensure reliable access to sufficient, safe water in India.

Water Demand in Built Area

In 2023, the real estate segment of construction industry comprising of residential offices, hotels, retail, leisure parks etc is valued at USD 20.71 billion and is expected to grow at a CAGR of 21.20% during 2023-2028. The construction sector presents contributes 9% of India's GDP which is quite significant. A growth rate high as 21% implies there is a huge demand of accommodation in urban cities leading to immense strain water supply and sanitation systems. For 1 square meter of wall construction, an average of 350 liters of water gets used. With such copious amounts of water being needed at every stage of construction, built up area is becoming more and more water intensive. The ramification of urbanization will be severe. Recent study by TERI found that the groundwater abstracted in Delhi in the period 2005-2016 (−18.75%) is greater than the amount of total groundwater recharge (14.67%). Thus, increased urbanization will lead to reduced groundwater recharge, increase in surface water runoff and evaporation, and changes in impervious area.

The most vulnerable to water stress is the socio-economically weaker section. With a growing population and higher per capita consumption, water resources are increasingly being taxed to meet the demands of agriculture, industry, and households and

1. https://www.fao.org/land-water/water/water-scarcity/en/

the socio-economic backward section comes last in the priority. Thus, water shortage will exacerbate its negative effects, reinforcing poverty, slowing economic development, and widening social inequalities (Israilova et al., 2023).

To ensure India's continued economic growth, it's crucial to address these problems. In recent years, the idea of water resource management has emerged to treat water as an economic and public good (Hellegers 2002). We need to prioritize maintaining and upgrading existing infrastructure, improving water management, and implementing effective stormwater and wastewater treatment solutions.

Although some approaches exist for more precisely managing urban water, such as water footprint (Ene et al., 2013; Long et al., 2022); life cycle evaluation (Ma et al., 2018); and water pinch analysis (Liu et al., 2019), they have not yet provided the best guidance for establishing a connection between water use accounting and organization's benefits. Additionally, these techniques are only employed from an accounting perspective, without further research and targeted improvement efforts, so it is challenging to develop an effective and ongoing management plan (Lyu et al., 2023)

In this respect, water audit has emerged as a potent tool for addressing urban water challenges like water scarcity and mismanagement. Water auditing is a systematic process of assessing, analyzing, and optimizing water usage within various sectors, offering a pathway to unlocking efficiency and sustainability. This paper will delve into concepts of water audits in detail discussing real life examples of how it has positively impacted the water availability in an organization.

2. Importance of Water audit

A water audit—also called a water evaluation or assessment—is a comprehensive analysis of the current water use of a building or campus, and the subsequent development of a strategy to increase water usage efficiency and identify alternative water resources. The goal of a comprehensive water audit is to reduce the demand on freshwater resources. It provides a better understanding of customer water use patterns, characteristics, and consumption. The data gathered during a water audit will also assist in establishing a baseline for various customer segments and for future strategic and policy planning. By meticulously examining water consumption patterns, identifying areas of inefficiency, and recommending targeted solutions, water auditing empowers organizations to make informed decisions that not only conserve precious water resources but also yield substantial economic benefits. Auditing can also mitigate conflicts over water usage, promoting equitable distribution, and safeguarding the interests of all stakeholders. By embracing water auditing as a cornerstone of sustainable water management practices, India can chart a course towards resilience, prosperity, and environmental stewardship in the face of mounting water challenges.

3. Review of Literature

In the literature, there are several frameworks integrating urban planning with water management. For instance, a study by Koc (2022) build an integrated Urban Water Management framework that connects water supply, sanitation, rainwater and wastewater management with land use planning and economic development, aiming to achieve sustainable economic, social, and environmental objectives. Another study by Puchol-Salort et al., (2022) presented a CityPlan-Water framework to achieve water neutrality at a city scale. The interventions include retrofitting existing homes with water-efficient appliances, water reuse systems, and implementing rainwater harvesting and Blue Green Infrastructure in new urban developments and existing households.

A study by Barrington et al., (2013) investigated the use of water auditing techniques to examine water flows within a petroleum refinery, concurrently identifying practical ways for achieving water conservation. The work demonstrated that, even in a refinery with processes considered highly efficient within the industry, many opportunities existed to improve water conservation through technical, cultural and behavioural adaptations. Neelofar et al., 2023 highlighted major challenges faced by water resources management in India and illustrated how well-planned water auditing and water recycling can be used as effective tools for the management of water resources in the country. The authors concluded that if water audit is promoted on the lines of financial audit in the country, it has the potential to revolutionize to the large extent the reforms that will encourage this practice of water audit in all sectors thereby leading to wise and judicial use of water for safeguarding water resource.

3. Who needs water audit?

Water audits are essential for a broad range of organizations, no matter their size or industry. Water audits provide an accurate picture of the organization's water usage. Auditing in water boards is extremely

beneficial to estimate the quantity delivered and lost during the process. They are also useful for companies looking to minimize financial costs associated with water, businesses that want to ensure that they comply with environmental regulations, and those seeking green business certifications. In India, SEBI has introduced new reporting requirements on ESG parameters called the Business Responsibility and Sustainability Report (BRSR). As per the BRSR format, details like surface water, Ground water, Desalinated water, Power consumed in pumping and Total volume of water consumption (in kilolitres) are to be furnished on year-on-year basis. Thus, water auditing will become important to fulfill the ESG compliances and sustainability KPIs as well[2]. Because water auditing demonstrates a commitment to resource efficiency and environmental responsibility, they can provide important data for certifications such as LEED or ISO 14001 that require a comprehensive sustainability report as a part of the application process.

4. Types of Water Audit

Broadly water audit is conducted categorically in two systems, resource audit or supply side audit and the other one as consumption audit on demand side. Supply-side water audits shift the focus outward, examining the external sources and systems that supply water to an organization. These audits assess the revenue and non-revenue water, metered and non-metered water supplied. On the other hand, demand-side water audits focus on analyzing and optimizing the consumption patterns and behaviors within an organization. These audits delve into internal processes, infrastructure, and user practices to identify opportunities for reducing water usage and increasing efficiency.

In the realm of business, demand side water audits come in various forms, each tailored to meet specific organizational needs and objectives. Whether aimed at achieving sustainability goals, enhancing operational efficiency, or complying with regulatory requirements, businesses can choose from a range of audit types to suit their unique circumstances.

Comprehensive water audit: Provides an extensive view of water usage, any risks, and opportunities for improvement within the organization. This type of audit is helpful for companies seeking high-level green business certifications or serious about their sustainable business practices and achieving their sustainability goals.

Irrigation systems water audit: Focused specifically on outdoor water consumption, including irrigation and landscaping activities, this audit type targets businesses with significant outdoor water usage. By scrutinizing irrigation practices and identifying inefficiencies, companies can optimize water usage in landscaping while minimizing waste, thereby promoting environmental sustainability and cost savings.

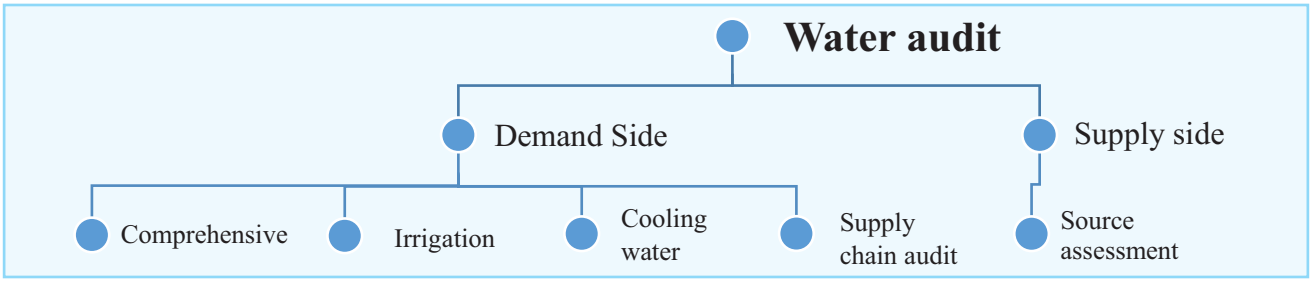
Cooling water audit: Essential for businesses relying on cooling systems, such as data centers or HVAC units, cooling water audits assess water usage associated with cooling processes. This audit type helps businesses identify opportunities for reducing water consumption, improving cooling system efficiency, and mitigating environmental impact.

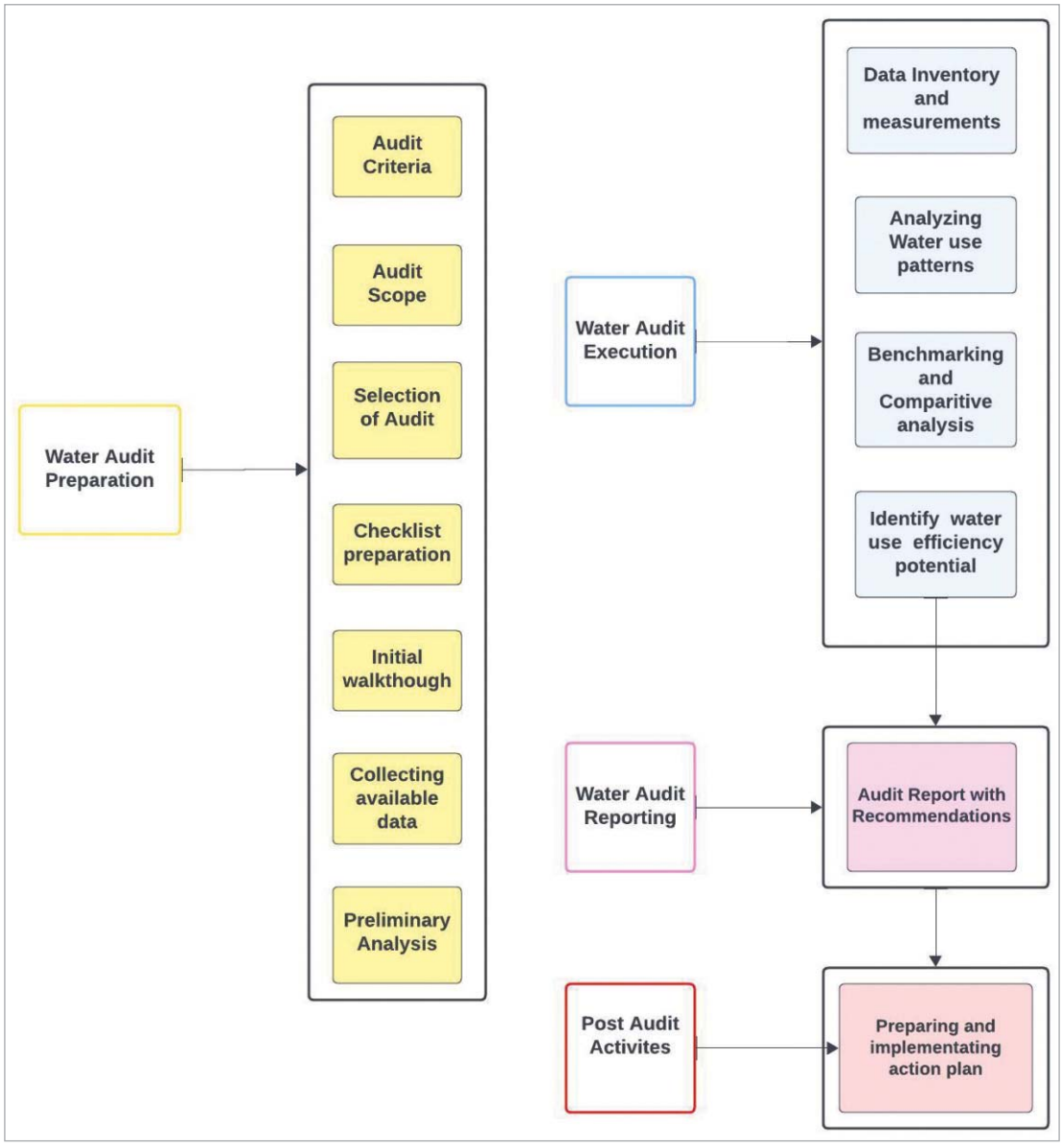
Supply chain water audit: This evaluates the water utilities along the supply chains. This is also important for ecommerce companies as their most significant areas of impact often lie along their supply chains.

5. Methodology

A thorough water use audit is the basis of a water use efficiency improvement plan and sets the foundation for the entire effort. The approach used for Water Audit, should be that all water is "accounted for" and quantified as either a component of beneficial consumption or wasteful loss by measuring (metering) or estimating water quantities. The process involves the following phases:

- Water audit Preparation (Pre-survey information and data collection, Site survey)
- Water Audit Execution (Analysis of the data collected)
- Water Audit Reporting (Documentation of results obtained)
- Post Audit Activities (Formulation of water-saving solutions and implementation)





6. Case Studies

In this section, real-world examples of water conservation projects that have successfully implemented water-efficient strategies and sustainable water management practices are discussed:

CASE STUDY 1: Water efficiency and conservation at a training institute in Alwar district, Rajasthan[3]

Overview: The Anil Agarwal Environmental Training Institute (AAETI), covering 10 acres (4.04 hectares) in Nimli village, Tijara block, Alwar District in Rajasthan, is a fully residential institute for training and capacity building on thematic areas related to environment and sustainable development. The site is not connected to the municipal water supply or sewerage network. The site draws about 76 KLD of groundwater during non-rainy season at its full capacity for all its potable purposes. Hence, annually the site will need about 22,155 KL of freshwater from the ground. The AAETI campus is a planned intervention means that adequate measures have been taken to ensure that groundwater levels are not depleted or contaminated, water consumption/demand is reduced, treated wastewater is locally reused as an alternative source of water in addition to the rainwater that is harvested.

3. Suresh Kumar Rohilla, Chhavi Sharda and Mahreen Matto, 2017

The following table tabulates the measures taken at the site to reduce demand for freshwater:

Table 1: Interventions for reducing water demand in AAETI Campus

In-situ water augmentation		
Intervention	**Details**	**Quantity of water**
Reuse of treated wastewater	Reuse for flushing and irrigation wastewater generated from cafeteria and housing blocks is treated using soil biotechnology, wastewater generated from the administrative block is treated through a decentralized wastewater treatment system (combination of settler, ABR, planted filter bed and polishing pond)	9,125 (25 KLD during days when it doesn't rain)
Recharge of harvested rainwater and storm water	Recharge well—Recharge of rainwater through rooftop RWH (rainwater from all rooftop areas except from canteen's rooftop) Tapping water from the storm water stream that flows through the site for recharge	25,000 KL
RWH for direct use	Storage of the harvested rainwater from the canteen's rooftop into RCC tanks for usage • Space cooling • Drinking water in canteen	780 KL (freshwater requirement was reduced from 76 KLD to 64 KLD)
Water efficient measures		
Reducing water consumption	• Usage of water efficient fittings and fixtures for toilets, bathrooms, kitchen and laboratory. • Reuse of treated wastewater for flushing	
Water-efficient landscaping and evapotranspiration (ET) controlled irrigation system	• This will reduce losses through the irrigation system • Using native plant species for landscaping	

Results

- Water supply is planned at 135 litres per capita per day (lpcd). Water demand will be reduced from 135 lpcd to 86 lpcd by using water-efficient fixtures, rainwater harvesting and reusing treated wastewater.
- The site will recharge about 25,000 KL per annum through different RWH and SWM technologies in comparison with annual freshwater withdrawal of 22,155 KL.

Case Study 2: Case Study 1: Sustainable Water Management in a Commercial Complex, City Center Commercial Complex, Anytown Nebraska, USA[4]

Overview: The City Center Commercial Complex is a bustling urban hub comprising multiple office buildings, retail spaces, and a food court. With a high volume of daily visitors and occupants, efficient water management became crucial to reduce the facility's environmental impact and operational costs.

Water Conservation Measures Implemented:

1. **Low-Flow Fixtures:** The complex replaced conventional faucets and toilets with water-saving fixtures to reduce water consumption significantly. Low-flow faucets and dual-flush toilets were installed in all restrooms, achieving a 40% reduction in water usage.
2. **Rainwater Harvesting:** To augment non-potable water supply, rainwater harvesting systems were installed on the rooftops of selected buildings. The

4. https://www.linkedin.com/pulse/water-conservation-strategies-efficient-plumbing-denismarie-uche/

collected rainwater is treated and stored for irrigation purposes, helping to reduce reliance on municipal water supply.

3. **Smart Irrigation System:** An advanced smart irrigation system was implemented in the complex's landscape areas. The system utilizes weather data and soil moisture sensors to optimize irrigation schedules, avoiding water waste and ensuring plants receive just the right amount of water.

Results: Through the combined efforts of low-flow fixtures, rainwater harvesting, and smart irrigation, the City Center Commercial Complex achieved a remarkable 30% reduction in water consumption. The initiative not only conserved water but also significantly lowered operating costs and contributed to the complex's sustainability goals.

7. Challenges

Water has always been considered as a free and unlimited resource. Any new policy or regulation regarding water conservation is not welcomed with open arms by the consumers. As of now, Govt. of India has made it mandatory for the industries to conduct periodic water audits within their premises. However, there are no guidelines or BIS Code for water audit in the country. Central Water Commission took the lead role and prepared "General Guidelines for Water Audit" that covers three aspects viz. irrigation, domestic and industrial.

