Central Water Commission

सत्यमेव जयते

Report of the Workshop on Environmental Flows for Strategic Planning for the Ganga Basin

Le Meridien Hotel, New Delhi, 5-6 February 2015

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[1] This report was prepared by Professor Mike Acremen, a consultant for the World Bank, under the overall guidance of Dr. Rafik Hirji (the team leader for the workshop) of the World Bank. The report preparation benefitted from inputs from Professor Jay O'Keeffe and Mr. Robert Speed (consultants for the World Bank) and detailed comments from CWC, India.

Contents

1.

Workshop objectives

This workshop on environmental flows for strategic planning for the Ganga basin was organised for the Central Water Commission (CWC) of the Government of India by the World Bank. Environmental flows are related to Integrated Water Resources Management (IWRM) in fundamental ways and IWRM was a topic of a recent CWC workshop held on February 2-3, 2015 in Delhi. The goal of this workshop was to contribute to the evolving practice of environmental flows for the Ganga. The specific objectives were to (i) develop a common understanding of the environmental flow concepts and how they relate to IWRM; (ii) inform the planning process for Ganga rejuvenation by raising the awareness of senior government officials of the importance of environmental flows to river health, and (iii) explore the available options for undertaking comprehensive environmental flow assessments as one component of a strategic approach to river basin planning for sustainable economic development. The workshop supported the Ganga basin strategic basin planning process.

Breakout Group discussion on Legislation and Policy for Eflows

2. Background

The Ganges is the most populated river basin in the world and is home to half the 1.25 billion population of India The basin provides over one-third of the available surface water in India and is the focus of over half the national water use – 90 percent of this being in irrigation. Water is a State subject and water management is largely undertaken at the state level. Currently, there have been no basin-wide efforts for volumetric water planning and allocation. With increasing demand for water in multiple sectors a more strategic approach is now warranted.

The ecological health of the Ganga River and some of its tributaries has deteriorated significantly as a result of high pollution loads (from point and non-point sources), high levels of water abstraction in a few river reaches for consumptive use (mostly for irrigation, but also for municipal and industrial uses), and lack of river flows during the lean period. River rejuvenation will require a combination of interventions basin-wide that are coordinated to reduce pollution loads from point and nonpoint sources, to improve water use efficiency, to augment flows during lean period and to maintain appropriate environmental flows[2].

The Government of India has committed to an ambitious goal of rejuvenating the Ganga and is allocating significant funds to address the problem. A strong evidence base is required to inform the rejuvenation process and ensure that these funds are invested effectively and efficiently. The scale and complexity of the problem requires detailed analysis. While significant analytical effort has been undertaken in the last two years that provides a valuable starting point, there remain many unknowns and uncertainties that require detailed investigation.

In particular, as yet there is no robust modelling framework that can assess the consequences of alternative interventions (or suites of interventions) for the environment (including water quality and ecological health of the river) and for different water use sectors. Interventions may include, for example, new sewage treatment facilities, treatment of industrial effluent, environmental flows, increased water use efficiency, improved land management, reconnection of the river with its floodplain wetlands, additional water storages and changed operation of existing water resources infrastructure.

Ganga basin rejuvenation will be a complex, multi- sectoral, multi-jurisdictional and multi-institutional challenge. In addition to the technical complexity and scale, Ganga rejuvenation in an inherently "wicked problem" given the wide diversity of stakeholder values and perspectives and the political and institutional dimensions that come from distributed responsibilities across multiple jurisdictions and institutions. The restoration works must therefore be coupled with sound technical analyses, a well-structured stakeholder engagement and consultation process, and appropriate governance arrangements to guide both the technical and consultation work. The technical analyses, engagement processes and governance arrangements are the critical pillars of strategic basin planning.

The determination of environmental flows is simply one vital aspect of strategic river basin planning or integrated water resources management (IWRM) at the basin level – it is a part of determining an agreed balance between the range of economic, environmental and social outcomes from the management of finite water resources. Strategic Ganga basin planning will also incorporate detailed

[2] Environmental flows are defined as the quality, quantity and timing of flows required for maintaining the assets, functions, processes and resilience of aquatic ecosystems that provide goods and services to people.

Dr AD Mohile, Ex-Chairman, CWC taking part in group activity

modelling of the basin's water resources and water uses, conjunctive management of surface and groundwater and integrate environmental flow assessments. The 2012 National Water Policy has embraced IWRM as a framework for guiding and informing water resources planning, development and management decision making in India; it provides the policy foundation for adopting a basin wide approach for the rejuvenation of the Ganga basin.

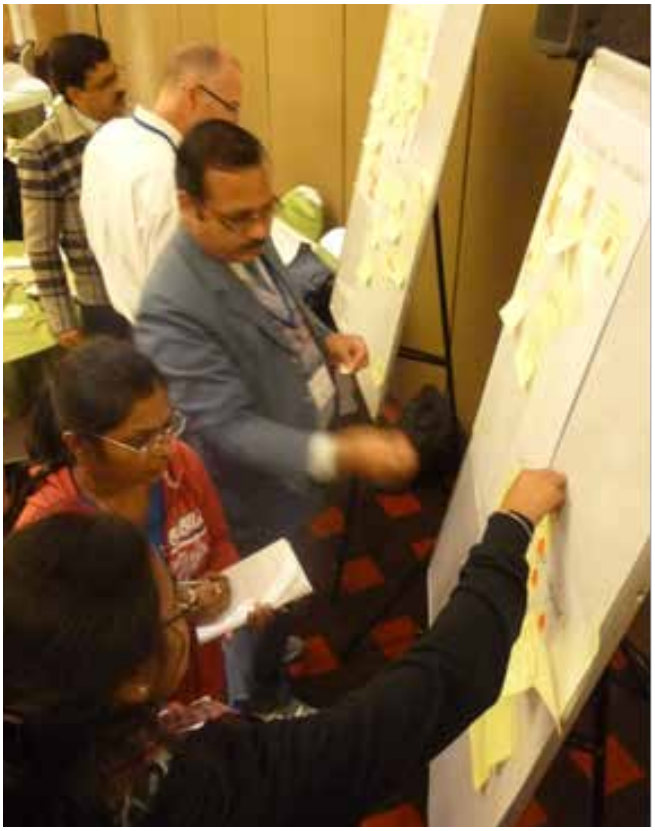
Recognition of the importance of environmental flows in India is growing. The Water Quality Assessment Authority (WQAA), chaired by the Secretary MoEF, constituted a committee, CWC to suggest a minimum environmental flow.

This Committee - under the chairmanship of Member, River Basin Management wing of CWC - recommended a figure of 10% of the flow as the minimum environment flow for the Ganga. This work and other recent work on environmental flows in India generally, and in the Ganga river basin specifically[3], had laid an important foundation by introducing this complex subject, describing the available environmental flow assessment methods, identifying the social and ecological issues on the Ganga, conducting initial environmental flow assessments and stimulating dialogue to support hydropower project planning and development. However, the discourse on and practice of environmental flows was still in its infancy and evolving. Few environmental flow assessments had been carried out and even fewer had been supported by adequate data. Most assessments had lacked adequate hydrological or ecological information or both. Hydrological, water quality, ecological, and social information, as well as information on water use, were essential for an effective environmental flow assessment.

Environmental flows are a key element of integrated water resources management but in practice they have rarely been considered in the water resources planning, development and management decision making process. The discourse in India also needs to be broadened beyond hydropower to address all important water uses and opportunities for improving water uses. Environmental flows have yet to be mainstreamed into water resources planning, development and management decision making. The Government has yet to develop a clear policy or technical guidelines or operational procedures for conducting reconnaissance level or comprehensive environmental flow assessments or to support their implementation or enforce compliance. Environmental flows are also not simply a hydropower issue, but a matter of ensuring an acceptable environmentally appropriate flow regime in the context of all users and

[3] This includes, for example, the 2014 WAPCOS Draft final report for a "Study, for Assessing and Strengthening Monitoring and Institutional Mechanism for Appropriate Environmental Flows for Himachal Pradesh", 2012 WWF report "Assessment of the Environmental Flows in the Upper Ganga basin" WWF report "Environmental flows for Kumbh 2013 at Triveni Sangam, Allahabad, the Wildlife Institute of India report "Assessment of Cumulative Impacts of Hydroelectric projects on aquatic and terrestrial biodiversity in Alakanda and Bhagirathi basins, Uttarakhand", the IWMI Research report "An Assessment of Environmental flow Requirements of Indian River Basins", and 2011 IIT Consortium report "Environmental flows State of the art with special reference to rivers in the Ganga river basin"

impacts on the flow regime – especially the major consumptive use of irrigation, as well as ensuring hydrological variability and important ecological connectivity through the river system (upstream-downstream, and river-floodplain).



Mapping of priorities by participants

Environmental flow assessments need to be informed by science and implementation, guided by systematic monitoring and adaptive management. An effective environmental flow assessment needs to be under-pinned by science and supported by key stakeholders. Implementation of environmental flow regime needs to include regular monitoring of impacts of flow releases to verify and evaluate if the desired environmental outcomes are being met or not, and an adaptive management framework that is flexible and able to integrate lessons from monitoring by modifying the operations of flow release structures. Implementation is a process of measuring, learning and refinement that is underpinned by science.

The Government of India wishes to raise awareness of and address systematically this vital dimension of river protection or rejuvenation (especially for the Ganga). It wishes to better understand international best practice and access global knowledge and expertise, and guide and coordinate various efforts in environmental flow assessment and implementation to more systematically support the planning, development and management of the Ganga river basin. This dimension of river protection would complement the ongoing clean-up efforts on the Ganga.

3.

Workshop format

Annex 1 contains the workshop program. The workshop was organized around a series of presentations and group discussions that brought together academics, practitioners and water managers who hold knowledge of the current best practice approaches and tools for determination, implementation and monitoring of environmental flows relevant to the Ganga basin. These include Indian water and environmental management experts and specialists in environmental flows from across the globe with experience that could support work in the Ganga.

The aims of the presentations were to examine international best practice, relevant case studies from around the world and current local efforts in environmental flow assessment.

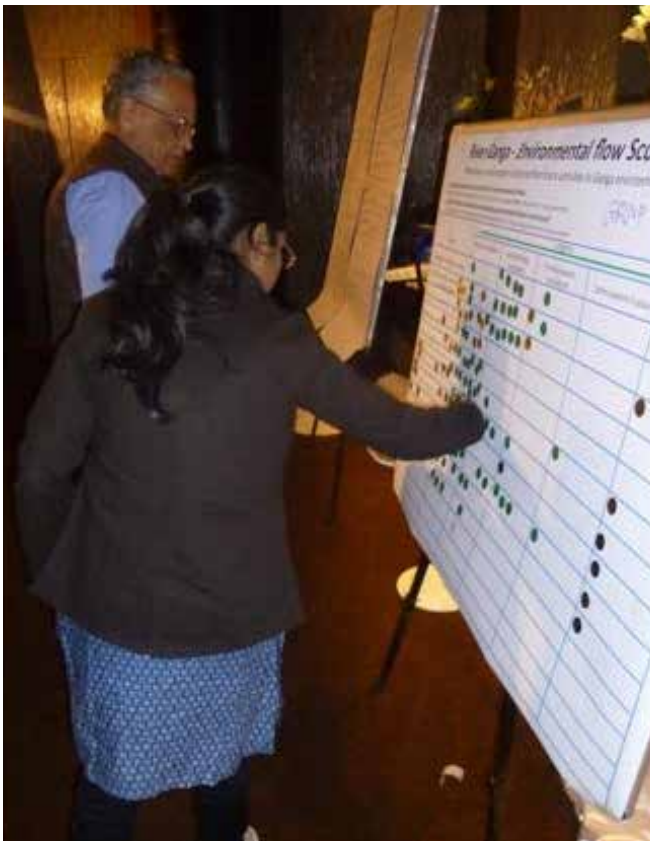
The working sessions (group discussions) were designed to build understanding of environmental flows, to allow participants to express views and to develop a strategy for the future based on inputs from all delegates. Three working sessions followed the following process:

- Highlight issues, barriers and constraints to environmental flows in the Ganga
- Suggest solutions to constraints to determine and implement environmental flows
- Identify steps for the establishment and implementation of environmental flows as part of the Strategic Planning for the Ganga basin

4.

Participants

Workshop attendance was on a by-invitation basis. Invitations were sent to senior officials of relevant central and state government agencies with responsibility for water and or environmental management in the Ganga basin, as well as academics, NGOs and consultants with relevant experience. Around 100 invitations were issued across central agencies (MoWRRDGR; CWC; NMCG; MoEF&CC, MoS; NIH), state agencies (Uttarakhand, Uttar Pradesh, Bihar, Jharkhand, West Bengal), IITs (Kanpur, Delhi, Roorkee, Gandhinagar), NIE, WWF, TNC, IWMI and universities. Annex 2 contains the list of the workshop participants.



Mapping of priorities by participants

5.

Issues highlighted by chairs and panel members

Keynote address by Additional Secretary, MoWRRDGR

Dr. Amajit Singh, Additional Secretary, Ministry of Water Resources and River Development and Ganga Rejuvenation stated that allowing River Ganga to degrade was like cutting-off the branch of the tree on which we sit, as it was so important to the people of India. The Ganga is a life line tied to our religion and feelings. There was a need to review the manner in which water is used in India. Agriculture productivity ranged greatly with some areas producing only 1.5 tons per ha, whereas in other countries, such as Ukraine, yields were 9 tons per ha. Only 20-30% of the water provided to crops is actually used by the crops themselves and too much water was going to the sea. So there is great potential to leave more water in the river.

River pollution was a major issue with only 20% of sewage treated, but even this was often not working properly. Cleaning-up pollution and maintaining environmental flows were two parts of the same issue and environmental flows must be maintained in the lean period. The subject of environmental flows was in its infancy and India needed to learn from best practice including experience from abroad. The economics of environment would be a critical factor in defining water allocation.

Stakeholder engagement was as important as hydrology. The National Water Policy accepted by chief ministers in India is built around the concepts of IWRM, which include environmental flows. A mechanism for implementation was the Ganga River Basin Authority, which included all 11 riparian states. Dr Singh thanked the World Bank team for helping to organize the workshop. The workshop would address important issue in our lives.

Keynote address Chairman CWC

Shri A.B. Pandya emphasised that water is essential for all life and demand in India is rising. Almost 80% of precipitation falls in the months June to September requiring artificial storage to provide water for the remaining period of the year. The most significant factors for river health were pollution from industrial and domestic waste, fertilisers and pesticides. Preventing pollution is a key priority, but assuring adequate flows is equally important, as indicated in the 2002 and 2012 National Water Policy. Nevertheless, he indicated that 'dilution (alone) is not the solution to pollution'. Mr Pandya underlined the need for analysing the issue of environmental safeguard measures in the context of "if not" scenarios. He elaborated that the environment concerns should also include the scenario without the project in place or in which an alternative project had been adopted[4].

Insufficient environmental flow was primarily a lean season problem, with lean season flows comprising around 12 % of total flows. There was currently inadequate water storage to capture wet season flows for use in the lean season and building additional storage could provide the capacity to help deliver environmental flow needs. There was a pressing need to adopt Integrated Water Resources Management to coordinate development

[4] For example, a thermal power station in place of hydro power plant would require mining of a large tract of land on a continuous basis and addressing irreversible consequential environmental concerns.

of land and water in synergy, which would permit environmental flows to be considered to meet the needs of all stakeholders.

The Central Government had set up the National Ganga River Basin Authority (NGRBA) to undertake planning, financing, monitoring and coordination. In turn, the National Mission on Clean Ganga was established to accomplish the mandate of NGRBA. Various studies had produced a wide range of estimates of environmental flow needs, which had created uncertainty for project planning. Additional data and a consistent method were urgently required. There would inevitably be a trade-off between water resources development and river health. The impact on all sectors needs to be considered when allocating water. Some 75% of Ganga flow is diverted to agriculture during the lean season and India needed to improve water use efficiency with, for example, sprinkler and drip irrigation. Operation of dams, such as at Tehri, could help augment river flows where needed.

Keynote address Work Bank

Dr. Bill Young emphasized that environmental flows were about enabling sustainable economic development not constraining it. The science of environmental flows was new and there was a requirement for more data and better methods. However, perfect data and science would never be achieved so it was important to define 'sufficient certainty' to make decisions. The monsoon climate in India made river flows very seasonal. Dams were storing water between seasons but not between years. All global circulation models showed climate change would bring earlier onset of the monsoon. There was a need to think about what these changes might mean economically and ecologically.

6.

Lessons from international studies

International experts made a series of presentations on environmental flow studies worldwide that contained issues relevant to the Ganga.

World Bank review of global experience

Dr. Rafik Hirji explained three ways in which environmental flows are embedded within Integrated Water Resources Management. He summarized the main findings of a global review of environmental flows in water resources policies, plans and projects carried out by the World Bank. He highlighted the need to balance infrastructure for reliable, adequate and safe water and productive uses of water with environmental protection and delivery of ecosystem services for human well-being. Infrastructure development had originally been the domain of water engineers, but progressively more economists, sociologists and ecologists had become engaged in the debate that now included displaced people and downstream impacts.

The initial focus of environmental flows was for new infrastructure projects, but now it also included rehabilitation and catchment/basin planning and water/environmental policy. Deciding on the level of environmental flow was a social choice and not a technical decision but a decision that needs to be informed by sound science and social input. The World Bank has produced a book containing findings and recommendation from a review of 17 case studies of environmental flows within diverse water resources contexts (and an accompanying report on the 17 case studies). This book and report are referenced in footnote number 5 below.

Three diverse case studies particularly relevant to the Ganga were elaborated. In Tanzania, an endemic toad had been discovered downstream of new hydropower development on the Kihansi River after the hydropower plant construction had started, highlighting the limits of the EIA that had been undertaken. In addition, there was a lack of policy guidance to cover this and significant and expensive mitigation measures were needed. In central Asia, excessive upstream abstraction for irrigation had led to a major reduction in the size and volume of the Aral Sea, which had led to a loss of livelihoods and had created health problems. Rehabilitation had focused on the northern Aral Sea, as the cost of rehabilitation of the entire Sea was considered too prohibitive, and required both transboundary coordination and new infrastructure. In the over-abstracted and dried-up Tarim basin of China, improvements in irrigation efficiency and water management practices including institutional reforms and strengthening had been important to providing flows to restore a green belt along the River Tarim and terminal lakes.

Lessons and challenges related to the integration of environmental flows in water policies, plans and project case studies were presented and implications for integration of environmental flows in India and the Ganga basin were discussed. A hardcopy of the environmental flow book and soft copies of six (6) books, reports and technical notes on environmental flows produced by the World Bank[5] were shared with all participants.

[5] These included: (i) Hirji, R and R. Davis (2009a) Environmental flows in water resources policies, plans and projects: Findings and Reccomendations, Washington, DC: The World Bank; (ii) Hirji, R and R. Davis (2009b) Environmental flows in water resources policies, plans and projects: Case Studies, Washington, DC: The World Bank; (iii) Davis, R. and R. Hirji, R., eds. 2003. Environmental Flows: Concepts & Methods. Water Resources and Environment Technical Note C.1. Washington, DC: The World Bank; (iv) Davis, R. and R. Hirji, eds. 2003. Environmental Flows: Case Studies. Water Resources and Environment Technical Note C.2. Washington, DC: The World Bank; (v) Davis, R. and R. Hirji, eds. 2003. Environmental Flows: Flood Issues. Water Resources and Environment Technical Note C.3. Washington, DC: The World Bank; and (vi) Krchnak, K, B. Richter and G. Thomas (2009) Integrating Environmental Flows into Hydropower Dam Planning, Design and Operations. Water Working Note No. 22. Washington, DC: The World Bank.

Prioritizing action plan

India, Brazil, East Africa

Professor Jay O'Keeffe explained that during his research and training in more than 16 countries worldwide over the past ten years, environmental flows had become a standard component of sustainable water resource management in almost all countries. He drew on environmental flow assessment studies which he has facilitated in East Africa, Brazil and India to illustrate the following lessons. At the start of the environmental flows process in new countries/regions, the best approach was to choose a relatively unstressed small river that is not currently over-allocated for pilot studies. A quick implementation of environmental flows here provides a powerful example of the benefits of environmental flows. Social, cultural and spiritual values that depend on the flow characteristics of a river can be used to motivate the needs for environmental flows, and are often well-aligned with biodiversity objectives. A detailed environmental flow assessment, carried-out before a river is over-allocated, can be incorporated into future plans for water resource development, without necessarily constraining future allocations. In rivers that have already been over-allocated, immediate options for restoring flows are more important than a detailed environmental flow assessment. Monitoring of the effects of restored flows can then be used to refine environmental flow requirements. In large rivers, macro-processes such as sediment transport and floodplain connections

are often more useful indicators for assessing environmental flows than the flow-dependent species, for which some habitat will still be available in large rivers, even at very low flows.

Australia

Mr. David Papps, the Australian Commonwealth Environmental Water Holder (CEWH), presented an approach to actively managing environmental water in the Murray-Darling Basin, Australia. The CEWH is a statutory position, created under the Australian Water Act 2007, and charged with responsibility for holding and managing water entitlements for purpose of protecting or restoring the environmental assets of the Murray-Darling Basin.

At that time, the CEWH held water entitlements for an average annual volume of 2.25 billion m3. These entitlements were equivalent to entitlements held by other water users, such as irrigators, and the actual volume available to the CEWH varies annually based on the seasonal availability of water, in the same way that entitlements for irrigation are also adjusted. The entitlements held by the CEWH had primarily been acquired through the voluntary purchase of existing water entitlements on the water market, or via investments in irrigation efficiency measures, with some of the "saved" water transferred to the CEWH. Decisions on how to use the environmental water held by the CEWH were made based-on the Murray-Darling Basin Plan and accompanying Environmental Watering Plan, the Basin-wide Environmental Watering Strategy, and an annual prioritisation process. This could involve, for example, water being released from a reservoir at a time to maximise its benefit for downstream ecosystems, such as an important wetland. Responding to a query about e-flow in Murray Darling Basin, it was indicated by Mr Papp that the total Environment flow release target to be achieved by year 2019 was 3.62 BCM, which was about 11.4 % of the mean annual average flow.

Key lessons for the Ganges included: (i) the importance of a strong system of water entitlements to support and protect the implementation of environmental flows, including the importance of placing a cap on total water abstractions (ii) the criticality of having clearly identified objectives for the use of the environmental water and (iii) the importance of a comprehensive monitoring program to support adaptive management.

China

Mr. Robert Speed presented cases on river basin planning and environmental flows in China. China had recently revised the master basin plans for the country's seven major river basins. In contrast to traditional "technical" approaches to planning, this process had required a more strategic approach. Such an approach recognised the complexity of issues in the basin, the critical role of water in supporting economic development, and the trade-offs required in balancing competing interests. The process had also relied on strategic environmental assessments to help prioritise freshwater ecosystem services as part of the trade-offs.

Examples of environmental flow issues and assessments in the Yellow and Yangtze Rivers were also presented. These case studies highlighted the range of impacts on river function that can result from changes to the flow regime, and particularly the impacts on river processes such as the transport of sediment. Changes to sediment movement had increased flood risks in the lower Yellow River, and had contributed to lakes becoming disconnected from the main-stem of the Yangtze. The major lessons for the Ganges were (i) that decisions on how much water to allocate for environmental flows is a socio-political process, but one which should be undertaken transparently and informed by the best available science and (ii) environmental flow assessments need to be based on clearly identified objectives for the river basin.

Europe

Professor Mike Acreman presented a case study from the River Thames, UK, whose river basin is only 10,000 km2, but is home for 15 million people. In 1858 the smell of the Thames from

untreated human and industrial waste was so bad in London that Parliament was suspended, at a time of major cholera outbreaks in the city. This prompted installation of a new sewerage system. The Thames had been subject to environmental improvements for the past 150 years. This started with preventing point source pollution, but it was realized that sufficient flow in the river was vital to restore river health and associated ecosystem services that deliver human benefits. Thus the recent focus had been on implementing environmental flows. The major investments involved have been worthwhile, resulting a return of key ecosystem services; for example salmon (a fish very sensitive to river flow and quality) were recorded in 2012 and people's spiritual reconnection with the river had been re-established with use of the river for bathing, boating, fishing and general recreation.

The Thames won the 2010 International Theiss River Prize for an outstanding world-class restoration achievement. The European Water Framework Directive now provided consistent objectives for all rivers of at least Good Ecological Status, or Good Ecological Potential (where rivers are heavily modified). Implementation across Europe had required considerable investment in harmonization of practices and procedures. The Thames case study had two major lessons for Ganga. First, the need to set a long term goal, recognizing river restoration may take many decades, but with clear achievable short-term steps. Second, the requirement to integrate environmental flows with pollution prevention.

In discussion it was felt that these international case studies could offer useful lessons if considered appropriately. In India precipitation was limited to monsoon months that occured over a period of about 30 days. Furthermore, the Ganga had some unique attributes, particularly the combination of large floodplains, high population, high use / management and very seasonal climate with high water availability during monsoons. In addition, there were no established property rights. In a democracy government sets the aims and makes decisions on environmental flows following consultation with stakeholders; science just defines flow needed to achieve selected aims. Implementation of environmental flows in South Africa had been difficult because of the nature of the law and more flexible aims might be advisable.

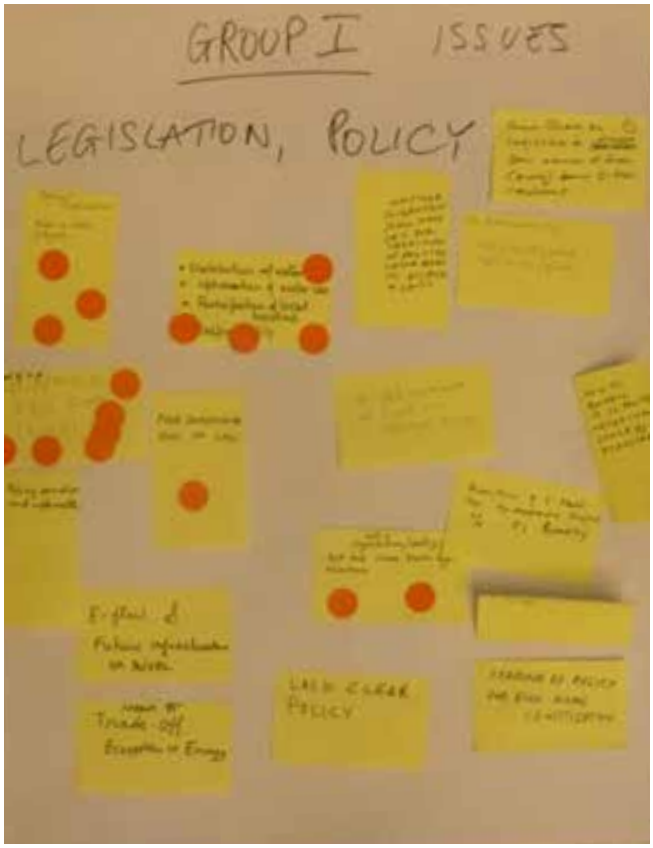
7.

Lessons from Ganga studies

Indian experts made a series of presentations on environmental flow studies and issues in the Ganga.

Ganga River Basin hydrological regime

Dr. William Young presented the work of Dr. Sandhya Rao on water resource availability figures for various tributaries and main-river reaches of Ganga, plus the locations of dams, canals and irrigation systems. For a series of locations on the river network he presented the percentage change in annual basin outflow compared with the natural (pre-development) situation. For example, current annual flows from the upper Yamuna were 51% of natural, whereas flows from the Ghaghra were 34% of natural. Complementary data were presented on water available within each state.



Output of Group Activity on Legislative & Policy for Eflows

A series of ecologically significant flow parameters was presented, including highest monthly flows, lowest monthly flows, highest and lowest flow volume, persistently higher and persistently low flows (where flows were keep artificially high or artificially low for long periods by river regulation) and seasonal flow shifts. These parameters were related to ecosystem health, such as light penetration, habitat availability or drying stress. These parameters had been applied to various river locations in the Ganga basin (Chambal, Ken, Sind, Yamuna, Betwa) and colour coded, e.g. red for major changes in parameters from natural.

Socio-Economic Values of wetlands

Dr. Ritesh Kumar highlighted the important economic values of the River Ganga and its floodplains and wetlands, plus non-market values including religious and cultural heritage. He explained how hydrological regime regulation and modification had compromised river ecosystem integrity and the high costs of the loss of ecosystem goods and services were not adequately considered in decision-making. The Kanwar Jheel wetlands, for example, were a source of livelihoods for 15,000 fishing and farming households, held significant archaeological and cultural significance and supported large populations of migrating water birds. Due to water management, the area of wetland had reduced from over 7000 ha in 1980 to 4000 ha in 2010 with a major loss of fisheries and water birds, breakdown in social structure and loss of flood water storage. This highlighted the need for assessment of trade-offs in water development options assessments.

Workshop in progress

Ecosystem Services Perspective

Professor Vinod Tare explained the range of ecosystem services provided by the River Ganga including those of provisioning (food, fibre, water), regulating (flood attenuation, preventing of salt water intrusion), cultural (recreation, spiritual fulfilment) and supporting (nutrient cycling, soil formation and biodiversity maintenance). The floral and faunal species and communities and the services they deliver, varied within the different parts of the Ganga (Himalayan mountains, Gangetic plains and estuarine areas). These were threatened by a range of pressures including habitat fragmentation, shrinkage, alteration, pollution, invasive species and encroachment. Fish catches at Allahabad had declined from over 1300 kg per km of river in 1950 to 300 kg in 2010. Environmental flow requirements would depend on the objectives for the river health (excellent, very good, marginal, poor or dead). Professor Tare presented some typical daily hydrographs that suggested environmental flow needs could be around 40-50% of natural flow depending on the time of year.

Ganga environmental flow assessments

Mr. Suresh Babu presented environmental flow assessments led by WWF as part of its Living Ganga Program focusing on the upper Ganga, above Kanpur. The assessments included by technical and social processes and considered all key aspects associated with Ganga including religious and spiritual connection to the river. The Building Block Methodology (BBM), developed in South Africa, was employed using a multidisciplinary team of 25 experts over a period of 3 years (2008 - 2010). The work culminated in a workshop in Delhi in 2012.

The objectives of the study were to promote the sustainable use of water resources in the Ganga to ensure ecological integrity, provide livelihoods and maintain sacred values. Indicators included fish, dolphins, invertebrates, algae, religious rites, local livelihoods and channel processes. Critical flows were defined to maintain specific elements of the river ecosystem. Studies were also made to define flows required for the sacred Kumbh Mela festival at Triveni Sangam in 2013. Key lessons

from the study were that: environmental flows is and its implementation is an adaptive process; a multidisciplinary, coordinated approach increases the reliability & credibility of results; data are key; capacity building at all levels is needed; documenting the cost-benefits and trade-offs is required; and there is a need for a framework to integrate environmental flows and trade-off management in basin management plans.

Environmental flow issues in Ganga Basin

Dr N.N. Rai explained that all components of the hydrological regime had certain ecological significance. High flows of different frequency were important for channel maintenance, bird breeding, wetland flooding and maintenance of riparian vegetation. Moderate flows may be critical for cycling of organic matter from river banks and for fish migration. Low flows of different magnitudes were important for algae control, water quality maintenance and the use of the river by local people. The Ganga basin, to the Indian border, is 861,452 km^2 with a mean annual runoff of 525 billion m^3 and population of 505 million. It was thus classified as water-stressed by the World Water Assessment Programme.

Average monthly flow patterns vary significantly around the basin. Dams such as Tehri (live storage 2.615 billion m3) had a substantial influence on the flow regime downstream. Diversions for irrigation at Haridwar ranged from 79% of the flow in March to 12% of the flow in August. Different environmental flow studies had made different recommendations; IWMI suggested 67.6% of the flow is required for a class A river, whereas 12.1% is needed for a class F river. The Wildlife Institute of India (WII) had recommended 20%-30% (depending on the season) of the flow was required for fish downstream of hydropower dams in the Alaknanda and Bhagirathi basins. The Chopra committee recommended environmental flows of 50% during the dry season and 30% during the remaining non-monsoon months.

Dr. Rai explained that the allocation of water for environmental needs should not be decided in isolation, rather it was important to maintain a balance between development and environmental needs. Detailed study of each basin/sub-basin covering the ecological characteristics of river and environmental flow requirements should be carried out. Hydraulic rating and habitat simulation methods could be applied initially to assess environmental flow requirements. When data availability improves, other comprehensive methods, such as holistic approaches, could be used. Dr. Rai suggested that broad allocations could be made using the WII study recommendations, namely: (a) 20% of monthly average of flow during dry season (November to March), (b) 25% of monthly average of flow from October and April, and (c) 30% of monthly average of high flow season from May to September. Considering the population and consumptive uses in Ganga basin extra water in river during the lean months could be made available either by increasing irrigation efficiency, river interlinking or storing surplus water during the monsoon.

In discussion, Dr Kumar agreed that floodplain wetlands alone were not the solution to flooding problems but could nevertheless play a key role in an integrated approach. Their advantage was that they brought multiple benefits to support human welfare. Water engineers worked within precise standards, such as hydropower design for 90% dependability, irrigation 75% dependability, public supply for 100% dependability; in contrast concepts, such as a healthy river, were rather qualitative and more specific environmental metrics were required. This would enable trade-offs to be assessed better and the compromises between rights of people for livelihood and environmental flows to be define.

8.

Towards a ten-point plan for implementing environmental flows in the Ganga basin

The workshop included three group discussion sessions on the two days. Delegates worked in two groups in three linked working sessions, such that each built on the previous. The first session focused on identification of barriers and issues to environmental flow assessment and implementation in the Ganga. The second session developed possible solutions to these barriers and the third session combined the barriers and solutions into a potential ten-point plan. Each delegate was given an opportunity to convey in writing his/her views during each group discussions (see Annex 3) and to vote in the Ganga river environmental flow scorecard (which is described and its results presented below). All the written inputs (in the yellow sticky notes) and votes of all the delegates using green and golden dots were synthesized and are summarized in the ten-point plan for implementing environmental flows in the Ganga basin described below.

The following ten-point plan includes a wide range of activities required to build a long-term sustainable programme that supports institutionalisation of environmental flows into environmental and water resources planning and management decision-making at the state, national and Ganga basin levels. The plan is flexible. Some activities are large and will take several years; others are small and can be implemented rapidly. These activities are not necessarily in chronological order; indeed some may overlap or be done in parallel. The 10 point plan forms a broad set of recommendations that support implementation of the 'Ganga River Basin Management Plan', particularly Mission 3 on 'Ecological Restoration' and Mission 8 on 'Environmental knowledge-building and sensitization'. Its implementing agency has yet to be defined and implementation cost estimates and sources of funding have not yet been developed or agreed. Furthermore, as the policy, institutional, legal and political environment of India evolves, the activities in the plan may become more or less relevant and could be modified appropriately.

1. Policy and planning

The concept of environmental flows has been implicit in many policies in India including the 2012 National Water Policy in which section 1.3 includes minimum ecosystem needs as a priority after safe drinking water and sanitation. Section 8.4 states that environmental needs of Himalayan regions, aquatic eco-system, wet lands and embanked flood plains need to be recognized and taken into consideration while planning. An explicit policy paper (or a policy note or an addendum to the water or environmental policy) is required following a review of the utility of existing laws to address environmental flows systematically. Such a policy (or policy note or addendum) would not only give water for the environment a clear legal standing, but it also would establish the key principles, methods and approaches to guide the establishment and implementation of environmental water requirements. This would not only fill-in the existing policy vacuum, but would also help move from an ad hoc approach to a more systematic approach of addressing a subject that is here to stay under IWRM. The preparation of an environmental flow policy note could be a short term high-priority action.

Under the Indian constitution, a state government has the power to make laws in respect of water resources of that state. Improved inter-state and central government-state cooperation will be required to implement consistent environmental flows, especially for trans-boudary rievrs. Although the Interstate Water Dispute Act (1956) provides a mechanism to solve water sharing disputes, it is often

a long-drawn out and politically sensitive process. Although environmental flows are part of many of the water allocation conflicts between states and sectors, environmental flow requirements rarely feature in many conflict resolution processes.

A single River Basin Organisation (RBO) is required to deliver a holistic approach for Ganga basin development. Implementation of the forthcoming River Basin Management Act will provide the necessary legal framework for this. This RBO (whether it is the existing NGRBA or another institution) should prepare an IWRM plan in which a clear vision for the Ganga basin is stated in terms of environmental objectives and targets.

The RBO needs to develop a framework for making informed water allocation and planning decisions that incorporates the trade-off between se of water for different uses, including environmental flows, irrigation, hydropower, navigation, industry and domestic supply.

2. Water demand and supply management

Water in the Ganga is already heavily used for a range of purposes including irrigation, hydropower generation and public and industrial water supply. However, river flows are only partially regulated given the rather small amount of water storage in the system. There are plans to enhance navigation of the river, which may require certain flows to maintain critical depth, especially during the lean season. Future expanding food, water supply and energy needs plus climate change impacts on hydrology suggest water resources will come under increasing stress. Some reaches of the river are likely to have insufficient water remaining to implement environmental flows. Implementation will require water saving in other sectors. Incentives are required to improve water use efficiency in irrigation to save water. As point source pollution, from industry and public sewerage, is reduced, discharged water becomes a benefit to the river and recycled water may help support environmental flows. Further river regulation through the construction of additional storage, if cost effective, could also provide additional benefits for both consumptive and non-consumptives uses of water as well as environmental flows.

3. Rights and responsibilities

As stated in the 2012 National Water Policy, water needs to be managed as a common-pool community resource held, by the state, under public trust doctrine to achieve food security, support livelihood and ensure equitable and sustainable development for all. Responsibility and accountability of all to water should be confirmed and emphasized through the establishment of water entitlements. Environmental flows should be recognised as a fundamental component of the water entitlement and water allocation system and the absence of a clear water allocation policy also impedes the systematic establishment and implementation of environmental flows.

4. Collaboration

The establishment and implementation of environmental flows is a multi-disciplinary and multi-sectoral activity. It must involve all stakeholders with an interest including central and state agencies, ULBs, GPs, farmers, hydropower generators, industries and civil society. A key question that arises is who represents the environment? In Australia, this is the role of the government's Environmental Water Holder; a specially established body mandated by law. In India, is it the MOEF that is responsible for the management of the environment or the MOWR that is responsible for managing water for all its different users. Institutional clarity is essential to addressing an emerging challenge that is likely to be confronted across the country as needs for water for various consumptive and non consumptive uses grow. An additional option is to establish a collaboration of NGOs and academic institutions, charged with responsibility for arguing for waters needs of the river ecosystems within the context of a RBO. Such collaboration could have a key role in advising the RBO Board. Such representation would allow for full stakeholder consultation on draft river basin plans and project EIAs.

5. Knowledge base

Engineers, planners, scientists, managers and all stakeholders need supporting written material in their work. There are many examples of environmental flow methods and assessments around the world that

can provide valuable insights into decision-making frameworks, the application of methods, collection of data, implementation and other issues. There is often a need for a national library of reports, to which there is free access, containing manuals and papers bringing together the global knowledge of environmental flows, plus a database of the location of additional information, such as data holdings. A first step will be to identify a suitable host institution, such as an existing library in a university or ministry.

Many existing data required for environmental flows are not shared and are fragmented. The 2012 National Water Policy envisaged a standardized national information system with a network of data banks and data bases. The Indian Hydrology project has started to address hydrological data and the Water Resources Information System (WRIS) and is starting to make hydrological data available on the web. These products need to be publicized and made available in local languages. Data held in analogue form need to be digitized.

There remains a lack of data in many areas of environmental flow allocation decision-making, including river hydro-ecology, sediment transport, hydraulic geometry and geomorphological processes, ecosystem services and cultural/spiritual links to rivers. A further area where little information exists is the economic and social values of river ecosystems and ecosystem services.

6. Research and analysis

Section 3.3 of the 2012 National Water Policy states that, "ecological needs of the river should be determined, through scientific study". Associated research and analysis of data are required on a range of related topics including the natural hydrology of the Ganga basin, monsoon and non-monsoon river flows, the role of green water infrastructure (forests, wetlands, grasslands) in regulating the hydrological cycle and providing natural storage. Research is also needed on increasing productivity and irrigation efficiency (more crop per drop). To complement these biological and physical science, research on methods for trade-off analysis and valuation of ecosystem services is required.

Some methods are available, but application to Indian rivers, and especially the Ganga, has not been undertaken systematically. There is a need for whole basin modelling that integrates surface and groundwater and provides baseline, current and project flows under different future scenarios.

A key output from the analysis should be technical guidance material for undertaking environmental flow assessments in India for different contexts, including project (water supply, irrigation or hydropower) planning and development or river basin/sub basin management and planning. The preparation of technical guidance could be a short-term high-priority action, based on: (1) a review of existing Indian case examples under which environmental flows are emerging as important issues; (2) a review of the relevant environmental flow methods; and (3) a review of relevant international environmental flow case studies that can be used to inform future operations and river basin planning in India.

7. Trial applications

More than 250 environmental flow methods have been developed around the world. Some have potential for application to the Ganga. The Building Block Methodology, developed in South Africa, has been applied to some locations of the Ganga and found to be a useful tool. However, different methods may be required to address different pressures on the river system such as hydropower or diversion for irrigation. The best way to understand the different kinds, including what data they need, how much they cost, how long they take, and what their results can be used for, is to take part in a test application. A set of case studies in different tributaries or mainstream reaches of the Ganga could be undertaken. It would be beneficial to establish a task force of perhaps 20 people, including key specialists from each relevant discipline, would take part in the activity, with sub-sets being involved in different method applications. An output would be a set of technical guidelines that define the range, appropriateness and limitations of different environmental flow methods and approaches for the Ganga and India. A further

output would be operational guidance on to under environmental assessments as part of the river planning process.

8. International case studies

Reading reports of environmental flow studies on river basins around the world provides valuable information about the practicalities of the process, the methods used, data needs and implementation procedures. These can provide both positive and negative perspectives of water resources use. However, actually visiting such river basins and discussing relevant issues with scientists, water managers and stakeholders provides a level of insight and understanding that cannot be achieved through the written word. Locations to visit could include the Aral Sea in Eastern Europe, the Murray-Darling basin in Australia and the Oliphants River in South Africa.

9. Training and capacity building

A range of formal training activities are required to provide existing and the next generation of water and environment planners, managers and engineers with skills in environmental flows. Training should place environmental flows within the context of Integrated Water Resources Management and River Basin Management.

Training can be university-based, where environmental flows can form part of syllabus of courses in water engineering, water resources planning and management and environmental planning and management. Environmental flow training modules would be developed that integrate hydrology and hydraulics; morphology, aquatic ecosystems, water quality, socio-economics etc. in environmental flows framework. Training on the job could be achieved by offering fellowships in government institutions or consultancies; the government could offer to support apprenticeship in this area. Such training should be linked to outcomes in river ecosystem management. Specialist short course should be arranged for particular target groups such as journalists who focus on environmental issues. Environmental flow course curricula development could be part of the short term priority actions.

Training courses should be wide ranging and include all aspects of environmental flows including hydrology, ecology, sediment dynamics, economic valuation of ecosystem services and methods of assessing trade-off in water allocation.

A particular skills that must be nurtured in the ability to assemble and coordinate teams of experts and run workshops with stakeholders as these are required to undertake effective environmental flow assessments.

10. Awareness building

A vital step in establishing an environmental flow programme is to ensure that everyone understands what environment flows are, and how they could help promote sustainable use of water resources in Ganga basin. The target audience for awareness building is very wide and includes all relevant sectors, such as water managers and policy makers, politicians, lawyers and other scientists. However, the primary target would be current and upcoming water managers, followed by the general public. Products required vary according to the particular target audience, but could include brochures, newspaper articles, adverts before movies, TV interviews using in local languages where appropriate. The first step in this process is to develop an effective communications strategy, which needs to present environmental flows in terms of local culture/lifestyle. A productive step would be to revive cultural practices that create awareness of water; this could be included as part of environmental teaching on school curricula.

A key activity is the establishment and coordination of a network of the leaders or champions in different sectors, who understand perspectives and ways of working. The network will need a coordinator. Champions could include local politicians and film and sports stars, though campaigns such as ‘adopt a river’ or ‘save the Ganga’.

River Ganga - Environmental flow Scorecard

Scoring progress and prioritising future activities in Ganga environmental flows

1) Delegates placed green dots to show how much progress has been made in the environmental flows
2) Delegates placed gold dots to show where priorities should be in developing environmental flows in the future

Future priorities	**themes**	**Progress** →				
		Not yet considered	**Initial thinking completed**	**Practical aspects considered**	**Some aspects in place**	**Fully operational**
	Definetion of e-flows for India					
	Options analysis and planning to include e-flows					
	Aims and objectives of e-flows					
	Centralised coordination of e-flows					
	Public engagemet on e-flows					
	Training in e-flows methods					
	Research, date collection on e-flows					
	Centralised e-flows knowledge base					
	Preliminary e-flows assessments using desktop methods					
	Implementation of e-flows					
	Monitoring e-flows outcomes					

9.

Scorecard

Workshop delegates recognised that assessing and implementing environmental flows as part of the restoration of the Ganga would be a long journey. The idea of a scorecard was to capture perceptions of the degree of progress along this journey. The score card is a matrix grid of cells in which the rows describe various themes and the columns depict the steps from first thoughts to full operationalization. Workshop delegates were given six green dots each and they placed them in the grid where they felt that the dots best defined how much progress had been made in six selected themes that they knew best. Delegates were also given three gold dots to define which three themes should be given priority in the future.

It is clear that majority of the green dots are to the left of the scorecard indicating that many aspects of environmental flows in India are at an early stage or not yet considered. The themes that have progressed the most are definitions, aims and objectives, with some implementation. In terms of futures priorities, most votes were cast for research, training and public engagement, plus clearer aims and objectives and centralised coordination.

The scorecard exercise could be repeated in several years time to gauge further progress in the elapsed time.

10.

Summary and next steps

There was a strong agreement at the workshop on the importance of the River Ganga to the well-being of people in the catchment and more widely in India and beyond, highlighted by its cultural and spiritual values illustrated by the use of phrases such as Mother Ganga. Government has accorded the rejuvenation of the Ganga a high political priority. There was broad consensus at the workshop to restore the Ganga, with a desire to make it a living river and to ensure that 'we do not cut off the branch of the tree we are sitting on'. Everyone agreed on the need to work together to "protect the branch", but this would require political support to alter water allocations and alignment of sectoral policies related to irrigation, urban, rural and industrial water, hydropower and other uses.

There was further agreement that the more serious problem was during the lean season and much can be done to restore the river by a combination of water quality improvements (through pollution reduction) and ensuring sufficient flow through diverting less, but recognising that 'the solution to pollution was not dilution'. However, many emphasised the increasing demand for water from many sectors for growing food, generating power, providing navigation and supporting industry. There was a need to be realistic about the amount of flow that can be restored to the river. Some considered that little water can be re-allocated from other uses because of the consequences for other uses. Recovering over-allocated water would be a major challenge. Understanding of trade-offs of different water allocation options (costs and benefits) was required, including the role of the river ecosystem in enhancing human well-being. Some suggested the need to increase storage that could capture some of the monsoon flows for use during the lean season with sufficient capacity to include environmental flow releases. New dams and other built infrastructure would be needed, but these might also help to deliver environmental flows. Such construction should be complemented with improvements in water management through the implementation of water entitlements, pricing structures and technological innovations and restoration of natural systems to enhance natural infrastructure for the multiple benefits it provides in a cost effective manner.

Freeing up water for environmental flows would need better conjunctive use of surface and groundwater and enhanced technologies, such as drip irrigation, to make water use more efficient. In parallel, there is a need to set realistic targets for environment and clarity on flows needed for different purposes.

Implementation of environmental flows would require a range of actions including better collaboration between states and with central government, review of laws and policies, potential establishment of new institutions, awareness building, training and scientific research. Research outputs should be tested through a set of detailed studies in a set of sub-basins covering the range of ecological characteristics of rivers and conditions across the Ganga and India.

It was recognised that science would never be perfect, rather the focus should be on achieving 'sufficient certainty' to make decisions. Adaptive management would permit changes to be made in the future as knowledge evolves. Agreement of terminology should be reached together with a set of methods to provide consistency of approach. Although it would be difficult to put an economic value on many benefits of the environment some common 'currency' would be welcome to help decision-making.

All stakeholders involved in water management in the Ganga basin are invited to consider the issues debated and the conclusions reached during the workshop. Only by working together would sustainable progress be made. In particular, the collation of ideas of participants into a 10 point plan provides some useful guidance. The score indicate how far some issues have been addressed and gives priorities for future action.

Next step recommendations

The Ganga basin should have a long-term plan of at least ten years, as it is clear that all issues could not be solved within a few years. Yet achievable short and medium term steps should be defined to demonstrate good periodic progress.

Short term actions (1-3 years)

- Develop an environmental flow Policy Note
- Establish the River Basin Authority and key collaborative links
- Review of legal and institutional arrangements, rights and responsibilities
- Develop an environmental flow Technical Guide
- Establish a knowledge centre and collation of available data
- Initiate research projects and trail applications of environmental flow methods
- Develop a communication strategy for environmental flows
- Undertake visits to international case studies
- Review environmental flow curricula

Medium term actions (beyond 3-5 years)

- Embed environmental flows in all water training course
- Enhance Technical Guide when environmental flow assessments completed
- Produce environmental flow operational guidelines (procedures) from case study applications
- