Status Paper for River Ganga

Past failures and current challenges

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Ganga: past failures, current challenges

It was inevitable that Ganga, the largest river basin in India, constituting 26 per cent of the country's landmass and supporting 43 per cent of its population, would be the starting point of any cleanup initiative of the Government of India. In the 1970's the water quality of the much revered watercourse began to be visibly beset by the increasing trend of untreated sewage and industrial effluent discharge. Efforts to reduce pollution loads began in earnest in 1985 when the Centre launched the Ganga Action Plan (GAP). The Rs 462-crore initiative was aimed at improving the water quality to acceptable standards (defined as suitable for bathing) by intercepting the sewage and treating it before discharge in to the river. The programme selected 25 towns located along the river in the Uttar Pradesh, Bihar and West Bengal, all riparian states.

At the time (in 1985), 1340 million litres per day (MLD) of sewage was discharged from Class I towns (100,000 and above), not factoring the generation from scores of smaller towns in the basin. The first phase of GAP was completed on March 31, 2000, and financed government agencies in Uttar Pradesh to install sewage treatment plants with a capacity to treat 375 MLD, whereas 122 and 371 MLD was established in Bihar and West Bengal respectively. The river remediation plan aimed at installing infrastructure to treat 65 per cent of sewage generated in Class-I cities in the basin. Other work included afforestation, sanitation, crematoria and river front beautification.

It had been envisaged that phase-I would be completed in 6 to 7 years. But by the time it was brought to a close, a decade and a half after its inception, sewage generation increased substantially, from 1340 MLD to more than 2000 MLD. The programme was delayed considerably due to problems on the land acquisition front, litigations filed in the courts, but most of all due to poor planning and lack of experience in implementation.

The infrastructure installed failed to close the gap on the sewage generated in the basin. To make matters worse, operations and maintenance of the commissioned plants was marred by lack of uninterrupted electricity or dedicated power supply, resulting in reduced treatment efficacy, while petty corruption in operationalising backup power sources was widely reported. More importantly, erroneous positioning of treatment plants mostly in the peripheries ensured that while most operated well below capacity, some were overwhelmed with sewage flows where majority of sewage received was bypassed untreated.

The Ministry of Environment and Forests and nodal state government agencies paid no heed as the non inclusive, non participatory, hardware and technocratic approach of the action plan continued unchanged; there was neither any analysis nor any learning from phase-I going forward. The environment ministry defended the approach saying that expenditure would be visible when the left out works in the 25 class I cities and the works in other class II (50,000 to 100,000 population) and class III (20,000 to 50,000 population) towns along the river Ganga would be completed. The next phase works were taken up in stages between 1993 & 1996. In this phase, GAP-II, the Yamuna, Gomati and Damodar, tributaries which directly discharge in to the Ganga were taken up to reduce incoming pollution loads. To deal with untreated sewage in the main stem of the river, 223 MLD capacity funded by GAP-II has been commissioned, upping the total installed capacity to 1092 MLD. The total expenditure incurred so far, on conservation of river Ganga is Rs 950 crore. This was the status as reported by Jayanthi Natarajan, Minister of Environment and Forests, in response to a parliament question in the upper house in May 2013. It is important to note that this is inadequate to meet the quantum of sewage generated back when the plan was conceived, in the mid 1980's. The quantum of sewage generated today is nearing 3000 MLD, almost three times the available infrastructure.

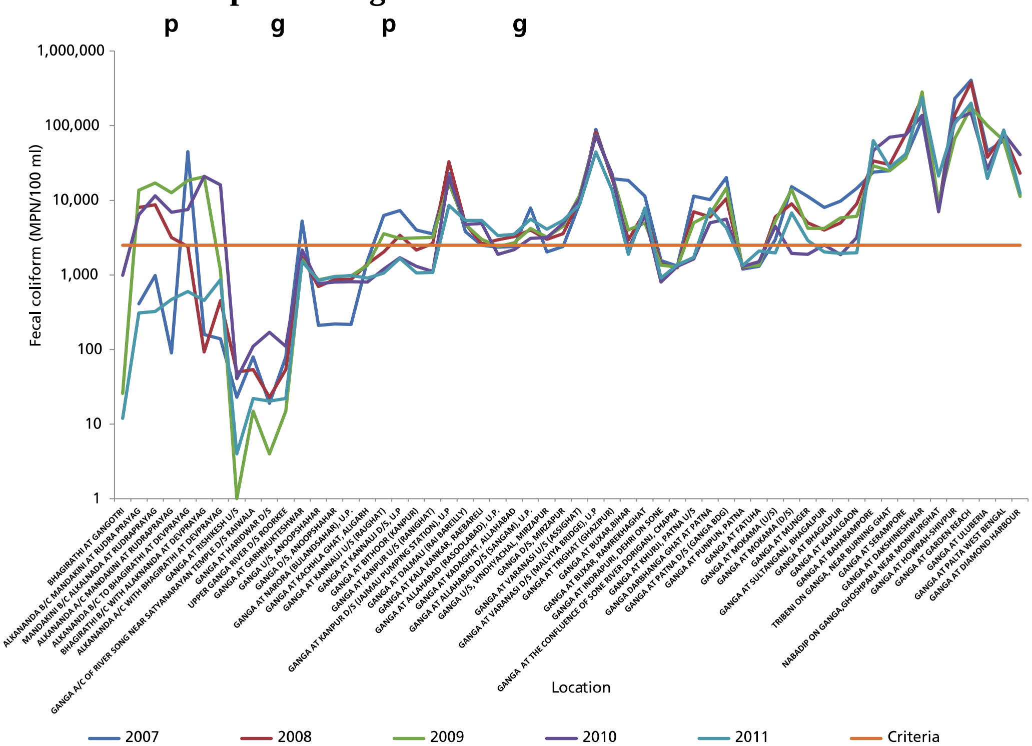
Under the GAP, a sewage treatment capacity of 1092 mld (GAP-I: 869 mld, GAP-II: 223 mld) has been created. In 2009, the Union government re-launched the Ganga Action Plan with a newly constituted National Ganga River Basin Authority. Earlier that year, under the notification dated 20.2.2009, the government gave the river the status of a 'National River'. The key difference being the recognition of the entire river basin as the basis of planning and implementation, precisely what civil society had been advocating for. After more than 25 years there was finally recognition that it is not enough to plan for one city's pollution, without considering the impact on the downstream area. The objective was set to ensure that no untreated sewage or industrial effluents be discharged in the river by 2020, something officials today accept they may renege on.

The GAP (I&II) solely focussed on interception, diversion and treatment of sewage. In 2009, it was accepted too, at long last, that plans for river restoration must take into account the need for adequate water in the river – a minimum, or even better an ecological flow keeping in mind the specific requirements of biodiversity and other factors be it cultural or religious. But what all this means for the river remains ambiguous; Ganga river restoration is very much at a crossroads.

Challenge of pollution remains grim

According to recent estimates of the Central Pollution Control Board (CPCB), fecal coliform, an indicator of pathogenic contamination is well above the stipulated levels considered safe for bathing in the main stem (2,525 km from Gangotri to Diamond Harbour), other than a segment in its upper reaches. But there are worrying signs as increasing trends are recorded in Rudraprayag and Devprayag suggesting untreated sewage discharge and reduced flow in these highly oxygenated stretches for dilution (*see graph 1*). According to a 2009 status report of the Ministry of Environment and Forest, before the launching of GAP, the DO values were recorded well over 4 mg/l and ranged between 6.8-7.2 mg/l in most stretches. Today, pollution levels are a cause of concern in the hotspots – the mega and fast growing cities – along the river. As per CPCB data, the Biological Oxygen Demand (BOD, a key parameter to gauge organic pollution) too is well beyond safe limits for bathing downstream of Haridwar, Kannauj, and Kanpur and after receiving the flush of the city of Varanasi. In the 25 years of monitoring water quality, the station downstream of Kanpur has recorded the highest values in the basin. But in all stretches a trend has emerged; pollution loads are steadily increasing. This is not surprising given that all along this heavily populated stretch, fresh water intake from the river is increasing, but what is returned is only waste.

Graph 1: Ganga annual trends of feacal coliform



Source: CPCB (2012) Overview of Ganga River Pollution

Sewage is clearly the major point source of pollution in the river. The CPCB assessment of 2012 makes public the fact that sewage accounts for roughly 85 per cent of all wastewater, the rest being industrial effluent. The assessment shows that there is also a massive gap between the generation and treatment capacity in the main stretch of the Ganga. The current treatment capacity lags behind at 1208.80 MLD, far less than half of what is required.

It is important to compare this with the 2009 estimate (*see table 1*), which shows that as we invest in sewage treatment capacity, due to the high cost of our technology choices, and lack of political will in making sewage treatment a public spending priority, a significant gap does and will remain. Finally, factoring the utilization of the sewage treatment capacity, which is known to be poor (because of lack of electricity to operate the plant, and the lack of sewage that reaches the plant for treatment because of inadequate sewer networks), more sewage flows untreated into the river.

The main problem lies in the manner in which government agencies estimate sewage volumes and plan for treatment. The estimation of sewage is based on the quantum of water supplied. The assumption is that 80 to 85 per cent of the water supplied in a township is returned as wastewater. But since cities do not accurately measure water supply and private groundwater abstraction, sewage arithmetic is often grossly under estimated or well off the mark. This shows up in the data collected by CPCB for Ganga. The official estimates of sewage under estimates actual discharge of wastewater monitored by CPCB for the main stem of the Ganga by approximately 20 per cent.

Table 1: Sewage generation and treatment capacity created in Ganga

	2009	**2012**
Sewage generation (MLD)	2,638	2723.30
Treatment capacity (MLD)	1174	1208.80
Gap (MLD)	1464	1514.50
% gap: treated versus untreated	55	55

Source: CPCB (2009) and (2012) Overview of Ganga River Pollution

Most cities along the Ganga do not have a complete sewage conveyance system. In Kanpur, Allahabad and Varanasi as much as 70 to 85 per cent of the cities households remain unconnected to the sewerage network (*see table 2*). What exist instead are open drains or *nalas*, which make their way through the crowded cities to the river. In Allahabad as many as 57 drains flow into the river, of which city officials say that 10 drains do not add to pollution as their discharge does not reach the river. But the problem is that this untreated sewage flows in unlined drains adding to the pollution problem, often by contaminating shallow groundwater.

Table 2: Connectivity for sewage treatment plants: UP cities

City	Area of city (ha)	Area with sewerage (ha)	Unsewered area (ha)	Unsewered area (%)	Drains
Kanpur	25,810	7558	18,252	71	37
Allahabad	9,510	2013	7,397	78	57
Varanasi	10,058	1635	8,432	84	23

Source: UP government 2010, Presentation made at the meeting of the Executive Committee of the State Ganga River Conservation Authority, Lucknow

Cities must address the underlying problem of lack of connectivity to sewage systems. Past experience suggests that cities – old and congested – will be unable to lay underground sewer lines and intercept waste before it reaches the river; the infrastructural challenge is not just costly but a time consuming and difficult proposition. The cities are not Greenfield projects – the network needs to be built, or repaired and refurbished in already congested and built up areas. So reality is that while a fully connected system across the old and new city does not happen, the sewage treatment plant is first built, but the drains to intercept sewage do not get completed. The river continues to be polluted.

Who will bear the cost?

The moot point since 1985 has been the funding mechanism. Who will provide the capital and funds for operating sewage treatment plants? The capital costs of sewage treatment plants, in early 2000, ranged from Rs 30 Lakh/ MLD to Rs 60 lakh/ MLD. These costs have now climbed to roughly Rs 1.25 crore per mld, even without the cost of land. Some of the newer, energy intensive technologies cost up to Rs 3 crore per mld. The operation and maintenance costs (electricity, chemicals and labour) are anywhere between Rs 0.60 to Rs 3 per KL, but can increase for tertiary treatment.

If projects under JNNURM-I are used for estimation then the average cost of a comprehensive sewage project, including collection network and treatment plant is anywhere between Rs 3.33-6.00 crore per MLD, and per capita cost would be Rs 4000. But this is widely considered to be an underestimation as the per capita costs are lower than even what is estimated for a comprehensive water supply scheme – Rs 4500 per mld. This lack of clarity on the full costs of sewage networks and treatment is understandable because there have been few instances where such comprehensive sewage system have been built.

The payment for the system – capital and O&M – are a key issue of contest between the Central and state governments. When it began, the programme was funded totally by the central government. But in early 1990, states were asked to invest half the funds. Seven years later, there was a reversal in government policy and this decision was revoked in 1997. It was then agreed, once again, that the central government would spend 100 per cent of the funds.

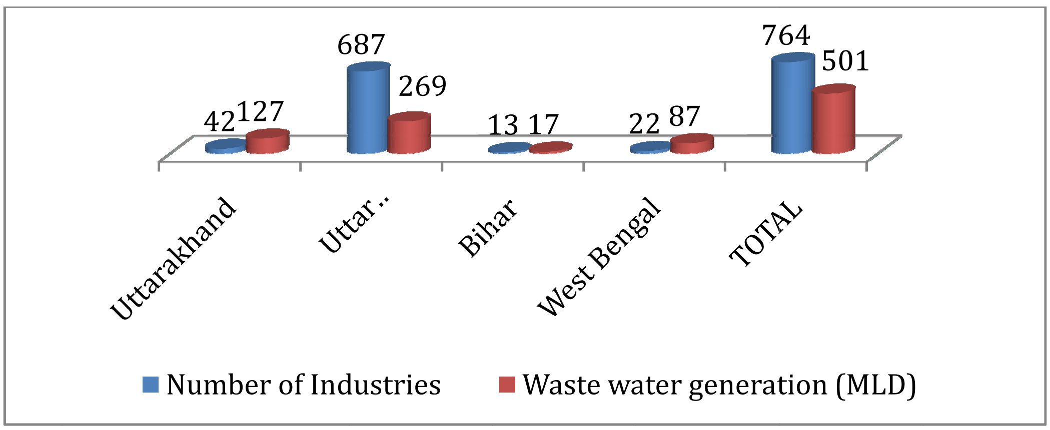
This arrangement did not last for long. In 2001, a new cost-sharing formula was evolved: 70 per cent funded by Centre and 30 per cent by states. Local bodies were expected to contribute one-third of the 30 per cent share of the state. The operation and maintenance of the assets created under the programme was also the full responsibility of the state government and the local body. But this arrangement did not work, because of the poor financial state of the municipal bodies; their expenditures exceeded revenues.

Under the National Mission Clean Ganga, the payment formula has been re-visited. The Centre plans to build projects through a PPP route, which will require the concessionaire to design-build-operate the plants for 5 years. The environment ministry had earlier agreed to the proposal that the operations and maintenance be shared 70:30 by the Centre and states for the first three years. In the second meeting of the NGRBA in November 2010, Jairam Ramesh, then environment minister said that the Central government will bear the full costs of capital, and maintenance for 5 years after which the plant will be handed over to the state government. The assumption is that in 5 years, the funds will be available to run the plant. It is not clear how these assumptions have been made, and how the requisite capacity is to be built given the poor financial state of all city agencies along the Ganga.

Managing Industrial pollution

Industrial pollution into the main stem of the Ganga has been an issue of attention and focus, but without much success. According to an affidavit filed in the Supreme Court by the National River Conservation Directorate of the environment ministry on January 2007, there were 661 grossly polluting industries (each generating over 100 kg BOD load per day) along the Ganga. Of these 66 per cent had installed effluent treatment plants and were stated as functioning as per the effluent discharge norms, while 22 per cent were shut down as the remaining continued to function as defaulting units. In 2012 CPCB estimated that roughly 500 mld of industrial discharge flows into the river from 764 industries. The bulk of these industries – 90 per cent – operate in the stretch of the river that flows through the state of Uttar Pradesh (*see graph 2*).

Graph 2: Uttar Pradesh: problem child

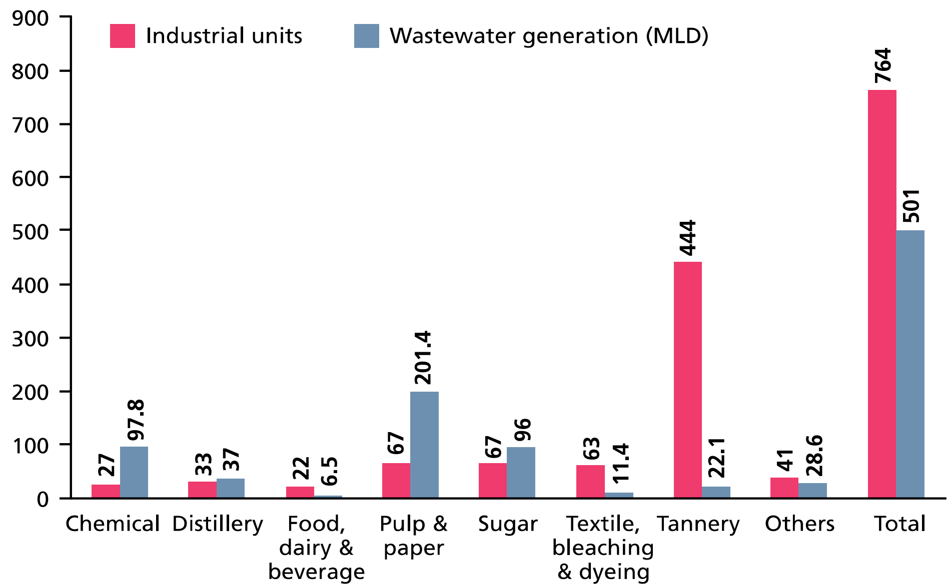


Source: Central Pollution Control Board (2012)

The bulk of sector specific wastewater generation comes from pulp and paper industry, with 67 units generating more than 200 MLD. Tanneries are the highest in number (more than 400 units) but have a lower wastewater output in comparison, generating 22 MLD (*see graph 3*). The problem here is that many of the industries are small scale, where technologies for treatment are inadequate or unaffordable. The problem is compounded by the fact that this waste is both concentrated in stretches of the river where there is no dilution, and toxic because of its high chemical load.

Over the past years, efforts have been made by the judiciary and state pollution control boards to reduce the pollution impact of these industries, but with little success. As a result, the only real difference is seen when industries are given closure or stop work notices, as seen during the recent Kumbh mela. But as this is not a permanent solution, clearly more will need to be done to find ways to reduce the pollution from these industries, urgently and effectively.

Graph 3: Industrial wastewater generation discharged to Ganga



Source: CPCB 2012-13: Overview of Ganga River Pollution

The fallacy in the pollution control system is that you can’t shut down a city. Kanpur, for instance generates more than 400 million litres of sewage each day. Only 171 MLD is treated, as the remaining is discharged untreated in to the river. For industry it is different. The Prime Minister’s Office in the run up to the Maha Kumbh released a statement in January directing state pollution control boards to ensure that industry ‘comply with prescribed norms’.

There are more than 300 functioning tannery units in Kanpur. Respecting the faith of the pilgrims visiting Allahabad, the tanneries association voluntarily agreed to stop operations before the six main bathing days. But the state government had other ideas. On January 3, a letter from the government directed tanneries to remain shut during the entire mela period except January 10-13, February 22-24, and March 6-9. An estimated 100,000 people’s earnings were affected; clearly shut down is not a viable long term solution. According to data logged in real time monitoring station installed downstream of Kanpur, the closure resulted in a significant reduction in BOD, which exceeded 20 mg/l in the pre-mela period, to between 6-10 mg/l. The chemical oxygen demand too, which measures the strength of biodegradable and recalcitrant matter in wastewater, reduced due to the industrial shutdown and release of freshwater upstream.

Kumbh Mela, 2013: learning from Allahabad

Maha Kumbh in Allahabad has perhaps no parallel in terms of the sheer size of the congregation – with over 120 million people visiting the city of the confluence of the Ganga and Yamuna over 55 days. During this Kumbh, the Central and state government's efforts to combat pollution have had measureable impact on water quality. These steps tell us that it is possible to reduce pollution in the Ganga and all other rivers of the country. The steps taken were as follows:

First, more water is allowed to flow in the river. The UP government mandated the irrigation department to release 2,500 cubic feet per second (cusec) (71 cubic metre per second/cumec) from January 1 until February 28 to ensure adequate depth and dilution of expected pollution loads at the bathing site in Allahabad. Additionally, two days before and one day after each of the 6-shahi snan days, the state irrigation department released 11.3 cumec, over and above the aforementioned minimum stipulated flow.

Secondly, Allahabad broke convention in intercepting sewage from open drains to convey to treatment plants. Given that the city does not have underground sewage, the built plants did not ever work to capacity. This changed during the Kumbh as sewage was lifted from nearby open drains and treated, without underground drainage.

Thirdly, the government took tough measures against polluting industries—mainly tanneries and distilleries—discharging into the river. In 2012, Central and state government's had already directed one-fifth of the tanneries in the upstream city of Kanpur, which were failing to meet the discharge norms to shut down. During the Kumbh a complete closure of all tanneries in the city was ordered.

Fourthly, the city experimented with innovative ways of treating sewage—by using bio-remediation techniques. The preliminary reports suggest that this system is working but needs careful scrutiny and constant monitoring. During the project period the Uttar Pradesh Pollution Control Board (UPPCB) took 19 grab samples from 39 drains, where bio-remediation was being tried. According to their data there was a 40 per cent reduction in BOD using this technology. A report assessing this technology experiment is awaited, which will help review its effectiveness and options for the future. The current sewage generation for Allahabad is 240 MLD, based on CPHEEO water supply norms of 150 litres per capita daily. But the city, as with all cities in India, bases its sewage generation on a thumb rule or 80 per cent of water supply estimates.

The reality is that the per capita supply in the city is 190 lpcd. The authorities admit the flaw in the system; there are 67 official tube wells and thousands of other private abstraction structures, which that the city is currently generating a quantum of sewage projected for 2025.

Before December 31, 2012, Allahabad had two sewage treatment plants, set up under the Ganga Action Plan with total capacity to treat sewage 89 MLD. Since then, with the intervention of the High Court, five more treatment facilities bolstered the treatment capacity to 211.5 MLD, which is expected to increase by a further 42 MLD after commissioning of all units, expected by June later this year.

Most areas in Allahabad still remain unsewered and therefore majority of the treatment plants remain underutilized. The authorities, with pressure from the judiciary, have taken the decision to lift sewage from the storm water drains which carry sewage. Due to poor implementation of bylaws, and the political establishment allowing illegal and unauthorised buildings to come up, the aim of 100 per cent sewerage may remain a pipe dream for the foreseeable future. The existing length of sewers in Allahabad is 595km; sewerage capacity needs to be more than double this length to deal with the present generation. There are 57 drains in the city, but each year minor drains appear, which carry sewage from unauthorised and illegal colonies.

Many of these drains discharge untreated sewage to the Yamuna and Ganga. Authorities argue that sewage systems cannot be re-laid overnight and sewage easily re-routed. The use of microbes to break down the organic matter, a process known as bioremediation was discussed in the High Court as an interim solution. “We make it clear that it shall be open for the authorities to treat the sewage flowing in the river through bio-remedial technique but said treated water should not be thrown in to the river and be used for some other purpose,” announced the two member bench last year while hearing a public interest litigation on Ganga pollution. The city agencies finally decided to treat the sewage in 35 untapped drains using a microbial solution supplied by a Ghaziabad based firm. For this purpose the state government sanctioned 2.2 crore. Although the authorities agree that this may not be a proven treatment practice, they state that the colour and odour in the drains reduced markedly.

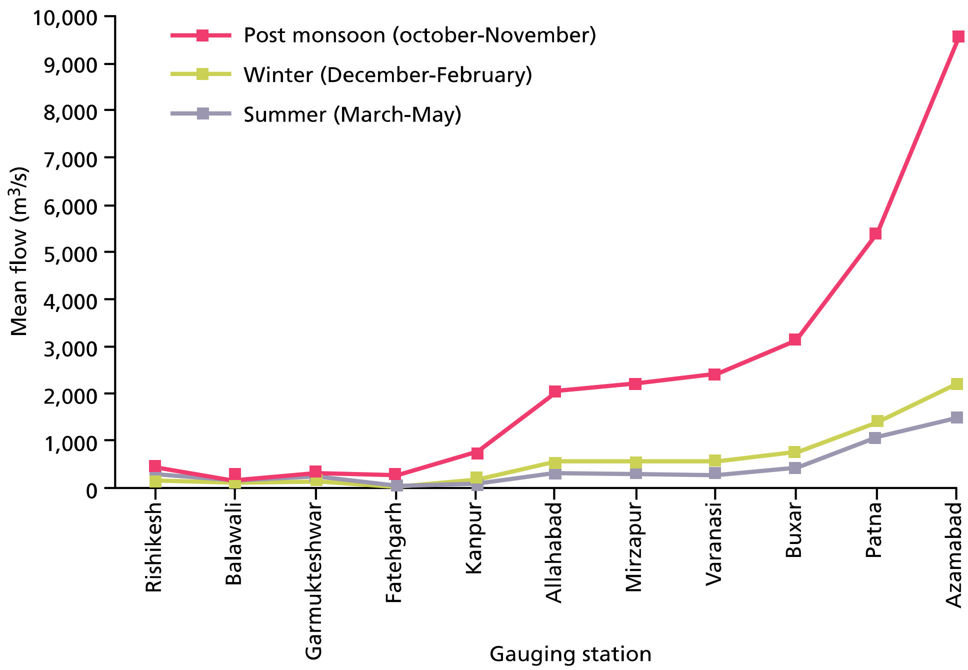
The need for dilution

The annual average rainfall in the Ganga basin varies between 390 to 2000 mm and more than three fourths is received in the four monsoon months. There is large differential in lean (December to May) and high season flow as a result.

The Ganga, more so than other rivers has a self-cleansing ability, which allows for assimilation and treatment of biological waste. But in the current context, where withdrawal from the river is much higher than the discharge of waste, deterioration of water quality is inevitable. In the upper reaches of the river, where the oxygenating abilities of the river are the highest, there are growing signs of contamination. This suggests that even here, water withdrawal for hydroelectricity is endangering the health of the Ganga. As the river reaches the plains, the water withdrawal hits the highest point for irrigation and drinking water (*see graph 4*). In the stretch of the river – from Rishikesh to Allahabad, during winter and summer months, there is almost no water. In other words, the river stops flowing. But wastewater flow does not ebb. The river, then receives only waste and turns into a sewer.

The Chief Minister of Uttar Pradesh during the third meeting of the NGRBA in 2012 said it would not be possible to maintain 200 cumecs flow from Narora to Allahabad as suggested by non government organizations and activist groups. The virgin discharge in the non monsoon period is 35-65 cumecs and the government is releasing half as ordered by the Allahabad High Court, he stated at the meet.

Graph 4: Seasonal discharge for the Ganga



Source: CPCB 2012-13: Overview of Ganga River Pollution

It is essential to note that rivers without water are drains. It is also a fact that this release of additional water potentially deprives upstream farmers of their source of irrigation, cities and industries too. The water for ecological flow becomes contested. But this flow must be mandated so that it comes from the state government's own allocation of riparian water. The government has a choice to build storage to collect monsoon water for dilution within its territory or to 'release' water to rivers and make other choices for use in agriculture, drinking or industry. In other words, all users must be forced to plan for water needs based on what the river can spare, not what they can snatch.

Two, plans will accept that urban areas will not catch up with the infrastructure to build conventional sewage networks at the scale and pace needed for pollution control. Therefore, the conveyance of waste must be re-conceptualized and implemented at the time of planning treatment plants. This will then lead to innovative ideas for controlling pollution in drains – in situ – treatment of sewage as well as local treatment and reuse using non mechanical less energy intensive methods.

Also as the plans are premised on the acceptance on non-availability of sewerage networks then discharge of treated effluent will be carefully reconsidered and designed. The treated effluent will not be 'mixed' with the untreated waste in drains. Instead all treated effluent will either be designed for reuse or it will be discharged directly into the river.

Three, plans will accept the need to design affordable water and sanitation solutions. Even if current situation requires Central government assistance for capital and operational costs, this is not tenable in the long run or for the scale of pollution control infrastructure that is required to clean the river. As long as states do not have the responsibility to build sewage treatment systems, they will have no incentive to release more water for pollution control. Therefore, there will be a clear conditionality in Central government funding, which is matched to the quantum of ecological flow released by the state in the river.