Despite these efforts, widespread adoption of water auditing remains elusive, necessitating heightened awareness among commercial and residential water consumers. Numerous challenges impede the effective implementation of water auditing. Foremost among these challenges is the difficulty in obtaining accurate and comprehensive data. Inaccuracies in measurement and reporting can significantly undermine the efficacy of auditing endeavors, underscoring the importance of investing in advanced monitoring technologies and standardized data collection methods.

Moreover, the absence of benchmarks tailored to commercial sector buildings poses a significant hurdle. Lack of financial incentives to invest in water-efficient infrastructure further dampens enthusiasm for conservation measures, especially given that the cost of water is often lower than that of energy. Furthermore, there is a notable absence of guidance and strategic frameworks for managing the risks associated with water auditing.

Addressing these challenges requires a multifaceted approach, including targeted educational campaigns, the development of industry-specific benchmarks, and the formulation of policies that incentivize water conservation investments. Only through concerted efforts can the nation effectively address its water conservation imperatives and ensure the sustainable management of this vital resource.

8. Policy Implications

While auditing at the scale of individual developments can play a vital role in achieving water conservation or more sustainable water usage, systemic changes will be essential to achieve significant improvements in water efficiency. Top-down supportive policy and stricter legislation is necessary to take this agenda forward, as we observe with carbon neutrality. Governments can play a pivotal role in promoting water auditing by mandating regular audits for businesses and industries. This policy can drive awareness, encourage compliance, and ultimately lead to more efficient water use. In addition to national policy and central government, local councils can also play an important role in driving water neutral development forward at the ground level. They can encourage developers to work with other stakeholders to adopt water conservation measures such as integrating reclaimed water systems and water-efficient devices as part of the planning process for new development within the city or district (Makin et al., 2021). Incentive programs, such as tax breaks or grants should be encouraged to invest in water-saving technologies and implement the recommendations arising from water audits. Further, collaboration between governments, non-governmental organizations, and private entities can facilitate the sharing of expertise, resources, and technology, promoting a holistic approach to water management.

9. Conclusion

The year 2023 marked the launch of Green Credit Programme to incentivize various stakeholders like individuals, communities, private sector industries, and companies take voluntary actions across diverse sectors of which one important sector is water conservation. The widespread adoption of water auditing exercises stands out as a significant pathway to earning green credits, while also propelling us closer to the goal of achieving water security by 2047. This paper has delved into the intricate considerations surrounding water auditing, examining its significance, challenges, and policy implications in our collective pursuit of sustainable water management.

Following are some recommendations and suggestive activities:

a. Use of advanced remote sensing and metering technologies

b. Use of open access global and regional databases reduce costs and make it easier to share information

c. Actively engage stakeholders in accounting and auditing processes as it contributes significantly to the accuracy, relevance and adoption of water auditing findings, outputs and recommendations.

d. Treat water auditing as a cyclical learning and information sharing process to keep a check on the process efficiency and infrastructure[5]

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5. FAO 2020, Water accounting and auditing for better water governance. THE STATE OF FOOD AND AGRICULTURE

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Becoming Water Positive for Sustainable Development

- Avinash Mishra

1. Introduction:

Globally the need for freshwater has almost doubled in the past 50 years, reaching over 4 trillion cubic meters per year, posing a significant challenge to global sustainability (Ritchie and Roser, 2018). Concurrently,

the urban population grappling with water scarcity is projected to surge from 933 million in 2016 to a staggering 1.7–2.4 billion people by 2050, with India projected to bear the brunt of this crisis (He et al., 2021). World Bank estimates that the water crisis could slow GDP by 6 per cent in some countries by 2050 (UNICEF 2022).

India supports and sustains 17.7% of the world's population through only 4% of the world's water resources (NITI Aayog, 2019). Access to safe drinking water in the country is limited to 25% of dwellings, and more than 800 million people in India live with per capita water availability of nearly 1000 m^3/year. This indicates that more than half the population of the country lives in water-stressed areas (NITI Aayog, 2018). India recently ranked 139th out of 180 countries in the environmental performance index regarding drinking water and sanitation (Wolf et al., 2022). In terms of water use efficiency, India stands at mere 3.12 USD/m3 as per the Global Water Security Report 2023 of United Nations. Luxembourg demonstrated the highest efficiency at 1,190 USD/m3 and Somalia recorded the lowest at 0.2 USD/m3 (MacAlister et al., 2023). Thus, India still has a considerable distance to cover in order to meet its SDG 6.4 target of improving water-use efficiency in all sectors and guarantee sustainable withdrawals and freshwater supply by 2030.

1.1 Water Positivity is important?

a) National Concerns and Challenges

Water stress and scarcity are common even in the regions with sufficient water resources due to less efficiency, lack of infrastructure, unequal distribution, pollution and conflicts in demands. Also, it is very difficult to define Water Stress and Water Scarcity, and it is very subjective depending on the living conditions and social settings. Though there are many studies and methodologies describing correlation among water availability, scarcity and stress, **annual per capita water availability, is a reliable parameter assessing water security** around the world. In India, per capita water availability in 2025 works out to be 1434 cum. and that in 2050 as 1219 cum. However, in this approach, the **spatial disparity of water resource availability is largely ignored. Average annual water resource availability** for all basins in India is estimated to be 1999.20 BCM, whereas 31% of this volume is contributed by Brahmaputra and Barak basins. Both these basins which is flood prone. Further, the **mode of water abstraction has undergone undesirable change** over the past years. An analysis of last three Minor Irrigation Census data (i.e. 3rd, 4th and 5th) reveals that number of surface water based schemes has been reduced by 56000, while there is an increase of 20 lakh ground water based schemes. Saturation of all rural households with Functional Household Tap Connection (FHTC) will also create **an additional demand of about 8 to 10 BCM.**[1] India Meteorological Department's (IMD) analysis of rainfall data for the

1. National Jal Jeevan Mission (Rural) is progressing steadfast and crossed 71% coverage. Once the mission objective of 100% Functional Household Tap Connection (FHTC) coverage in rural household is achieved, 19.45 crore household will get access to 55 lpcd water supply. This means an addition of 16.2 crore household in 5 years' time which would require an additional quantity of 16.27 BCM. A portion of this demand would have been existing in the system even before JJM period by way of manually lifting water from wells, bore-wells or a source at a distance. But, at least 50% of the volume of 16.27 BCM would be an additional demand.

period 1971-2020 shows that the long period average (LPA) of south west monsoon declined by 1 cm and that of annual rainfall 1.7 cm, as compared to the 1961-2010 average. **Shortage of 1 cm rainfall across the country means reduction of about 25 BCM to 30 BCM** from the annually expected water availability. This will further stress the supply side.

b) Water Availability and Demand Issues

It is well known that distribution of **4000 BCM of average annual precipitation** in India is not uniformly available across the country ranging from <100 mm in Rajasthan to >2500 mm in Assam. Less than 50% of total precipitation flows to the rivers and it is estimated as 1869 bcm. However, only **690 BCM surface water resources** can actually be utilized (Central Water Commission 2015). This available water should either be stored in reservoirs or be transferred from surplus basins to deficit ones. However, both these options aren't easily implementable owing to geographical limitations. As of now, our surface water storage is about 260 BCM and may go up to 300 BCM when the on-going projects are completed. Alongside, national wastewater generation is increasing significantly. According to the Central Pollution Control Board 2021, **urban India currently generates 72,368 million litres per day** of municipal sewage which is estimated to increase to 1,20,000 MLD by 2050. This is an alarming number given the operational sewage treatment capacity in the country being only 26,869 MLD (37 % of the total sewage generated). The water demand in the industrial sector particularly MSME sector of India is growing and thus increasing the demand for wastewater recycling and zero discharge systems, as well as government initiatives aimed at improving water management and conservation[2]. Only 60% of industrial waste water, mostly large scale industries, is treated. Performance of state owned sewage treatment plants, for treating municipal waste water, and common effluent treatment plants, for treating effluent from small scale industries, is also not complying with prescribed standards. Thus, effluent from the treatment plants, often, not suitable for household purpose and reuse of the waste water is mostly restricted to agricultural and industrial purposes. 40% of industrial waste water still remains untreated, owing to the numerous constraints faced by small- and medium-sized industries (India Infrastructure, 2021). This has resulted in severe pollution in more than 279 Indian rivers which might reduce the downstream regions' GDP growth by up to a third (Desbureaux et al., 2019).

Due to rapid shifts in both economic and demographic landscapes, there is a noticeable surge in water requirements across various sectors. The demand for water in India is expected to grow at a 2.8% Compounded Annual Growth Rate (CAGR) from 2010 to 2030, **facing a supply gap of 50% by 2030**[3]. According to the National Commission on Integrated Water Resources Development (NCIWRD) projections, the irrigation sector alone is anticipated to necessitate an additional 71 billion cubic meters (BCM) by 2025 and a substantial 250 BCM by 2050, compared to the demands recorded in 2010 (Press Information Bureau 2013). Despite the anticipated decrease or stagnation in per capita available water, there is an expected surge in per capita water usage, projected to climb from 99 liters per day (l/d) in 2009 to 167 l/d by 2050. Forecasts also indicate an escalation in average domestic water demand from 85 liters per capita per day (lpcd) in 2000 to 125 lpcd by 2025 and 170 lpcd by 2050, respectively. Moreover, the total industrial water demand is set to rise significantly, reaching 92 bcm and 161 BCM by 2025 and 2050, as per data from the Ministry of Statistics and Programme Implementation (2011).

c) Water Demand in Built Area

As India is making rapid strides in its economy and is poised to become a $5 trillion economy by 2026–2027 (Mint, 2023), the infrastructural needs will also be much greater than what are being provided now. Also, the aspirations of its people for better infrastructure will grow rapidly. In the 2023 Union Budget, capital investment outlay is increased steeply to $122 billion, accounting for approximately 3.3% of GDP (Ministry of Finance, 2023). Consequently, construction industry in India is experiencing significant growth. The size of the Indian construction market is around USD 639 billion, and is anticipated to register a CAGR of over 6% during the forecast period. This growth is driven by factors such as an increase in population, demand for more accommodation, especially in tier 1 cities, and the government's emphasis on the development of rural areas. Urbanization underpins a massive increase in total residential floor space from less than 20 billion square meters today to more than 50 billion in two decades. This will result in immense strain on urban infrastructures, with water supply and sanitation systems emerging as fundamental components. Buildings and built environments are responsible for more than 10% of total water consumption. A study by Balha et al., (2020) has estimated that 1 km2 increase in built-up area will decrease 0.3 million cubic meters of

2. https://www.trade.gov/market-intelligence/india-water-and-wastewater-treatment-industry
3. The 2030 Water Resources Group Data

groundwater recharge by rainfall in Delhi (Balha et al., 2020). Thus, increased urbanization will lead to reduced groundwater recharge, increase in surface water runoff and evaporation, and changes in impervious area.

It can also result in water stress and conflicts among different sections of the society due to increased demand within the hydrological unit. If the watershed is already near its saturation as is the case in many areas, any additional demand will create water stress and conflicts. This will widen the existing disparity in the water availability among different sections of the society. Naturally, socio-economically weaker section will suffer the most which will ultimately offset the already social advancements (Unfried et al., 2022).

The focus on building new structures often means we overlook the importance of maintaining existing ones. This is especially evident in urban areas in India, where outdated water systems, significant water losses, energy-intensive pumping, and a lack of proper sewerage systems persist. These issues not only lead to mismanagement of water but also create challenges in handling stormwater. Moreover, the discharge of untreated or partially treated wastewater is causing serious environmental damage, polluting both surface and groundwater. To ensure India's continued economic growth, it's crucial to address these problems. We need to prioritize maintaining and upgrading existing infrastructure, improving water management, and implementing effective stormwater and wastewater treatment solutions. This integrated approach is essential for sustainable development.

Recognizing the urgency of the situation, a shift towards water neutrality is imperative for India. By adopting water-efficient technologies, enhancing distribution systems, and implementing comprehensive wastewater management, India can alleviate stress on its urban infrastructure and pave the way for sustainable economic growth.

d) Climate change and its implications on water

As climate change has shown its ugly side in recent years, it has now become a pivotal factor for water security as well. Changes in temperature and precipitation due to global warming and related processes have resulted in serious impacts on hydrological cycle and regional water resources of India. Climate change has affected the supply-demand balance of water as well as its quality, especially in arid and semi-arid areas. The IPCC AR5 indicates a pervasive increase in mean annual temperatures across Asia, with projections suggesting a rise of over 2°C by the end of 21st century under the Business-As-Usual (BAU) scenario (Hijioka, 2014). This escalating temperature poses a threat of glacier retreat thereby impacting the livelihoods of a large population. In the past decade alone, approximately 67% of Himalayan glaciers have experienced retreat due to warming effects. The increasing unpredictability of water availability raises the likelihood of future drought situations in certain parts of India[4]. Another consequence of climate change and rise in temperature is noticeable shifts in weather patterns. In 2022, a study by IMD reported an average decrease of 0.23% in the number of rainy days per decade. Duration of rainfall has also decreased by around one and half days since 1947 with a maximum decline of 1.22% during monsoon[5]. In the face of these climate-related challenges, it is getting necessary to take adaptation and mitigation strategies and ensure sustainable water management.

The outcomes of the COP 28 conference, held in Dubai in December 2023, carry significant implications for improving global water management in the pursuit of limiting global warming to 1.5°C above pre-industrial levels. The establishment of the Global Goal on Adaptation, with explicit targets set for 2030, directly addresses water concerns by emphasizing enhanced capabilities in water security, ecosystem restoration, and health. The Global Stocktake's endorsement, calling for a tripling of global renewable energy capacity and a doubling of the average annual rate of energy efficiency improvements by 2030, contributes indirectly to sustainable water management by mitigating the environmental impact of energy production. The Global Cooling pledge, signed during the conference, commits countries to a substantial reduction of cooling-related emissions by at least 68% globally relative to 2022 levels by 2050, thereby positively impacting water resources. The launch of the Green Credit Initiative, issuing Green Credits for plantations on waste/degraded lands and river catchment areas, further supports efforts to rejuvenate and revive natural ecosystems, indirectly contributing to improved water management on a global scale. These decisions collectively signify a comprehensive approach to address the interconnected challenges of climate change and water sustainability. COP28 also called for transition from fossil fuels, in a just, orderly, and equitable manner, accelerating action in this critical decade, to achieve net zero by 2050. As countries push for a just transition away from fossil fuels, they must also transform. It is no longer enough to Reduce, Reuse and Recycle. Countries need to recover, recharge and return more water than they use.

4. (https://www.adriindia.org/adri/india_water_facts)
5. https://english.jagran.com/india/climate-change-impact-on-crops-agriculture-reduced-rainfall-alarming-trends-since-independence-10084767

The outcomes of COP 28 underscore the critical interplay between global climate decisions and water management, providing a compelling impetus for India to embrace a trajectory towards water positivity. This can be achieved only when there is a strong political will and financial backing. Every level of government, communities and businesses must step up to build a water-secure future for all.

2. Water Neutral Concept

The concept of water-neutral was conceived in the Johannesburg World Summit for Sustainable Development (WSSD) by Pancho Ndebele held in 2002. The water consumed by delegates during the conference was quantified and translated into real money. Attendees of the conference were encouraged to make the summit water neutral by purchasing water neutral certificates to offset their water consumption during the ten-day summit, with the offset investment being earmarked for the installation of play pumps to water needy communities in South Africa.[6]

A process, product, consumer, community or business is water neutral when: (i) Its water footprint has been reduced where possible, particularly in places with a high degree of water scarcity or pollution; and (ii) When the negative environmental, social and economic externalities of the remaining water footprint have been offset (compensated) by making a 'reasonable investment' in establishing or supporting projects that aim at the sustainable and equitable use of water3. It can be defined as "Total freshwater consumption should either be less than or equal to all the quantifiable (and verifiable) water savings both in plant's watershed as well as critical watersheds from where supply chains are derived giving priority on neutralizing impacts in same watersheds or aquifers where high criticality exists and impact occurs" (NITI, Aayog 2023).

It must be understood that being water neutral does not mean bringing the water footprint to zero but that the environmental impacts of the activity are reduced and compensated. Being water neutral is about creating a balance between resource and the environment. It has the potential to deliver large scale water savings and also achieve water-saving credits just like carbon credits. Unlike carbon neutrality where compensation can be carried anywhere in the world, compensation activities must be within the hydrological unit in which impacts of water footprint are located. Several big brands such as Facebook (Meta, 2021), Google (Brandt, 2021) and Microsoft (Smith, 2020) have made water neutral pledge of restoring and replenishing more water than it consumes by 2030. Additionally, Indian States such as Telangana has taken the initiative to implement regulations that promote water neutrality in buildings, specifically high-rise residential and commercial structures (Hans India, 2023).

2.1 Water Positivity in Built Area

Water positive measures in built areas involve strategies that aim to replenish more fresh water than is consumed. These measures are crucial for sustainable development and can be implemented both at the construction and operational stages of built environments. Here are some measures being taken in India:

1. **Water Efficient Measures for Residential Townships:** The Mahindra-TERI Centre of Excellence (CoE) has developed guidelines for water use optimization and efficiency in residential townships. These guidelines suggest sustainable design options, technologies, operation and maintenance measures that can be adopted for water-related systems and infrastructure in the township. The aim is to help townships become net water positive.
2. **Water Recycling/Reuse and Effluent Water Treatment:** These are the most deployed measures in India. Recycled or treated water is used either in the process or for ancillary purposes such as dust suppression, green belt development, washrooms, etc.
3. **Water Efficiency in Construction:** It is estimated that buildings and construction use over 15% of global freshwater use. There are significant benefits to be realized from water efficiency during

6. http://www.indiaresource.org/campaigns/coke/2008/Waterneutrality.pdf

construction and operation of built assets. Some of the measures include upholding water-efficient practices during construction, consideration and mitigation of water footprint of materials, installing alternative water systems, installing water-efficient fixtures & fittings, metering & sub-metering, effective soil management, learning from global best practice, setting targets within a water management strategy, pursuing relevant green building accreditation, and water efficiency labelling schemes.

These measures, when implemented effectively, can contribute significantly towards achieving water positivity in built areas.

2.2 How will India benefit from Water Positive approach?

Becoming water positive entails not just addressing water scarcity but also replenishing and conserving water resources. This approach goes beyond mere sustainability; it aims to restore and enhance the natural water balance. By embracing water positivity, India will benefit in the following areas:

Improved water sanitation: Reuse and recycle of water can help prevent diseases that are spread through dirty water. An example of this is the wastewater treatment plant in Surat, India. The city faced a severe water shortage due to rapid urbanization and industrialization. The wastewater treatment plant was set up to treat sewage water and provide treated water for non-potable purposes such as watering plants and cleaning. This reduced the demand for freshwater, which in turn improved the water supply in the city. The treated water also helped in controlling the spread of diseases caused by contaminated water.

Reduced Cost of Water Management: When water is brought from a source and processed through treatment plants and sent through pipeline networks to the consumption points, and used water is pumped back to the centralized sewage treatment systems, a great amount of resources as well as cost is involved. But via water circulation in a local area, this entire inefficiency is cut down.

Non-potable applications: Water that has been recycled and cleaned can be used for various purposes like construction, watering plants, agricultural activities, washing vehicles, industrial applications, fire fighters, or even flushing toilets. This can help save fresh water for drinking and other important uses. If India reuses 80 percent of its untreated wastewater from 110 of its most populous cities, 75 percent of projected industrial water demand can be met by 2025.

Net zero target and green economy: Water circularity can help reach the goal of reducing greenhouse gas emissions to zero by reducing the amount of energy we use and the amount of pollution we create. It can also support a green economy by creating jobs in sustainable industries and reducing our impact on the environment.

Agricultural Resilience: Water positivity promotes sustainable agricultural practices, ensuring that farmers have access to adequate water for cultivation. Implementing precision irrigation, rainwater harvesting, and watershed management can enhance agricultural productivity while preserving water resources.

Economic Growth: Industries heavily rely on water, and water-positive practices can lead to increased efficiency and reduced costs for businesses. Adopting eco-friendly technologies and recycling wastewater can contribute to a circular economy, fostering economic growth without depleting water resources.

Urban Sustainability: Rapid urbanization demands innovative solutions to manage water supply and sanitation in cities. Implementing green infrastructure, water recycling, and smart water management systems can ensure sustainable urban development.

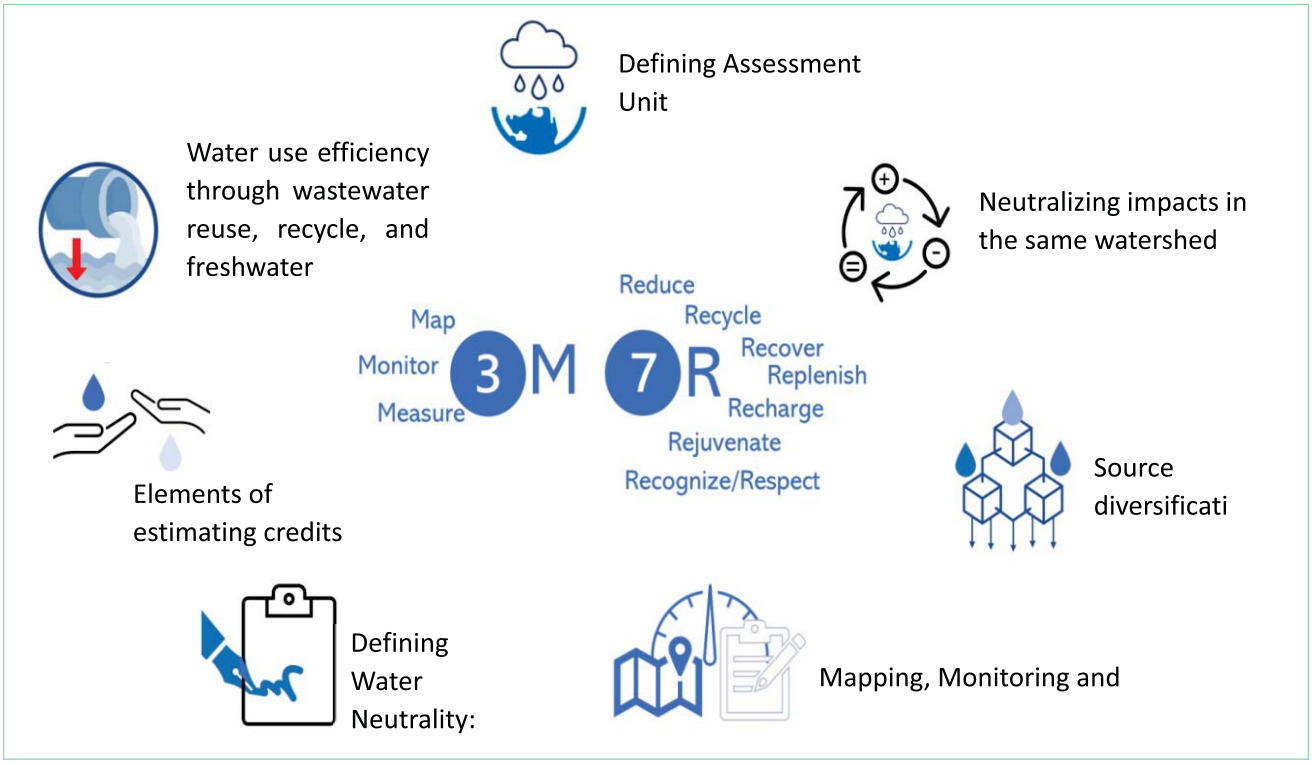
Ecosystem Health: A water-positive approach supports biodiversity and the health of ecosystems by maintaining river flows, wetlands, and natural habitats. Conserving water sources helps protect aquatic ecosystems and ensures a balance in the natural environment.

Climate Change Adaptation: Water positivity is a crucial strategy for adapting to the impacts of climate change, including more frequent and intense droughts and floods. Investing in climate-resilient water infrastructure and promoting sustainable water practices contribute to long-term climate resilience.

3. Methodology

3. 1 Principles of Water Positivity

Defining principles will guide in establishing a clear and consistent methodology for achieving water neutrality. There are seven principles that govern the water conservation measures of the water neutral concept (NITI Aayog, 2023) and organizations must ensure that their implementation plan covers these aspects.



Principle I: Water use efficiency through wastewater reuse, recycle and freshwater reduction

According to the first principal reduction in wastewater should be visible through reduction in freshwater use i.e., optimization.. of freshwater usage as well as source diversification especially if the freshwater source is groundwater located in a semi critical, critical or overexploited area as per CGWA classification of blocks. If in the considered watershed, ground water table is already high, water offsets need to be considered through various other means for the considered hydrological unit.

Principle II: Defining Assessment Unit

The fundamental basis is to undertake interventions where offsetting of impacts is to be done within the same hydrological and underlying hydrogeological unit where the impacts take place. The size of the assessment unit should preferably be in the range of 50 -200 sq. km i.e. typical size of a watershed.

Principle III: Neutralizing impacts in the same watershed

Water depletion or pollution in one watershed/ groundwater system of a watershed cannot be compensated or neutralized by water saving or pollution control in another watershed.

Principle IV: Source diversification

Source diversification (moving away from fresh water sources that are critical or stressed) is essential towards achieving neutrality. Thus, alternative water sources must be identified to reduce reliance on the freshwater sources.

Principle V: Mapping, Monitoring and Measuring

Evaluation of impact and offset against water consumed needs to be monitored to ensure that neutrality targets are being met. This principle therefore stresses the need to **measure the impact on availability, quality, and accessibility.** For this a robust system of measurement, monitoring and evaluation of the quantities is imperative, that makes use of IoT based digital fingerprinting-based instruments. Measurement of both quantity and quality needs to be ensured.

Principle VI: Defining Water Neutrality: Temporal context

The balance offset should be established in terms of both quantity and quality of the water drawn and replenished and also at the right time period, only then the industry may be called a water-neutral industry. Here defining the period for assessment is critical i.e., defining neutrality from a long-term perspective, annual/bi-annual. The re-assessment will be undertaken after every 3 years.

Principle VII: Elements of estimating credits and debits

Water status of the concerned facility (i.e water neutral, water positive, and water negative) will be assessed on the basis of three main elements Operational efficiency, operational sustainability, and supply-chain systems.

4. Measures to Achieve Water Neutrality

4.1 Reducing water footprint through the lens of circular economy: A shift in approach from linear economy of "take, make, consume, and waste" to circular economy "make, use, recycle" needs to be adopted by industries wherein all possible strategies to preserve and optimize water usage are taken. Broadly water neutrality measures can be achieved through the following three measures: Reducing water usage, reducing fresh water withdrawal and offsetting water demand as depicted in Fig. 1. The top most priority should be given to reducing the water usage within the system. This can be done by increasing efficiency and reduce total water volume used within the project. Using water-efficient fixtures and appliances, irrigation equipment, sustainable landscape design solutions, enhanced operation and maintenance of water systems can help in reducing the water usage drastically. Checking for water loss points like leakages in water line and taps, theft of water, tapping of water lines etc, use of smart meters are also important steps to be taken. A study conducted by Barberán et al., (2013) recommended replacing all existing fixture and installing new low-cost fixtures of one of the hostels in Spain. The study found that 21.5% of total consumption was saved and thus average daily consumption of water per guest declined from 321 to 252 L per day.

4.2 Reducing the dependency on fresh water: This is necessary to meet the water requirement within the system and also is an indicator of effective water conservation measure. Water reuse and recycling possess great potential to reduce the freshwater withdrawal rate (Karki et al.,2023). Recycled water can help satisfy most water demands, as long as it is adequate to ensure appropriate water quality for the intended use (Patil et al. 2013). Exploring alternative water sources is the key to reduce abstraction of fresh water. These include rainwater harvesting, stormwater collection and reuse, seawater desalination, wastewater recycling (grey and black). As grey water is less contaminated than black water, hence less filtration systems or minimum efficiency of filters can treat the available grey water on site. Hence, projects should install high-efficiency filters for a major proportion of grey water and lesser percentage of black water. Alternative sources typically exhibit high capital, operational, and maintenance costs. However, the biggest hindrance is accelerated pollution of both surface and groundwater (Mekala et al. 2008). Thus, alongside developing alternative sources, the quality of water must also be evaluated and maintained. Studies by Cooley et al., (2019) have found that all the water efficiency measures evaluated are highly cost-effective in comparison to the alternative water supply options.

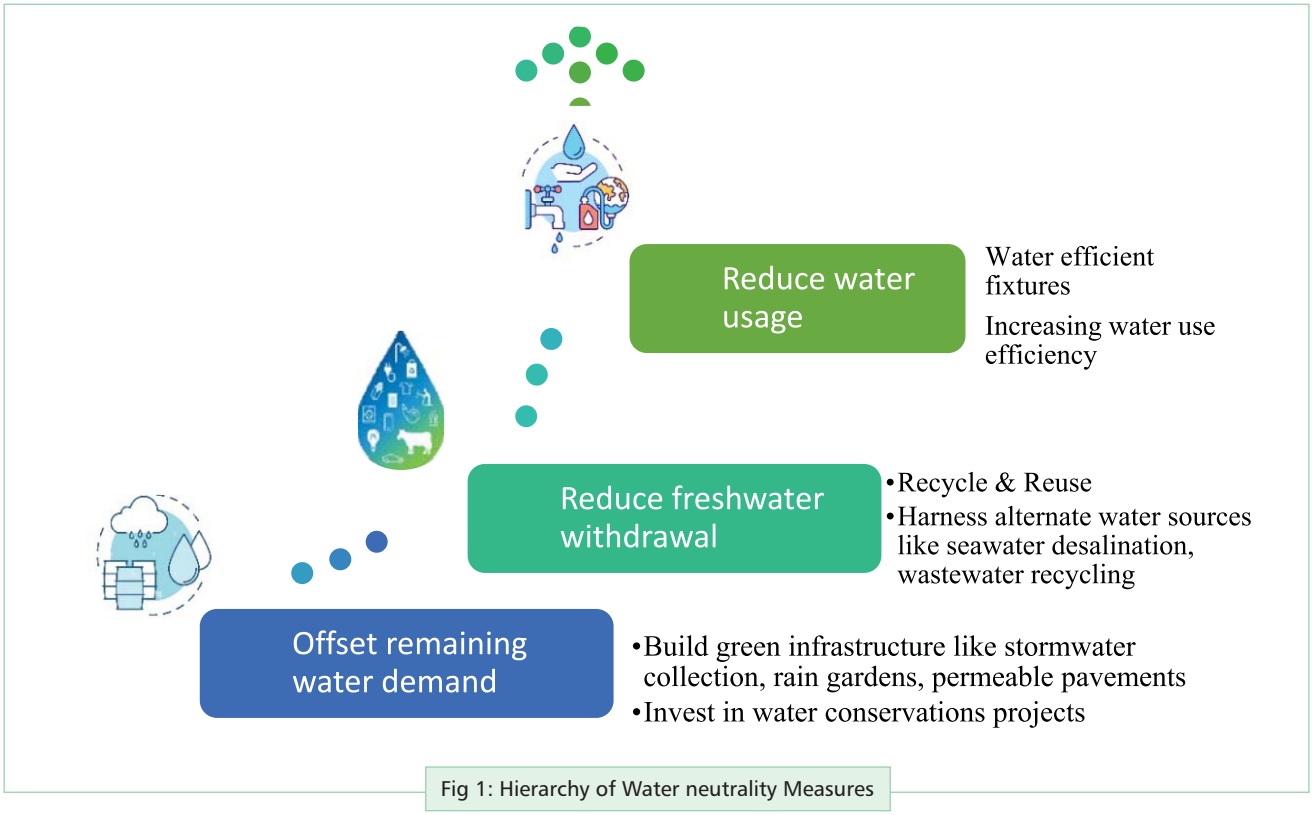


Fig 1: Hierarchy of Water neutrality Measures

4.3 Offset water: It involves making a 'reasonable investment' in establishing or supporting projects that aim at the sustainable and equitable use of water in collaboration with local bodies, industries, NGO's etc. The investment can be in terms of actual water saving interventions or in terms of providing funds to support projects run by others. The size of the investment (the offset or payoff price) should be a function of the vulnerability of the region where the water footprint is located. By reasonable investment, it does not mean that water polluting activities can be compensated for by investing in water related projects.

As an offset measure, an industry can fund the work of non-profits and local utilities to improve the health and resilience of local watersheds. It can invest in projects such as removing water-hogging invasive plant species, buying up farmland to assume and retire its water rights, capturing stormwater to help replenish depleted underground aquifers and reforesting areas destroyed by wildfires (Schupak A. 2021). Building net zero buildings or campuses which offset water use with alternative sources and also return water back to its original source.

Another area where funding can improve the local situation while also offsetting impact is integrating green infrastructure. Green infrastructure solutions can be applied on different scales, from the house or building level, to the broader landscape level. It incorporates natural infrastructure, enhanced solutions and engineered systems to provide clean water, conserve ecosystem values and functions (Fig. 2). These systems have the capacity to capture, infiltrate, treat, and convey urban runoff safely into the natural environment to avoid pollution, flooding, and other unintended impacts. Over 90% of pollutants can be eliminated by infiltrating through soils and plant tissues. In addition to natural infrastructure, enhanced and engineered systems such as green roofs, bioretention cells, and permeable pavements are capable of retaining 50%–70% of annual storm water runoff when maintained properly (TERI 2022).

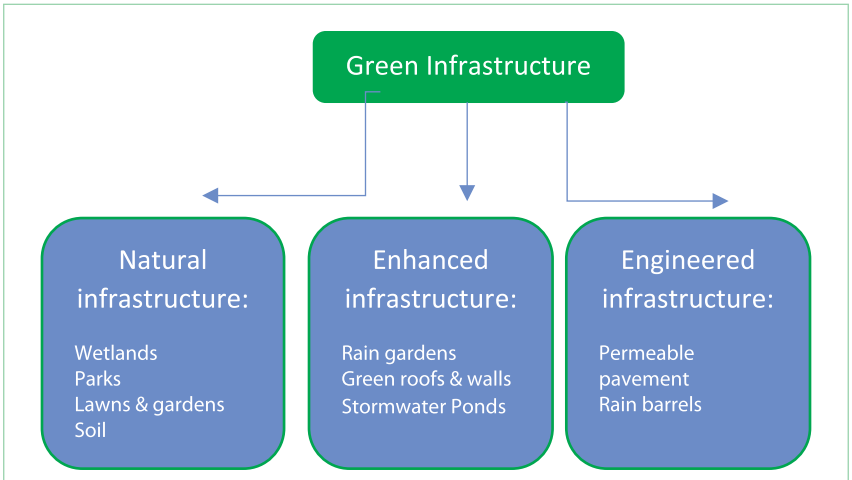


Fig. 2: Green Infrastructure examples for offsetting impacts

5. Challenges

Water neutrality is still in its nascent stage where creation of awareness among water consumers (agricultural, industrial and households) is necessary. Consequently, there are barriers to its effective implementation and adoption across the country: Lack of Targets for industrial and commercial sector, Lack of Funding from both Private and Govt sectors; Natural tendency to focus on offsetting instead of reducing and reuse and most importantly Lack of Public Awareness. There is also absence of guidance and strategy to manage the risks involved within this whole concept.

Besides barriers, certain questions also need to be answered for more clarity in the concepts and its effective implementation across all levels. What is an appropriate offset measure? There are diverse geographical, climatic, and hydrological conditions and identifying a universal offset measure under all such conditions is inappropriate as found by Ali et al., (2020). Further, the offset measures may also have to be aligned with local communities' values and practices. This aspect is essential but complex due to the diversity of social and cultural contexts. Secondly, how can the impact and size of effort be measured. How much reduction of a water footprint can be reasonably expected? The standard may be to implement so-called 'better management practices' in agriculture and 'best available technologies' in manufacturing, but what are these practices and technologies and how can they be measured? How does one deal with totally new products or activities?

Although, the water neutrality framework by NITI Aayog addresses the spatial constraints by defining that the offset measures should be taken within the same watershed, uncertainty over temporal constraints still remain. As an example, if water footprint is measured at one period of time, when should the offset become effective? How long should the mitigation activities be carried out to actualize the impacts? All these are relevant questions to be thought about.

6. Policy Implications

While measures at the scale of individual developments can play a vital role in achieving water neutrality or more sustainable water usage, systemic changes will be essential to achieve significant improvements in water efficiency. Top-down supportive policy and stricter legislation is necessary to take this agenda forward, as we observe with carbon neutrality. Govt. of South Africa took the lead with initiating and investing in large scale water neutral schemes in conjunction with WWF South Africa, and laid out a 3-step plan to invest in water neutrality. The aim of this scheme was to offset the 3,652 million m3 of water used by industrial and urban users in South Africa. Policy intervention can also contribute to the offset measures and targets as seen in case of United States where water demand offset policies requires developers to ensure that construction of new developments does not result in an increase in overall water demands. Thus, if a developer seeks a permit to construct a new subdivision or a community, the projected water consumption for the development must be offset by water use reductions in off-site end uses before approval is granted. As an example, Town of Weymouth, Massachusetts requires any new water use applications issued by the Town to complete a 2:1 water savings ratio.

7. Conclusion

As we move towards the goal of becoming water secure by 2047, water neutrality will play a crucial role. It is a progressive endeavor that aims to implement practices and initiatives for an improved water scenario taking in to account the availability and quality of water resources. A successful water neutral operation within a watershed leaves a legacy to next generation and encourages water saving behavior from an early age. This paper has delved into the intricate web of considerations surrounding water neutrality, exploring its principles, challenges, and potential solutions. One important point observed is that water positivity concept shifts the focus and load more towards offsetting, without addressing the more fundamental issue of why undertaking the water-using activity at all. Avoiding water-intensive products or activities must be the top priority followed by reducing demand, harness alternate sources and offset remaining water. Water neutrality can be delivered with existing technology and conservation approaches as showcased by countries like South Africa, US and UK where it has been adopted for new housing developments. Consumers have the ability to assume responsibility through their consumption behavior, and they can also advocate for governmental regulation of businesses. This advocacy may manifest in the form of labeling products as water-neutral or certifying businesses as water-neutral (Hokestra, 2008). The absence of regulatory framework and policy guidelines for water neutrality hinders the establishment of water neutrality in industries and organizations as they may struggle to adhere to consistent criteria. For effective implementation of this concept in India, greater policy support awareness is required at national and state level. Learning from leading countries, India may develop a water neutral policy for industries and businesses to create awareness among them and guide their working.

Following are some recommendations and suggestive activities:

- The major consideration of water neutrality should be in the areas with constrained water resources to address water availability and prevent future water stress conditions.
- Local planning policies should require developers to work with the local water company on proposals to minimize the water demand impact for new developments over a threshold size and target water neutrality.
- Industry specific targets need to be framed to measure the performance of any industry or business towards water neutrality.
- Availability of reliable and accurate hydrogeological data is paramount in watershed planning and thereby plays a crucial role in achieving the water neutrality.
- Including a well-prepared water-budget is important to prepare water neutrality plans which take into account future demands of the ecological unit.
- Creation of incentives for various resource users and managers to reduce their environmental footprint on water through Payment for Ecosystem Services program – A typical model is Water Quality Trading schemes through which participants can voluntarily exchange water quality credits or pollution rights. Relatively popular in the agri-environmental sector, they address a water pollution issue by providing new sources of financing for farmers and more flexible governance (Sauve et al., 2021).

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Avinash Mishra

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Chairman, Water Audit Council (An initiative of Indian Plumbing Association)

Avinash Mishra is having an experience of 33 Years of Water Resources sector. His educational qualifications are B.E. (CIVIL), M. Tech. (Water Resources) from IIT Delhi. He has been working in the National Policy Planning formulation, Action Plans of the country. He is engaged in the development plans, proposals of the State Governments relating to major, medium, minor irrigation, flood control, drainage, command area development, watershed development, drinking water supply & sanitation. He also assisted to plan Panel of the country in the Analysis and prioritization of various projects in terms of socio-economic benefits and its impact. Represented the Planning Commission, now NITI Aayog in the various technical advisory committees of the Irrigation & Water Supply Sector. Initiated many schemes i.e. PMKSY, JJM, SVAMITVA Yojana, Atal Bhujal Yojana, Aquifer Mapping, Member of various committee on Water Resources including the Committee of Bureau of Indian Standards. He can be reached on amishra-pc@gov.in

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A Thirsty Nation: The Need for Net Zero Water

- Ar. Ankoor Sanghvi

Bharat is the fastest growing large economy and to sustain the growth, availability of potable water and energy shall play a pivotal role. The energy sector has seen a lot of investment in renewables and the solar panel on the rooftop has become ubiquitous part of the urban landscape, however the sources of potable water are limited – India has 18% of the world's population & 4% of the fresh water and that too inequitably distributed.

The sheer magnitude of the population, climate change and ground water depletion have further aggravated water scarcity and now there is growing awareness that Net Zero Energy building is not the only sustainability goal, and water conservation is the need of the hour.

The primary source of water in India is rainfall (with the exception of a few parts of the northern plains which have glacier fed river systems. However, rainwater needs to be augmented with underground sources like borewells and tubewells.

We have always considered energy as expensive and taken water for granted, however water use is intrinsically linked to energy use and almost **18% electricity is used to treat and transport water and remove waste water.** In fact, excessive drawing of ground water during the drought of 2012 resulted in excessive pumping of ground water and led to a break-down of the northern electricity grid which left large swathes of northern India without electricity for 10 to 12 hours.

A conscious effort to treat water conservation at par with energy conservation and reducing carbon footprint is the need of the hour, as human beings can survive more than a month without food but cannot live without water for more than a week!

The Net Zero Water Approach:

Reduce Water Use:

There is now a wide array of efficient plumbing fixtures available. Water closets with 3/6Litres dual flush have become the norm, interruptible flush cistern and pressure assist water closets are also available that can further reduce the flush flow. Similarly, faucets with aerators have flow rates that are as low as 5.6 LPM. However, installing efficient plumbing fixtures alone will not reduce, the end users need to be conscious about water conservation.

Measure the Consumption:

Water metering allows the end users to know exactly how much water is being consumed and identify any leakages in the system. Smart Meters - IOT enabled electromagnetic and ultrasonic meters are now available which measure and provide data on real time consumption of water. A display of the real time consumption of water in the public area where the users can view the data may play a significant part in modifying the end user behaviour and attitude to water wastage and save water.

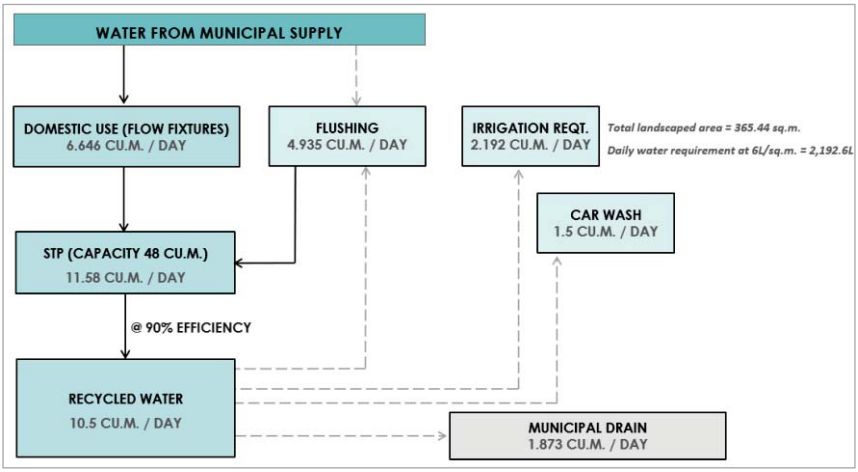
Treat and Reuse Wastewater on-site:

According to a survey on wastewater of 71 cities published in CSE publication (Excreta Matters, 2012) there is a severe deficit in connectivity and repair of sewage systems resulting in issues like sewage spills or sewage just being released in to empty lots.

On-site treatment of waste water reduces the building's dependence on municipal water

treatment plants. Also, the treated water can be reused to meet the flushing, landscape irrigation, car wash and cooling tower make up requirements. The water balance below, which is from an ongoing project, demonstrates how treating the water on site reduces the dependence on fresh water.

Typical Water Balance in a Commercial Building:



Rainwater Harvesting:

Water is made available at a highly subsidised and fixed cost; hence we do not take the cost of water into consideration. However, if water was available at a cost then we would ensure that all the rainwater that falls on our property is harvested. Take the case of Khambhat a town in coastal Gujarat where salinity ingress and lack of rainfall led the people to store the rainwater in cisterns below their home and use it round the year for drinking and cooking.

Site development typically leads to increase in impervious areas, which increases the flow rate of the rainwater and leads to erosion of soil and suspended solids in the runoff, which clog and contaminate the downstream. A proper rainwater harvesting system which collects 100% of the rainwater and either sores the rainwater for reuse or charges the aquifer is the need of the hour. Green rating systems such as IGBC Net Zero Water Rating System award projects where there is zero water that leaves the site either in the form of sewage or stormwater.

Water Quality:

The quality of water available has also been an issue. In many instances the quality of water is not drinkable especially in the semi - urban and fringe areas. It has been well established that diseases such as cholera, dysentery, hepatitis A, typhoid and polio are linked to drinking contaminated water. Young children and infants die in the country due to gastro intestinal diseases caused by drinking contaminated water, especially during monsoon. Collecting, storing and and reusing rainwater is the most economical way of ensuring safe potable water.

Climate change is affecting rainfall patterns and increasing the frequency of extreme weather events, leading to droughts and floods. Water conservation becomes vital in adapting to and mitigating the impacts of climate change. The Bureau of Energy Efficiency which has developed the Energy Conservation and Building Code (ECBC) which has been implemented across a number of states across India. BEE is now developing an updated code called the Energy Conservation and Sustainability Building Code (ESCBC) which mandates the implementation of water conservation strategies in new construction.

> ***"When the Well is Dry, we know the worth of water..."***
>
> Benjamin Franklin

Ar. Ankoor Sanghvi
Principal Architect, AMAS Architects & TC Member, IGBC

Ankoor Sanghvi is an architect with a Master's Degree in Energy & Climate from the Arizona State University. He returned to India in 2001 and started his firm AMAS Architects. He was a part of the team that designed the first LEED Building in India, the Sorabji Godrej –CII Green Business Centre-Hyderabad.

Ankoor is Co-Chair of the Envelope Committee for the ECSBC Standards being developed for the BEE (Bureau of Energy Efficiency). He was also a Member of the National Building Code Committee for development of a New Chapter 11 on sustainability. He can be reached on ar.ankoor.sanghvi@gmail.com .

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Water Reclamation System Design Studio

- Priyam Bhat, Dr. Dipsha Shah, Devesh Shah

The **Faculty of Technology, CEPT University** offers the **Water Reclamation System Design studio** for 4th and 5th year students pursuing **Bachelor's in Construction Technology**. The studio delves into the environmental engineering aspect of the built environment. India is a developing country with a growing population witnessing an increase in per capita water usage. However, strides have been made to provide clean water. The need for treating the water once used has gone unaddressed. The studio takes this challenge to inspire a batch of young engineers to work with innovating new technologies and design sewage treatment plants to better tackle this growing issue.

In the beginning, the students learn about the design of water treatment technology and the standards in use. They start with an empty plot of land given to them and design an entire water treatment plant (WTP) from scratch. The layout of the plant is designed keeping in mind CPHEEO and the Bureau of Indian Standard code in mind and government-mandated green spaces for public projects. This allows them to think like an engineer in designing the individual treatment units, like an architect in determining optimal usage of space, and like a client in developing a well-functioning and maintainable plant.

The second part of the studio delves into the primary aspect of the studio to develop a sewage treatment plant (STP). This time around, the students had the same objective to design an STP on a given plot of land optimally but with three different technologies, namely A2O (Anaerobic, Anoxic, and Oxic), Sequential Batching Reactor (SBR) and Moving Bed Biofilm Reactor (MBBR). The objective was for three students to develop an STP based on three different technologies for the same plot of land and sewage flow. The cost of construction was to be calculated later to compare the three technologies based on effectiveness and cost that could be used as a case study later by government institutes or by clients looking to construct an ideal STP for themselves for a given land parcel and flow requirement. The conclusion is to develop more effective and cheaper sewage treatment plants so that treated sewage can be reused in non-human applications, ensuring a decrease in demand for fresh water.

Model Brief:

Within the curriculum of the studio, students undertook the ambitious task of conceptualizing and crafting a model grounded in A2O (Anaerobic, Anoxic, and Oxic) Technology, a pivotal element of modern Sewage Treatment Plants. This model, meticulously rendered at a 1:1 scale, is tailored to accommodate a daily sewage flow of 500 liters. Its genesis lies in the recognition of a critical gap in the field—a need for smaller-scale alternatives that circumvent the exorbitant capital investments typically associated with conventional treatment plants during their development, commissioning, and maintenance phases.

The purpose of this model becomes evident when one contemplates the enormity of large-scale treatment plants. The sheer magnitude of resources and capital required to establish and sustain such facilities can be daunting. Thus, the conceptualization of a modular, small-scale treatment plant emerged—an innovative solution capable of scalability down to the dimensions necessary for serving a single family. The broader societal implications of such an invention become apparent when considering households in remote locations bereft of access to urban sewage and drainage networks. In these scenarios, this model serves as a beacon, enabling residents to discharge their moral duty by ensuring that the sewage generated within their abodes is treated before being released into the environment or repurposed elsewhere.

Among the trio of technologies explored for sewage treatment plants in the studio, the decision to forge ahead with A2O was not arbitrary; it followed an in-depth evaluation of its merits, particularly in the context of a micro-level plant. The underpinning philosophy involved a meticulous adherence to design considerations stipulated by the Central Public Health and Environmental Engineering Organization (CPHEEO) guidelines and Indian Standards (IS) codes, which are traditionally reserved for large-scale sewage treatment plants. This stringent adherence ensures that the model aligns with established norms and standards, contributing to its efficacy and reliability. The journey from concept to execution was marked by a series of refinements and iterations. The design underwent a metamorphosis to assume a box-shaped configuration, a crucial aspect for ensuring the smooth and continuous flow of sewage—a paramount consideration in any sewage treatment process.

In practical terms, this model envisions itself as a mass-manufactured household-level sewage system, designed to withstand the test of time through the use of robust, corrosion-resistant materials. To provide a

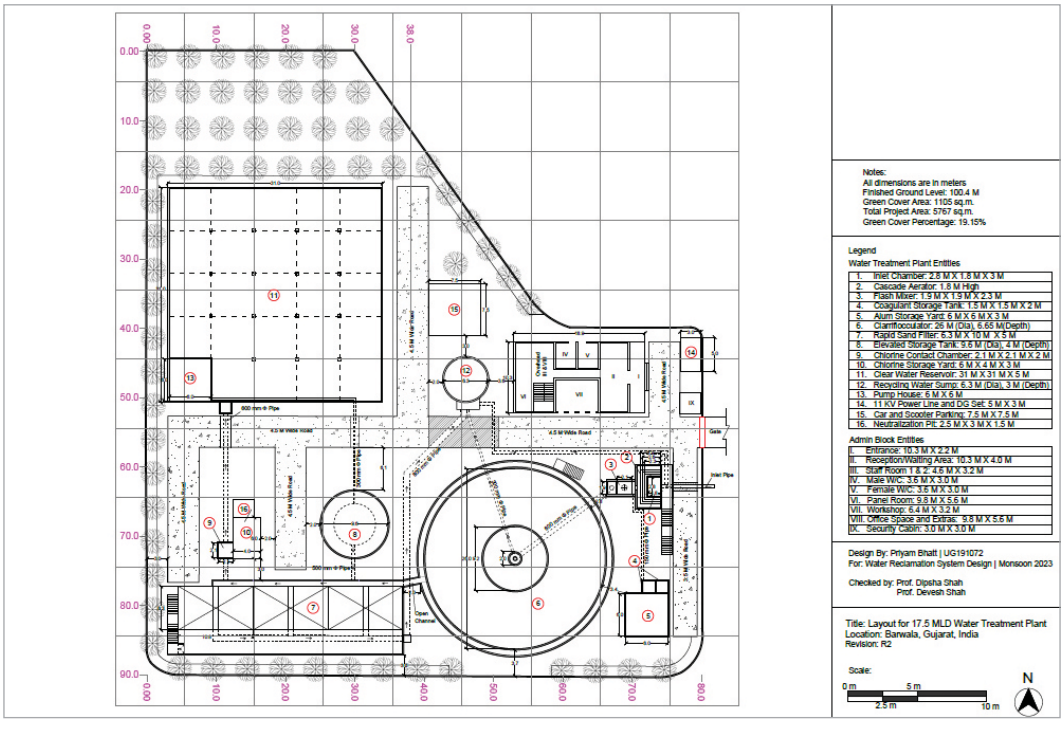
tangible representation of its inner workings, the prototype is constructed from transparent acrylic sheets, offering a visually striking portrayal of the sewage flow. The treatment unit is intricately connected to a water storage tank, forming a closed circuit facilitated by a pump. This intricate setup not only simulates real-world sewage flow but also serves as a visual aid for visitors, creating a comprehensive and immersive learning experience.

The prototype's design incorporates a thoughtful valve system in each chamber, allowing for the periodic emptying of sewage to facilitate inspection or maintenance—an essential feature for ensuring its long-term functionality. Both the primary and secondary treatment units integrate a bottom slope, strategically positioned to aid the movement of heavier inorganic matter before initiating the treatment of heavy particulates resulting from the biological process. The form factor of this innovation, characterized by an aspect ratio of a square, is not merely an aesthetic choice; it reflects a commitment to space efficiency. Moreover, the modular nature of the design allows for easy rearrangement of elements, showcasing a remarkable adaptability to suit diverse project requirements.

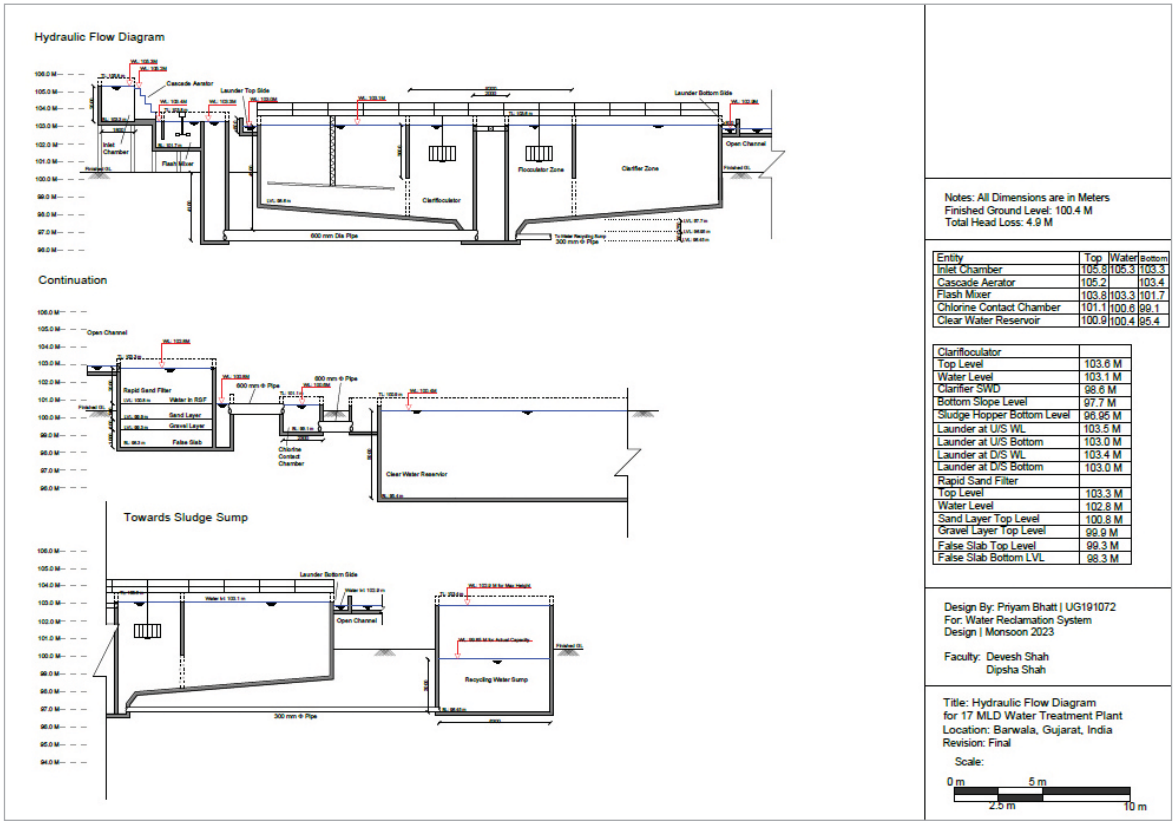
Looking ahead, the prototype aspires to a more sophisticated role—housing cell cultures for sewage treatment. This progressive step is envisaged to lead to laboratory testing, evaluating the efficiency of the treatment process. Beyond the confines of the studio, this proof of concept has the potential to revolutionize small-scale packaged sewage treatment plants. Leveraging the latest advancements in sewage treatment technology, this innovation aims to democratize access to high-quality treated sewage, an accomplishment traditionally associated with large-scale facilities. As this prototype represents a leap forward in sewage treatment technology, its impact transcends the confines of the studio, envisioning a future where decentralized, household-level sewage treatment systems become the norm rather than the exception.

A glimpse of the work of students is shown in the following images:

1:1 Scale A2O Based Conceptual Packaged Sewage Treatment Plant Model



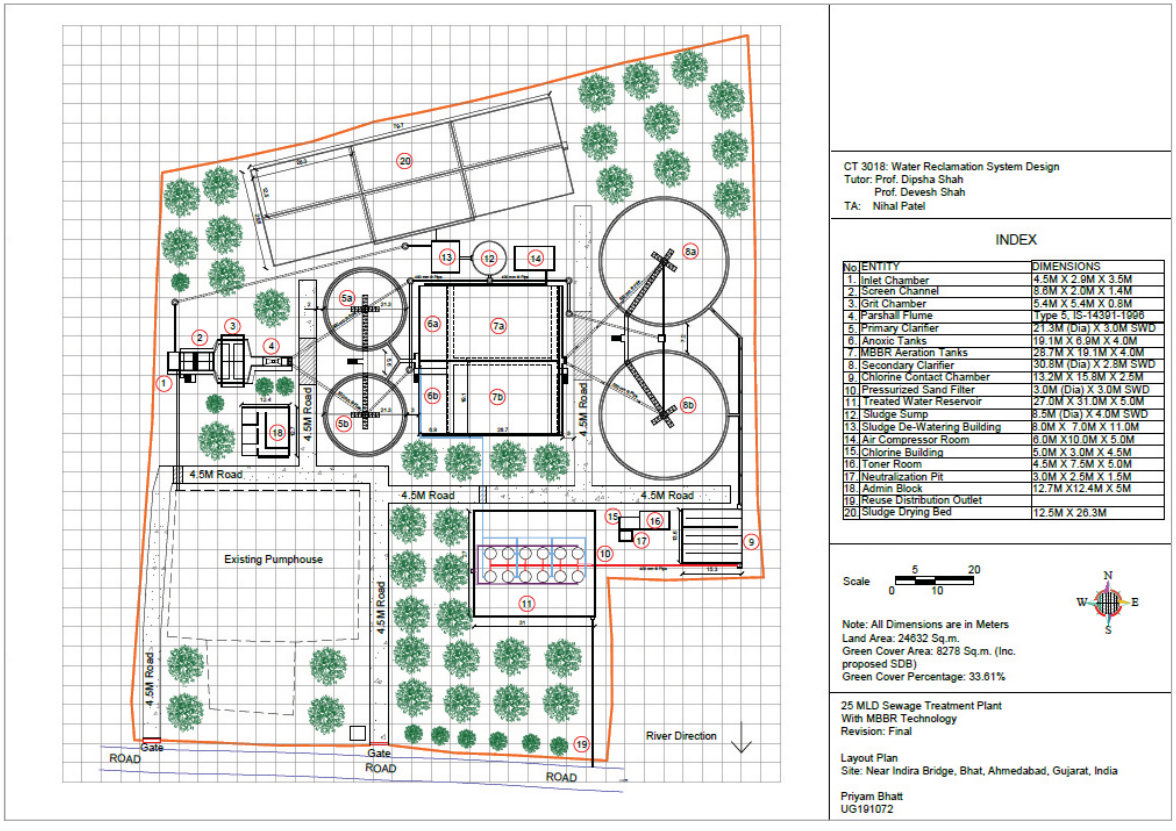
Water Treatment Plant Layout



Entity	Top	Water	Bottom
Inlet Chamber	105.8	105.3	103.3
Cascade Aerator	105.2		103.4
Flash Mixer	103.8	103.3	101.7
Chlorine Contact Chamber	101.1	100.6	99.1
Clear Water Reservoir	100.9	100.4	95.4

Clariflocculator	
Top Level	103.6 M
Water Level	103.1 M
Clarifier SWD	98.6 M
Bottom Slope Level	97.7 M
Sludge Hopper Bottom Level	96.95 M
Launder at U/S WL	103.5 M
Launder at U/S Bottom	103.0 M
Launder at D/S WL	103.4 M
Launder at D/S Bottom	103.0 M
Rapid Sand Filter	
Top Level	103.3 M
Water Level	102.8 M
Sand Layer Top Level	100.8 M
Gravel Layer Top Level	99.9 M
False Slab Top Level	99.3 M
False Slab Bottom LVL	98.3 M

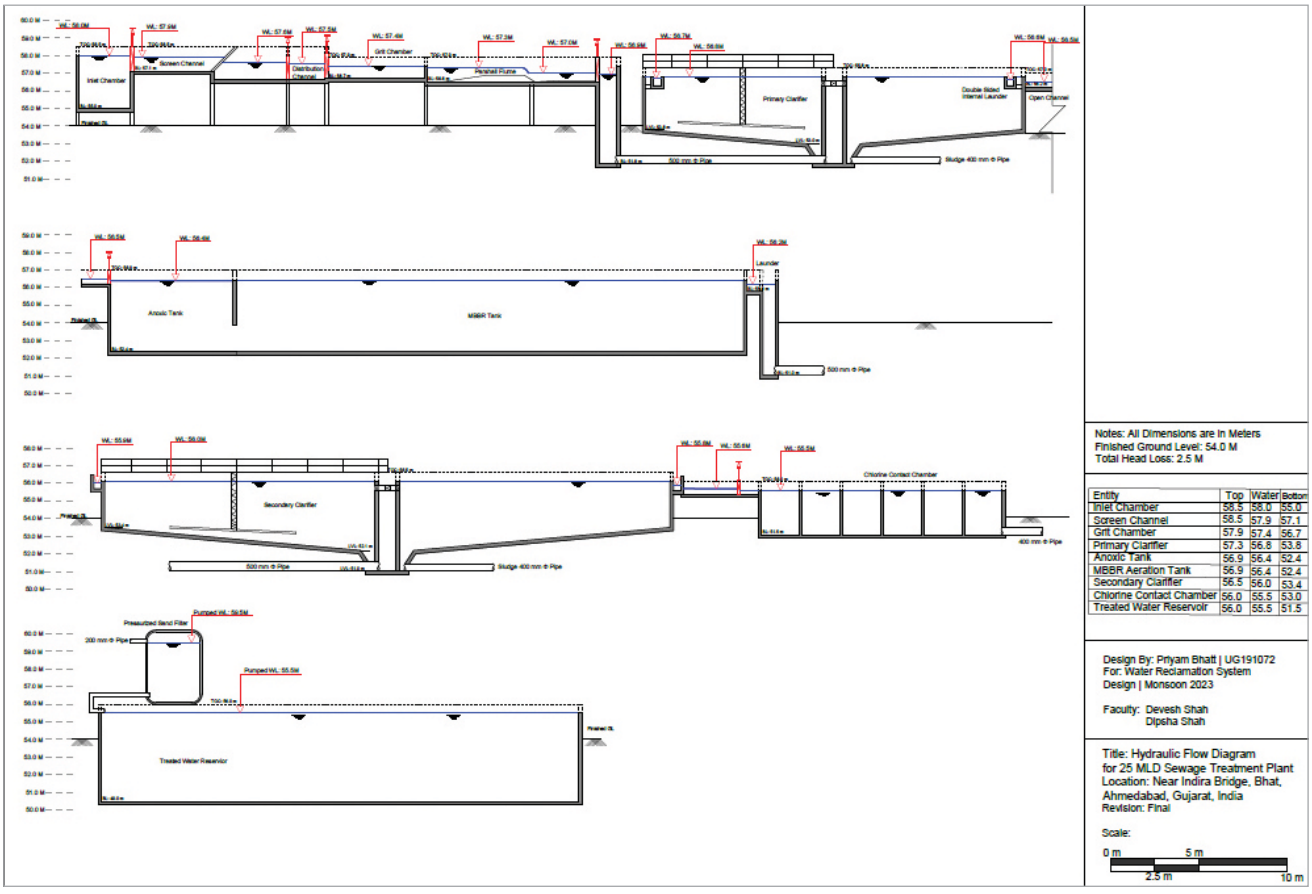
Hydraulic Flow Diagram of Water Treatment Plant



INDEX

No	ENTITY	DIMENSIONS
1.	Inlet Chamber	4.5M X 2.9M X 3.5M
2.	Screen Channel	8.6M X 2.0M X 1.4M
3.	Grit Chamber	5.4M X 5.4M X 0.8M
4.	Parshall Flume	Type 5, IS-14391-1996
5.	Primary Clarifier	21.3M (Dia) X 3.0M SWD
6.	Anoxic Tanks	19.1M X 6.9M X 4.0M
7.	MBBR Aeration Tanks	28.7M X 19.1M X 4.0M
8.	Secondary Clarifier	30.8M (Dia) X 2.8M SWD
9.	Chlorine Contact Chamber	13.2M X 15.8M X 2.5M
10.	Pressurized Sand Filter	3.0M (Dia) X 3.0M SWD
11.	Treated Water Reservoir	27.0M X 31.0M X 5.0M
12.	Sludge Sump	8.5M (Dia) X 4.0M SWD
13.	Sludge De-Watering Building	8.0M X 7.0M X 11.0M
14.	Air Compressor Room	8.0M X10.0M X 5.0M
15.	Chlorine Building	5.0M X 3.0M X 4.5M
16.	Toner Room	4.5M X 7.5M X 5.0M
17.	Neutralization Pit	3.0M X 2.5M X 1.5M
18.	Admin Block	12.7M X12.4M X 5M
19.	Reuse Distribution Outlet	
20.	Sludge Drying Bed	12.5M X 26.3M

Sewage Treatment Plant Layout



Hydraulic Flow Diagram of Sewage Treatment Plant

Dr. Dipsha Shah
Associate Professor at Faculty of Technology, CEPT University

Dr. Dipsha Shah is an Environmental Engineer holding PhD in Civil Engineering and has more than 15 years of academic and consultancy experience. Her areas of interest are plumbing design, air pollution management, and public health infrastructure facility design. She has delivered a number of expert lectures in various colleges on plumbing, water, and wastewater treatment, urban waters, and smart cities: Water and sanitation. She can be reached on dipsha.shah@cept.ac.in .

Devesh Shah
Owner, Arise Enviro Consultants, Ahmedabad

Devesh Shah is an Environmental Engineer and obtained an engineering degree in 2006. Since 2006, he has been working in the field of environment, especially water and wastewater treatment. He has more than 17 years of experience, especially in aerobic and anaerobic treatment. He has designed many water, sewage and effluent treatment plants for ULBs, industries, municipalities and Municipal Corporations.

Priyam Bhatt
Student, Bachelor of Construction Technology, Faculty of Technology, CEPT University

Priyam Bhatt is a fifth-year student at the Faculty of Technology, CEPT University, pursuing a Bachelor's in Construction Technology. Fond of environmental sciences, Priyam wants to pursue Construction Project Management to work on large-scale infrastructure projects in the green energy sector.

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BACK TO BASICS

VENT SYSTEM

- Milind Shete

1. Trap and trap seal

A trap is a device, which when vented properly prevents the sewer gases from entering into the habitable spaces. It also eliminates the possibility of pests and vermin, like cockroaches, rats etc from entering into the building.

The 50MM water seal of a trap creates a barrier that must be overcome before the gas or the vermin cross the trap and escape into the room. According to UIPC-I each plumbing, fixture needs a trap and each trap needs a vent to protect the trap seal.

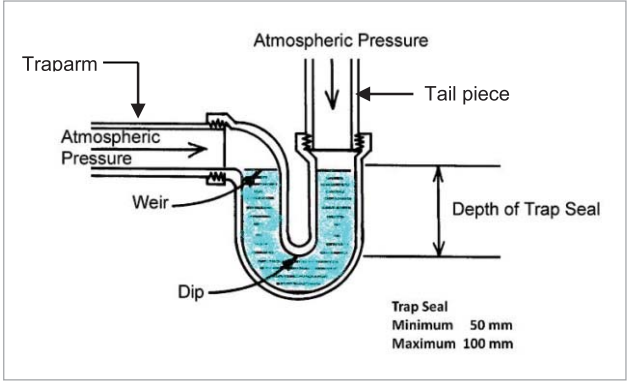

Fig. 01

Failure of Trap Seal:

The 3 basic ways by which the trap can loose its water seal is,

1) Siphonage
2) Back Pressure
3) Evaporation

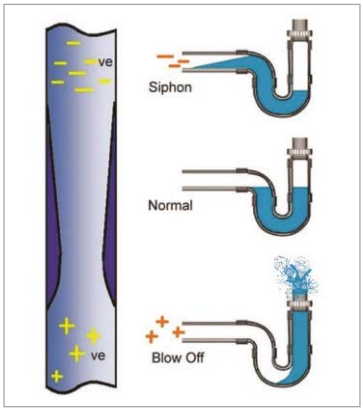

Fig. 02

Siphonage: When the water flows rapidly downwards, it also draws air with itself. In such case negative (-ve) pressure is created at the upstream of the water column, which will suck the water from the fixture trap and is called as Siphonage.

Back Pressure: When the water flows rapidly downwards, it also draws air with itself. In such case positive (+ve) pressure is created at the downstream of the water column. Now if this positive pressure occurs at the outlet side of the trap then it tries to push the air out off the trap, their by blowing the fluid out off the trap into the living space and is called as Back pressure. Even hydraulic jump can also create positive (+ve) pressure and can blow out the water seal.

Evaporation: In the area where you have extremely hot climate, then trap seal may evaporate and so trap primers are installed at such place to replenish the water seal.

2. Why venting is required

Whenever you flush a WC or use a plumbing fixture. The water is pushed down the stack. What happens is that along with the water, the air in the system is also pushed down. Now to maintain the equilibrium in the system this air has to be replaced with air from the atmosphere. This is what exactly the vent system does. By replacing the air the vent ensures equal pressure on both sides of the fixture trap i.e Tail piece & trap arm.

Without a vent, the trap seal is subjected to siphonage or backpressure, which would allow the sewer gas to enter into the habitable spaces.

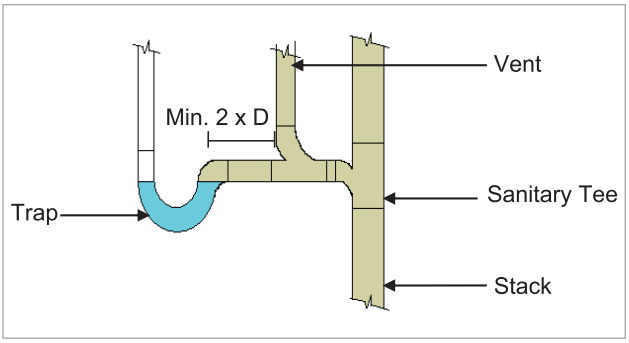

Fig. 03

[The consequences of sewer gas entering the habitable spaces can be a serious health hazard, as was proven in the SARS epidemic (severe acute respiratory syndrome) reported in Hong Kong, China in 2003, where 65 deaths occurred &231 people were infected from the virus in the sewer gases that escaped into the habitable spaces due to dry traps]

3. Vent system- Definitions

- **Vent -** A pipe or pipes installed to provide a flow of air to or from a drainage system or to provide circulation of air within the drainage system .The vent thus maintains the equilibrium in the system and ensures that the drainage system works smoothly.
- **Individual Vent -** A pipe installed to vent a fixture trap and that connects with the vent system above the fixture served or terminates in the open air.
- **Continuous Vent -** A vertical vent that is a continuation of the drain to which it connects.
- **Branch Vent -** A vent connecting one (1) or more individual vents with a vent stack or stack vent.
- **Relief Vent -** A vent, designed to provide circulation of air between drainage and vent systems.
- **Vent Stack** – The vertical vent pipe installed primarily for the purpose of providing circulation of air to and from any part of the drainage system.
- **Stack Vent** – The extension of a soil or waste stack above the highest horizontal drain connected to the stack.

4. Vent installation

The drainage system is incomplete and will not function properly in absence of correctly designed and installed vent system. Find below some important points that should be considered for proper vent installation.

1. Each fixture trap must be vented such that the vent pipe must be located at distance that is never less than two times the diameter of the trap arm away from the trap weir.

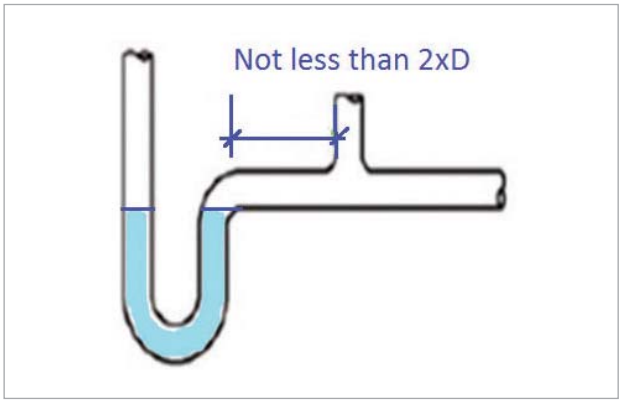

Fig. 05

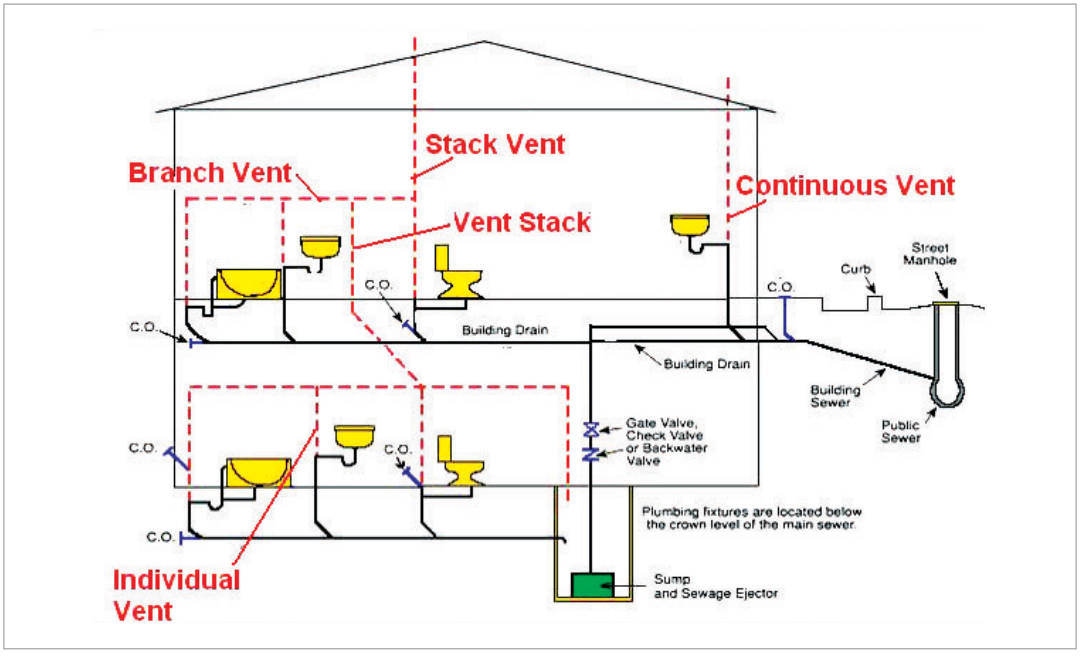

Fig. 04

2. The vent pipe should be minimum 150 MM above the flood level of the fixture before offsetting horizontally. This is to prevent the blockage of vent pipe in case the drain pipe is blocked.

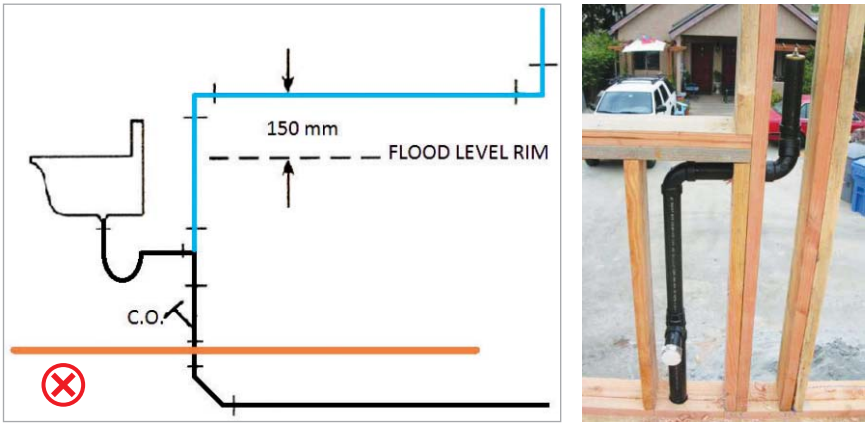

Fig. 06

3. For back to back fixture installation, use double fixture fittings with a common vent.

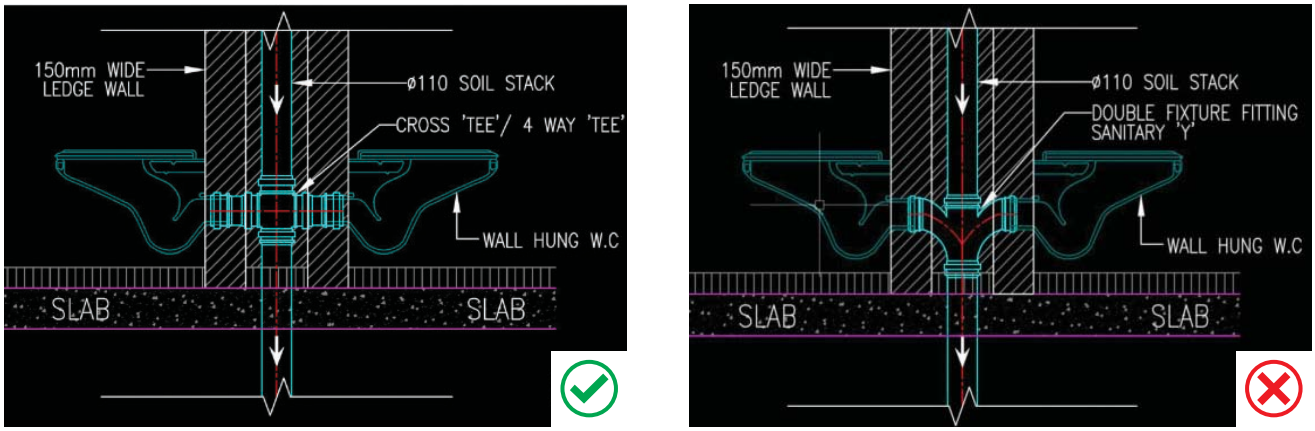

Fig. 07

4. The vent pipe opening from a soil or waste pipe should be always above the trap weir except in case of water closet.

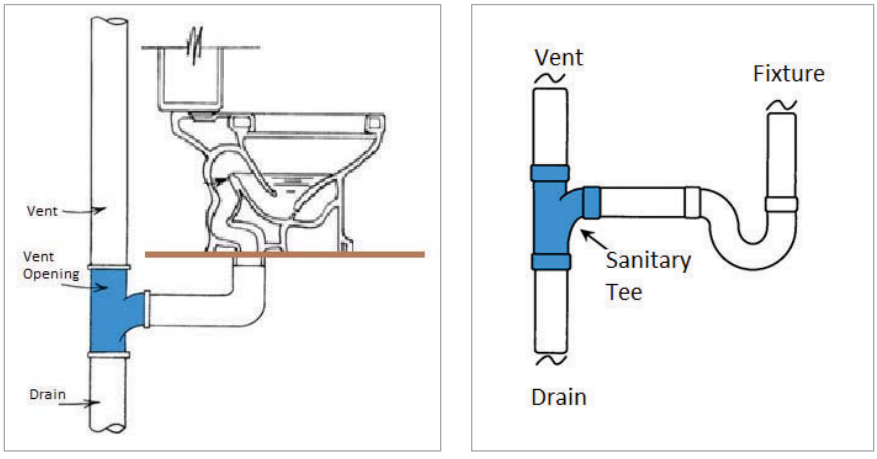

Fig. 08

5. Connecting vents together

- Vents branch shall be 150 mm above flood rim of each fixture
- Vents less than 150 mm above the flood rim shall use drainage type fittings, material and grade.

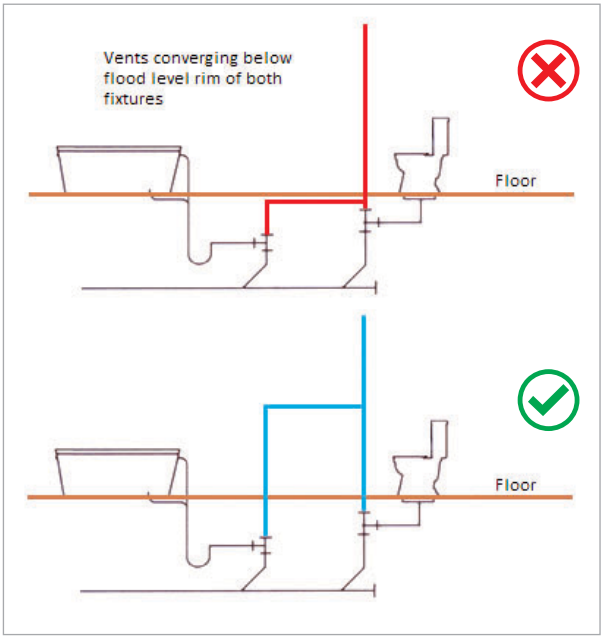

Fig. 09

6. Crown venting is prohibited.

Fig. 10

7. Length & vent piping should be as per the Table 703.2 which shows the maximum number of fixtures units allowed on a vertical or horizontal drainage pipe, building drain, or building sewer of a given size; the maximum number of fixture units allowed on a branch interval of a given size; and the maximum length (in meters) of a vertical drainage pipe of a given size.

TABLE 703.2
Maximum Unit Loading and Maximum Length of Drainage and Vent Piping

Size of Pipe, mm	32	40	50	65	80	100	125	150	200	250	300
Maximum Units											
Drainage Piping[1]											
Vertical	1	2[2]	16[3]	32[3]	48[4]	256	600	1,380	3,600	5,600	8,400
Horizontal	1	1	8[3]	14[3]	35[4]	216[5]	428[5]	720[5]	2640[5]	4680[5]	8200[5]
Maximum Length											
Drainage Piping											
Vertical, feet m	14	20	26	45	65	91	119	155	229		
Horizontal (unlimited)											
Vent Piping (See note)											
Horizontal and Vertical											
Maximum Units	1	83	24	48	84	256	600	1380	3,600		
Maximum Lengths, m	14	18	37	55	65	91	119	155	229		

1 Excluding trap arm.
2 Except sinks, urinals, and dishwashers- exceeding I fixture unit.
3 Except six-unit traps or water closets.

8. Vent pipes slope

All vent pipes shall be free from drops, and sags. They shall be in level or having slopes such that the condensate inside the pipe can travel by gravity to the drain it serves.

Fig. 11

9. Proper fitting for vertical Vent.

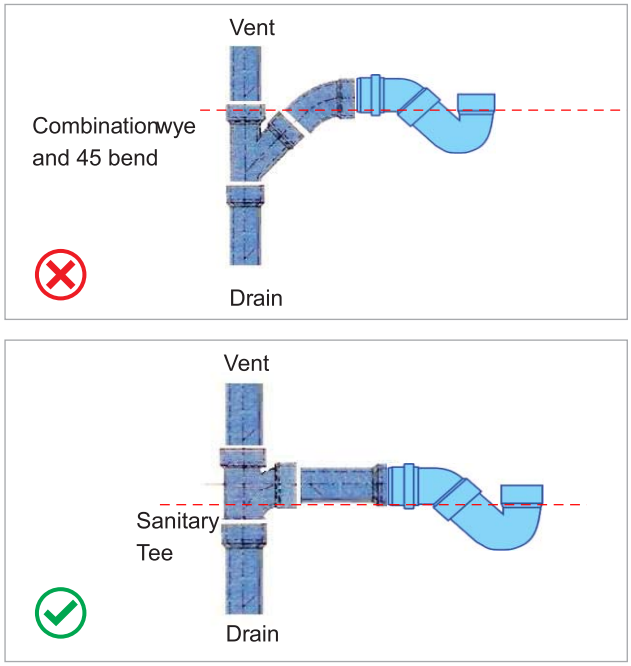

Fig. 12

10.Vent Termination

Each vent pipe or stack shall extend through its flashing and shall terminate vertically:

- Not less than 150 mm above the roof
- Not less than 300 mm from any vertical surface
- Not less than 900 mm above any openable window, door, opening, or air intake
- Not less than 2,100 mm above terrace
- Not less than 3,000 mm above the surrounding ground for outdoor installations

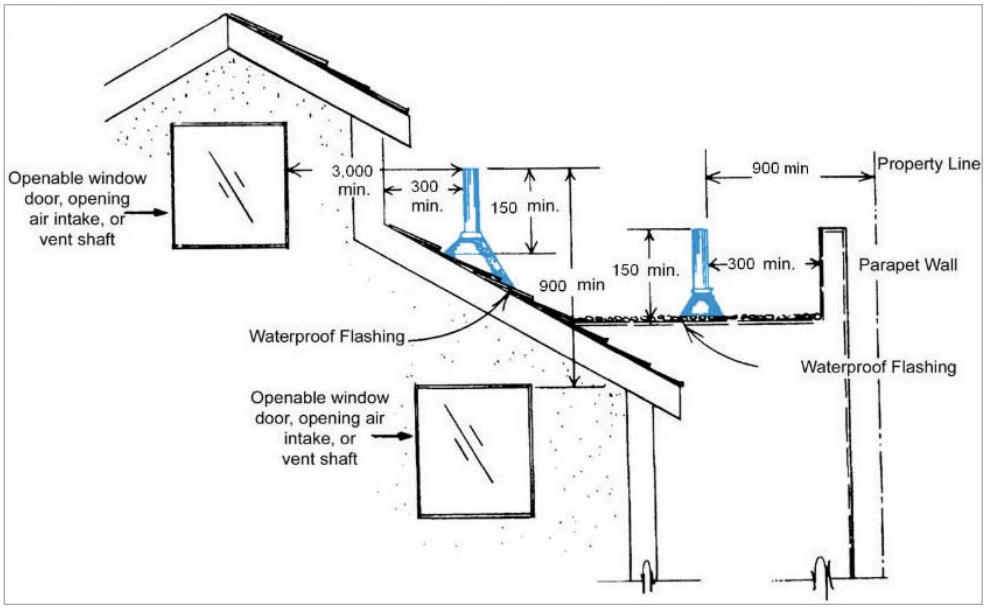

Fig. 13

11. Yoke vent - A stack of 10 or more stories building shall have a parallel relief vent stack. The yoke vent is installed after every 5floors between the soil stack and the vent stack.

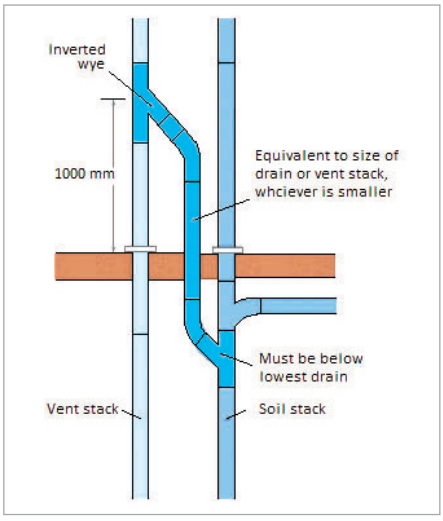

Fig. 14

12.Circuit Venting -

A circuit vent is an efficient method of venting a battery of plumbing fixtures with one single vent. The circuit vent connects between the 2 top most upstream fixtures. Minimum two and maximum eight fixtures can be served by one circuit vent

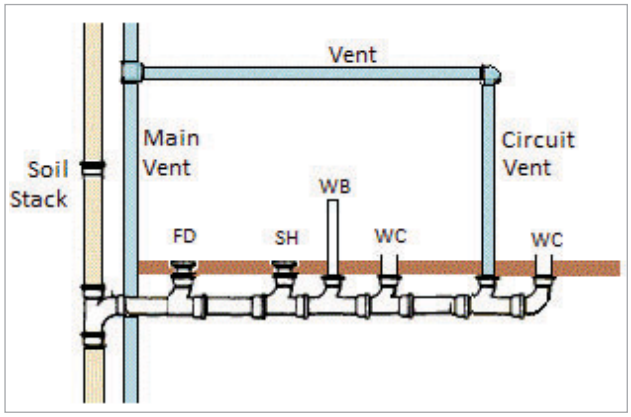

Fig. 15

13.Relief vent -

when 4 or more WCs are connected to the circuit vented horizontal branch drain then a relief vent is installed between the most downstream fixtures drain and the drainage stack.

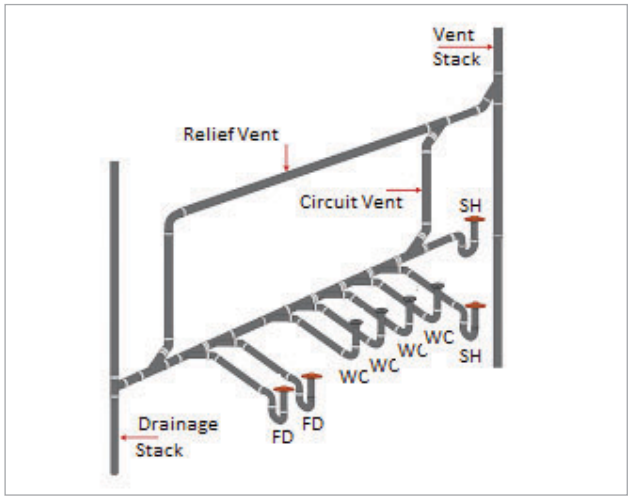

Fig. 16

Milind Shete
Director, Milind Services

Milind Shete is the proprietor of Milind Services, a leading plumbing, sanitation and public health engineering consultancy firm which provide environment friendly, energy efficient and cost-effective solutions. He has worked largely for private clients, govt as well as for semi-govt projects. His projects have been awarded by various institutes in the categories like best institutional project, best building, best township, best commercial project, best government building, etc. Milind Shete is Green Plumber Accredited Trainer of IAPMO. He has represented the country as the coach of the Indian team for a global competition "community plumbing challenge" in 2015 & South Africa in 2016. He is Chairman of IPA Nashik Chapter and National Convener, IPA Student Chapter Committee. He can be reached on nashik@indianplumbing.org .

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Wat-er View

COLUMN 5

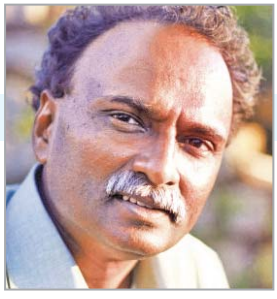
12 Questions You May Want to Ask As A Water Leader ...

- Hariharan Chandra

When we read the many provoking pieces in this journal's every monthly edition, one wonders how much of all this is actually read by professionals and implemented on ground. While we should indeed tell industry leaders as to what they ought to be doing, can we in turn ask ourselves our views on the dozen questions listed here.

Go ahead, maybe you want to reflect on them and set down your responses. Send them to Nivedita at acep@indianplumbing.org .

1. Would you agree that the difference between going green and going the regular way is today not any more a challenge of higher cost but better and smarter management of design briefs, drawings and execution.
2. There are over one lac flats in multiple apartments in the drier zones of north and east Bengaluru or on the outer reaches of NOIDA. There are no takers as tenants or buyers since water availability is a challenge. The story is no different in many other cities. If you don't build in water and energy infrastructure that is reliable over the long term in project design and implementation, do you see market potential growing over this decade for buildings?
3. With capital appreciation not as sharp as it was in earlier decades the resale value of homes also depends on long-term availability of such vital infrastructure. Your views.
4. At the apex of your company do you believe issues concerning sustainability should be pursued in projects because it's mandated by law or because it is desperately needed as a measure of beating the long-term water crisis?
5. As an alternative, would you encourage managers down the line to implement green solutions that go beyond regulatory compliance? Examples can be waste water reclamation, efficient hot water systems, local grid for energy, creating water infrastructure that avoids use of water from tankers and borewells in the long run for home occupants, harvesting rooftop and surface water for use in a manner that borewell extraction is reduced, use of good quality treated water for top-up demand for cooling towers in central air-conditioning.
6. Why should a residential builder adopt net zero solutions if these mean higher capital cost, specially since any drop in Opex costs benefits the client owner.
7. What's your view on companies that continue to say that the business of business is to drive the bottom line and it's up to the Govt to set regulations that industry should follow. Would you agree with them?
8. Do you believe the time has come for accepting what Alvin Toffler said in 1970, that localised solutions for water and energy and waste management is the only way forward in a country that is seriously in deficit on governance. Central approaches have not worked at all for fifty years…
9. Every city in India has just 50 percent as grid water supply. Groundwater exploitation is rampant, because builders do not offer basics of Rainwater Harvesting (RWH) or Sewage Treatment Plants (STP) or even aerators and smart flush tanks or water fixtures. What's your take on the ethic and accountability of builders offering homes that do not address the challenge of vital local infrastructure for water, energy or waste management?
10. What are policy interventions you envisage or you would seek from the government? For eg. there's a clear need for holding sludge back in septic tanks at every large facility and allowing only the water to flow.
11. As a water-user or as a consultant what benefit have you secured or offered to your clients in going green with projects?
12. How much do you think has policy helped to facilitate the building of resilience and sustainability in buildings?



Hariharan Chandra

The columnist is Trustee, AltTech Foundation and Prem Jain Memorial Trust, and Senior Fellow, CII IGBC. He is a green building pioneer and a Net Zero Water exponent guiding currently over a billion litres of low-carbon water for a variety of projects today. Reach him at hariharan@alttech.foundation

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EDUCATION SPOTLIGHT

Plumbing Curriculum gets included in Civil Engineering Model Curriculum

All India Council for Technical Education (AICTE) issued a letter dated February 1, 2024 announcing that the plumbing curriculum is being uploaded on AICTE's website under the open elective curriculum category.

IPA received this letter dated February 1, 2024, from Dr. Mamta Rani Agarwal, Adviser at AICTE, announcing that the plumbing curriculum is being uploaded on AICTE's website under the open elective curriculum category. More notably, the curriculum is included in the Civil Engineering Model Curriculum.

The journey toward this educational milestone began with IPA meticulously crafting and submitting a comprehensive 4-credit plumbing curriculum to AICTE.

The recognition by AICTE is a testament to the dedication and diligence of IPA in promoting the significance of plumbing vocational education. Despite its pivotal role in the construction industry, plumbing often finds itself relegated to the sidelines in vocational curricula.

Recognizing the need for change, IPA championed the cause, advocating for the inclusion of its plumbing curriculum in the model curriculum for Civil Engineering. The success of this endeavour not only highlights the importance of vocational education but also addresses a longstanding gap in engineering curricula.

Furthermore, the timing aligns with the introduction of the latest National Education Code (NEC), promising to elevate the status of plumbing education within the academic sphere. This development is poised to shatter misconceptions surrounding plumbing and underscore its critical role in the comprehensive field of Civil Engineering.

Dr. Mamta R. Agarwal,
Advisor-I, P&AP

Phone : 011-26131577 - 78, 80
011-29581000
Website : www.aicte-india.org

अखिल भारतीय तकनीकी शिक्षा परिषद्
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(शिक्षा मंत्रालय, भारत सरकार)
नेल्सन मंडेला मार्ग, वसंत कुंज, नई दिल्ली-110070

ALL INDIA COUNCIL FOR TECHNICAL EDUCATION
(A Statutory Body of the Govt. of India)
(Ministry of Education, Govt. of India)
Nelson Mandela Marg, Vasant Kunj, New Delhi-110070

Email- advpnap@aicte-india.org

F.No. AICTE/P&AP/Curri/plumbing/2024 Dated: 01.02.2024

To,
The National Vice-President
Indian Plumbing Association
416, DLF Prime Towers,
F-79&80, Pocket F, Okhla Phase I,
Okhla Industrial Estate, New Delhi-110020

Subject: Incorporation of open elective curriculum of Plumbing (Water and Sanitation) into Civil Engineering Model Curriculum

Dear Sir,

Greetings from the All India Council for Technical Education!

I am writing to inform you that the model curriculum w.r.t the Plumbing (Water and Sanitation) as an open elective has been uploaded on the Council's website. The said course has been included as a 3-credit module in the 5th Semester of the Civil Engineering program as well as an open elective to provide students with the opportunity to explore this specialized field further.

We deeply appreciate the valuable input and expertise provided by the Plumbing Association in shaping the educational landscape of our civil engineering programs. Your collaboration has been instrumental in ensuring that our curriculum remains relevant and aligned with industry standards.

You may pursue the uploaded curriculum at:
Updated Civil Curriculum: - https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final%20AICTE%20Model%20Curriculum%20_UG_Civil_2024.pdf

Open Elective - Plumbing (Water and Sanitation):
https://www.aicte-india.org/sites/default/files/Model_Curriculum/Curriculum%20-%20Plumbing%20(Water%20and%20Sanitation)%20R3_revised.pdf

We deeply appreciate your time and contribution.

With regards,

Yours sincerely,

01 Feb, 24

[Dr. Mamta Rani Agarwal]

Chandra Shekhar Gupta, IPA National Vice President presenting the IPA flag to Dr. Mamta Rani Agarwal, Adviser, AICTE

About the MoU between IPA and AICTE

In a pioneering move, the Indian Plumbing Association (IPA) and the All India Council for Technical Education (AICTE) joined hands on April 15, 2022, to redefine the landscape of engineering education. The collaboration aimed at developing a 4-credit course on Plumbing (Water and Sanitation), catering specifically to students in Engineering, Architecture, or Interior Design, with a focus on graduates holding a 'Major' degree in Civil, Environmental, and Mechanical Engineering, Architecture, or Interior Designing.

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(Founder Jaquar Group)

Jaquar Group IPA Neerathon:

A Resounding Success

4th February, Major Dhyan Chand National Stadium, New Delhi

The Jaquar Group IPA Neerathon, held on February 4, 2024, at Major Dhyan Chand National Stadium, witnessed an outstanding participation of 1600+ sports enthusiasts, army personnel, corporate leaders and first-time runners. The event garnered significant support from the Ministry of Jal Shakti (MoJS), Ministry of Housing and Urban Affairs (MoHUA), New Delhi Municipal Council (NDMC), Rotary Club of Delhi Central-District 3011, Rotary India Water Conservation Trust, and Gurudev Sri Sri Ravi Shankar.

Despite the challenges posed by adverse weather conditions, the running community's unwavering support propelled the Jaquar Group IPA Neerathon 2024 to a remarkable success.

The run commenced with the flag-off by Ms. Debashree Mukherjee, IAS, Secretary, Water Resources, Ministry of Jal Shakti. The ceremony was graced by the esteemed presence of Rajesh Mehra, Jaquar Group Chairman, Ranjan Dhingra, President, Rotary India Water Conservation Trust, Gurmit Singh Arora, IPA National President, Chandra Shekhar Gupta, IPA National Vice President, Mukesh Asija, IPA Delhi Chapter Chair, and various other dignitaries.

With an impressive turnout of over 1600 participants, including runners, athletes, and members of the general public, the event exuded a vibrant atmosphere despite the rain. Renowned figures Mr. Neeraj Badhwar, Senior Journalist, and satirist, and Ms. Ranjeeta Ashesh Sahay, Founder & Poetpreneur of Kshitij were the inspirational speakers who spoke on the importance of incorporating water conservation in daily life. 2 skits on water conservation were organized by girl students from Suraj Kanya Shikshalaya and primary students from Pragya Foundation.

Jaquar Group IPA Neerathon was supported by industry partners including Astral Pipes, Ashirvad Pipes, Lubrizol, Nugreen, APL Apollo, NeerDrains, KPT Pipes, Prince Pipes, KanTherm, Sloan, Neoperl, Empire Tubewells and Ganpati Enterprises. The event also received backing from Apollo Hospitals, Delhi Heart and Lung Institute, Brooks, Nutty Gritties, Delhi Pharmaceutical Sciences and Research University (DPSRU) and Free Water Movement.

The success of Jaquar Group IPA Neerathon 2024 stands as a testament to the community's spirit and resilience, demonstrating the power of collective efforts in promoting health, wellness, and water conservation. IPA Delhi Chapter members contributed largely to the success of the run.

Jaquar Group IPA Neerathon: A Resounding Success

4th February, Major Dhyan Chand National Stadium, New Delhi

Jaquar Group IPA Neerathon: A Resounding Success

4th February, Major Dhyan Chand National Stadium, New Delhi

Amit Narang is at National Stadium - India Gate - New Delhi.
6 February at 06:47 · Delhi ·

The raining & running Sunday 🏃‍♂️🏃‍♂️🌧️🌧️

The IPA Neerathon 2024 pacing job assigned to me accomplished to perfection 🎯👊
The 10km-60 minutes bus parked on time in 59 minutes & 50 seconds with loads of fun, laughter and insight sharing with fellow passengers 😀

(just for the information of non runners reading this post, my 10km-60 minutes bus means, I had to pace my fellow runners or push them to complete the 10 km run in 60 minutes or before. A pacer is required to curb his/her natural speed even if he can run faster and is required to complete the run in the duration allotted to him and to take the fellow runners alongside him)

There were a few runners who achieved their personal best & the icing on the cake was to be able to pace @chakravarti.shalinirajiv to her first Podium finish in the 50-59 years female category. She completed the run in 59 minutes and it was her PB as well 🏆🎖️💪
(Swipe left for Picture no 3)

Coming back to the run, the Rain Gods were in pouring mood today since early morning here in Delhi NCR, but could not dampen the spirit of runners who love the deadly combination of raining & running ❤️

Today's run was for a wonderful cause to create awareness to save water for future and sustainability organised by IPA under Ministry of Jal Shakti, Govt of India. Kudos to the organisers for a well managed event with a very good route, pre run warm ups and post run refreshments and wonderfully conveyed message of saving water for a better and hydrated future 👍👍

A happy and contented runner's Sunday today 🙌❤️
Happy running everyone 👍

#run4water #waterawareness #savewaterdelhi #savewater #ipa #ipaneerathondelhi #waterawarenessfestival #ministryofjalshakti

#pacer #runningambassador #run #runningcommunity #marathon #marathonrunner #fitness #fitnessmodel #fitnessmotivation #runningmotivation #delhidiaries #delhi #inspire #motivate #motivated #runforacause #athlete #happyrunner #rainrunning #runforgoodcause #pacing #inspiration

Ranjeeta Sahay Ashesh is with Rohit Srivastava.
5 February at 23:18 ·

#IPANeerathon #Poetpreneur #SaveWaterCampaign Honoured to be invited as #MotivationalSpeaker for Jaquar Group IPA Neerathon organized by Indian Plumbing Association which happened on 4th February 2024 at Major Dhyan Chand National Stadium. It's a marathon for water conservation and awareness around it.
The event was supported by the Ministry of Jal Shakti, Ministry of Housing and Urban Affairs, NDMC, Rotary and Gurudev Sri Sri Ravi Shankar ji.
It was heartening to receive the Memento from Mr. Rajesh Mehra,Chairman of Jaguar Group in the presence of IPA National Vice President Mr.Chandra Shekhar Gupta, IPA Delhi Chapter Chair Mr. Mukesh Asija.
On the other hand, it was a pleasure to meet my fellow motivational speaker and senior journalist, a well known satirist and columnist Mr Neeraj Badhwar. Thanks Mr. Rohit Srivastava for all the connections and inviting me to be part of this wonderful and well organized event despite the rain.

#GratitudetotheUniverse

Rajan Pundir
★★★★★

Dear Organizers, I wanted to express my heartfelt gratitude for the incredible experience I had participating in the IPA Neerathon 2024, specifically the 10KM Marathon. It was a spontaneous decision for me, and I am thrilled to share that I secured the 57th place despite not having any prior practice. The sense of accomplishment is truly invigorating. The event was a first for me, and I must say it exceeded my expectations. The energy, enthusiasm, and camaraderie among participants created an unforgettable atmosphere. The well-organized event and supportive environment made it a memorable day. I appreciate the opportunity to challenge myself and be a part of such a remarkable event. Although I haven't participated in many events like this before, the Neerathon has inspired me to explore more in the future. Thankyou once again for organizing this fantastic event. I look forward to future editions and new challenges. Regards Rajan Pundir Bib: 10235

Review for : JAQUAR IPA NEERATHON 2024, DELHI

Sanjay Aneja
★★★★★

Nicely organised inspite of the inclement weather

Review for : JAQUAR IPA NEERATHON 2024, DELHI

February 5, 2024 Reply Mark Invalid

Chitra Chatterji is with Lalitha Krishnan.
1 d ·

#ipaneerathon #ipaneerathondelhi #ipaneerathon2024feb #runner #tunnermom #runnerlife #runforcause #progress #savewater #waterislife #rotary When IPA organised this event along a run to educate on water conservation and simple means to protect this scarce and precious resource. I took the opportunity to run in this event (as it's my hobby & passion too). It is wonderful indeed to spread such knowledge to value nature & its resources. Thankful to IPA

Gautam Gambhir
9 January ·

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From Left to Right: Mukesh Asija, Chairman, IPA Delhi Chapter, Hariharan Chandra, Founder Trustee of PJMT, Gurmit Singh Arora, IPA National President, Payal Jain, Founder Trustee, Prem Jain Memorial Trust, Chandra Shekhar Gupta, IPA National Vice President after the MoU signing

The Indian Plumbing Association (IPA) signed a memorandum of understanding (MOU) with the Prem Jain Memorial Trust (PJMT) on 24th January, formalizing a collaboration to share knowledge and best practices between their members around critical areas like sustainability, water conservation, water and energy efficiency.

The MoU was inked at the 6th edition of the Prem Jain Memorial Address in New Delhi by Mr. Hariharan Chandra, Founder Trustee of PJMT and Mr. Gurmit Singh Arora, National President of IPA. The MoU was signed in the presence of Chandra Shekhar Gupta, IPA National Vice President, Mukesh Asija, Chairman, IPA Delhi Chapter and Payal Jain, Founder Trustee, Prem Jain Memorial Trust.

Under this strategic partnership, IPA and PJMT will facilitate cooperation, training programs, seminars, awareness drives and other capacity building initiatives for their members leveraging each other's expertise. There will also be cross-participation in conferences, advocacy efforts and technical committees to integrate valuable insights around rapidly evolving sustainability challenges.

"This partnership is an acknowledgment of the critical role the Indian plumbing industry plays towards meeting larger environmental goals, be it water management or sustainable infrastructure. Together with PJMT, we will raise the bar on adoption of green solutions contributing to national commitments," said **Arora**, speaking at the MoU signing ceremony.

Chandra added, "Collaborating with IPA provides a potent opportunity to integrate sustainability considerations early into plumbing designs and standards. By enabling knowledge sharing between our networks, we aim to accelerate India's progress towards water and climate security."

About Prem Jain Memorial Trust: To establish a foundation in memory of late Dr. Prem Jain, Prem Jain Memorial Trust was created with the mission to create, establish and maintain sustainability paradigm through education, recognition and nurturing of our present and future generations. The Trust aims at identifying future leaders who can be a catalyst for global development of sustainability and can create awareness and advocacy about the environment. It nurtures India's young talent by educating them about sustainable development ecosystems.

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16th NAREDCO National Convention

From Left to Right: Gurmit Singh Arora, Saurabh Diddi, Yash Pratap Singh, Michael Wing, Srinivas Valluri

16th National Real Estate Development Council (NAREDCO) National Convention, themed "Fostering Trust with Transparency: Pathway 2047," a two-day event, was held from February 2 to 3, 2024 at New Delhi. The convention witnessed critical discussions and proposed strategic measures by the governing council, NAREDCO members, key stakeholders from the real estate and construction sector.

Gurmit Singh Arora, IPA National President participated in the Panel Discussion on "Decarbonizing the Built Environment". Shailesh Kumar Agrawal, Executive Director, BMPTC, Saurabh Diddi, Director, Bureau of Energy Use Efficiency, Michael Wing, Head of International Development, Infracorp, Yash Pratap Singh, Partner, KPMG India were the other panellists in this discussion along with Srinivas Valluri, CEO Synergy Infra as the Moderator.

G. Hari Babu, President of NAREDCO, set the tone by stressing the urgent need for "All India Master Plans" and "All India State Plans" to develop Green Field Cities. He said, "India critically needs these plans by the time it grows into a 30 trillion Dollar Economy by 2047. This would be the primary requirement for the growth of the Indian Real Estate and Construction Industry."

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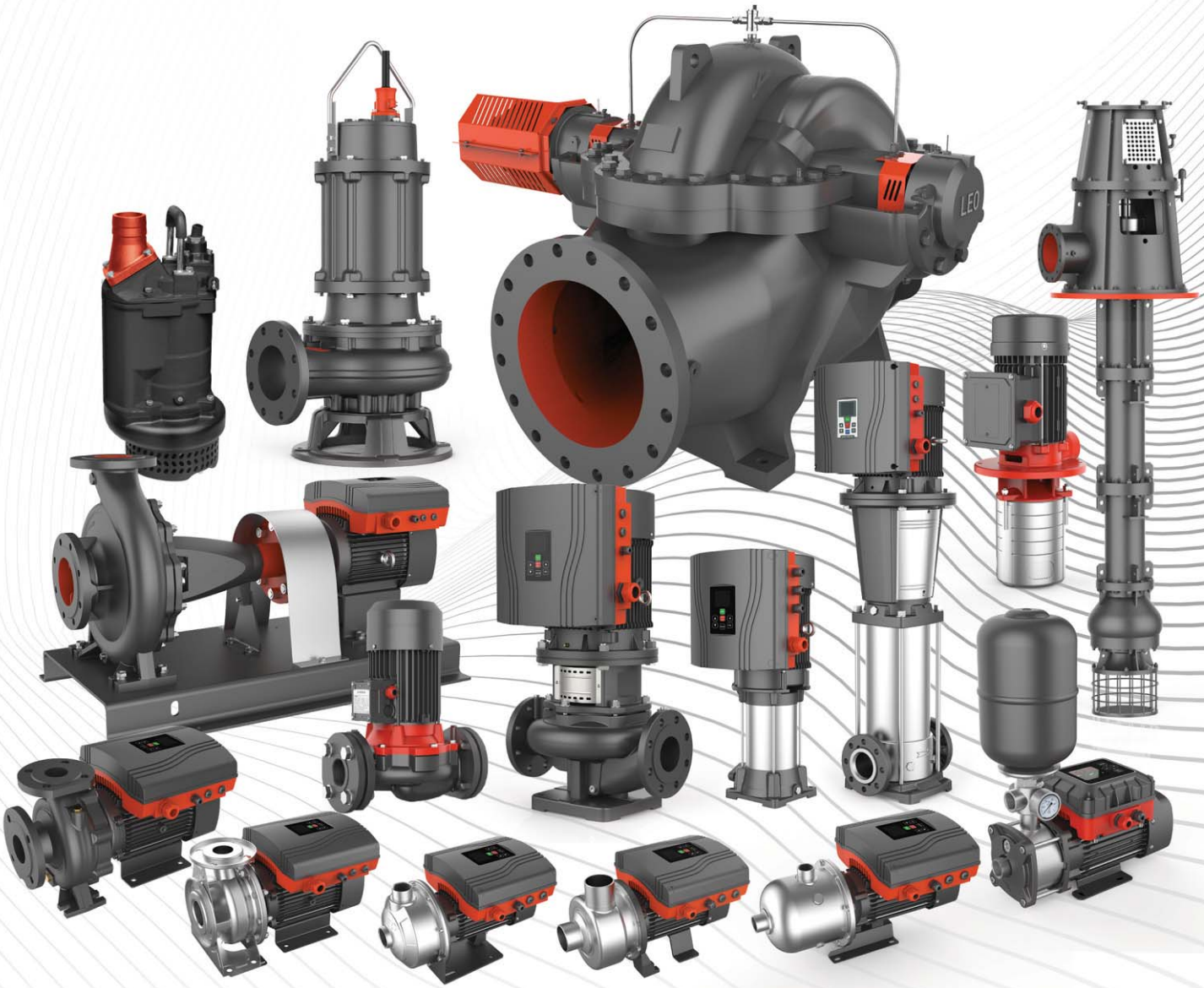

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CHAPTER EVENTS

Lucknow Chapter Launch: 25th IPA Chapter

Indian Plumbing Association Lucknow Chapter was formed on Friday 2 February 2024. This Installation ceremony was organized at the city's Hotel Hilton Garden, in the presence of the chief guest, former Chief Income Tax Commissioner Shri V. K Tiwari.

On this occasion, many eminent architects of the city such as Ashok Kumar, Ranjan Shukla, Rajneesh Aggarwal, ASSOCHAM President Anupam Mittal, Jal Nigam, Housing Development, PWD, and many people from other organizations congratulated the newly appointed executive committee.

Devesh Mani Tripathi, newly elected Chairman of IPA Luckow Chapter gave information about the history, vision and mission of the Indian Plumbing Association and its motto of water is life, economical use of water, importance of clean water, purification and use of water and the future.

This program was sponsored by Prince Pipes and Fittings Ltd. Jayant Kumar, National Head gave some important tips for the success of the chapter.

K Bhaskar, Convener, Membership Growth Committee gave an overview of IPA and informed the Chapter EC members about the way ahead for the future.

Amish Mehta, Chairman, IPA Mumbai chapter (returning office) conducted the election and oath ceremony for all elected members. Election was unopposed and the following members were elected.

Name	Designation
Devesh Mani Tripathi	Chairman
Rajesh Singh	Vice Chairman
Awadhesh Mishra	Secretary
Devendra Dwivedi	Jt. Secretary
Manish Kumar	Treasurer
Amit Raj	Executive Member
Deepak Kumar Pandey	Executive Member

From Left to right Amit Raj, Devendra Dwivedi, Awadhesh Mishra, Devesh Mani Tripathi, Rajesh Singh, Manish Kumar, Deepak Pandey

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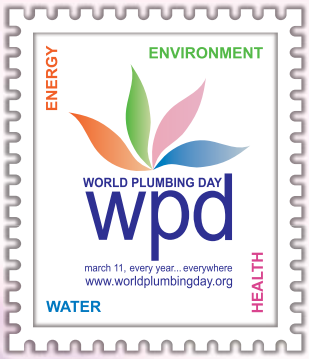

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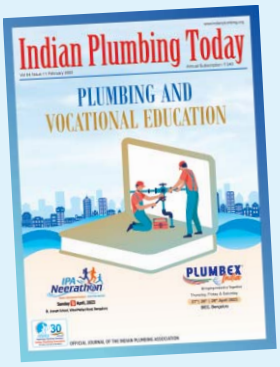

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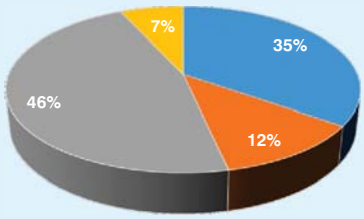

- Architects and Interior Designers and Project Management Consultants
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- Others

IPT Readers' Feedback

> IPT is a good magazine to update yourself with the latest technology and with the live examples/case studies as well as latest products.
>
> **Hiren Shah**
> Sr. Project Coordinator
> Aqua Utility Designs
> Ahmedabad

> We strengthen our skills and knowledge in plumbing field through IPT.
>
> **Sanjay Bhaskar Kajwe**
> Proprietor
> Hydrotech Systems
> Mumbai

> IPA is a good platform for awareness of advances in the field of Plumbing Technology.
>
> **Dr. Kailas Arjun Patil**
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Industry Feedback

with Nugreen Building Technologies Pvt Ltd

KESSEL NUGREEN

IPT: **"Atmanirbhar Bharat" is the clarion call given by our Honourable Prime Minister. Has this call inspired Nugreen to start manufacturing some products that were earlier not manufactured indigenously?**

Nugreen: Nugreen has been in the field of providing new age technology solutions to wastewater treatment, internal and external surface drainage for modern building constructions over the last 12 years. However, over the period Nugreen team has assessed and provided case specific and cost-effective solutions to the ever-growing demand of the Plumbing and drainage requirements of the construction Industry and has been a pioneer in this field by developing and introducing new products and systems in Kitchen wastewater treatment like Grease separators and also developed and customized indigenously developed stainless steel drains in the kitchen drainage segment.

IPT: **IPA always advocates for Good Plumbing Practices as per UIPC-I & NBC, what do you think would be a noble approach to promote this aspect on a large-scale PAN India other than the present avenues like Codes/ IPT & IPPL.**

Nugreen: IPA has been one of the only nodal body and platform promoting Good plumbing practises and showcasing new age technologies to the Plumbing fraternity and professionals through various conferences, seminars and exhibitions in the major metro towns of India. However, the time has come that these new technologies and systems which have found ready acceptance amongst the leading consultants and building construction industry and IPA needs to play a pivotal role in spreading the awareness to Tier 1 & 2 towns and we are sure industry will be keen to partner with IPA to support this initiative.

IPT: **How do you see the fittings and plumbing product replacement market in Tier II cities and urban/rural areas?**

Nugreen: Tier 2 cities and semi urban / rural areas have been using traditional products that result in unnecessary losses that occur due to usage of the wrong fitment accessories primarily due to lack of awareness, non-availability of the right accessories and cost. However, we are sure that if benefits of the new Plumbing / drainage products at the right price point are made available to this market segment, the demand from these consumers will also increase manifold.

IPT: **Do you agree that post pandemic Plumbing Installation costs have witnessed an upward revision?**

Nugreen: Yes, Post Covid both the Plumbing installation costs as well availability of the skilled manpower has been a major challenge that our industry is facing and this can be countered proactively by imparting proper training and upgrading skills of the present work force. Here IPA and the industry can play a pivotal role to train and guide the present plumbers and installers by providing a common platform and partnering with the Skill India development department of the central /state government.

IPT: **Your sales/installation or Project site team must be encountering some typical situations in product installations. Would you consider following up with your team or site team to share such incidents as a Case Study to be carried in IPT.**

Nugreen: Nugreen has a firm belief that trained installers need to install specialised wastewater treatment and drainage systems and has effectively trained all its engineers, installers and dealer network. In the better interest of the Plumbing industry, Nugreen is keen and open to share these practises, knowledge and instances with the readers of the IPT.

IPT: **How do you view the future of plumbing products and fittings market in the next 10 years?**

Nugreen: With increased challenge in managing the scare fresh water resources and moving towards a Net Zero Goal of the central government, we will definitely see more and more innovations coming up in the Plumbing products and fitting market segment leading to increased efficiency and minimal distribution losses. This is going to be a win - win situation for all the stakeholders in the Plumbing Industry and market segment where end consumer will be the ultimate beneficiary.

IPT: **Are there any product innovations or features that you have recently introduced in your product range?**

Nugreen: Since the inception of the Nugreen brand in 2011, the prime objective and philosophy of the management has been to develop latest products and systems in the field of wastewater treatment as well as internal / external surface drainage segment. Over the years, Nugreen has successfully launched new range of Grease separators with a Mascreating pump for effective cleaning and maintenance for the hospitality segment as well as indigenously developing complete range of Stainless-steel drainage systems like Shower channels/Point drains for Bathrooms for the Residential segment and innovative Kitchen drainage and collection systems for the Commercial / Industrial kitchens.

Raman Kapur
MD, Nugreen Building Technologies Pvt. Ltd.

Raman Kapur is an entrepreneurial executive who is a Civil Engineer and post graduate from IIM Calcutta.

He has extensive & varied experience of more than 30 years in organizational operations & strategic planning within the SAARC Region with rare distinction of exploring new markets across SAARC region for expanding businesses from scratch and scaling them specially on a pan India level.

He has worked in Sales and Marketing, Product development and Senior Management roles in both Indian and Multinational Companies. Apart from this he is also one of the main promoters of a NGO- Swayam that promotes self-employment to the deserving members of the less privileged section of the Society.

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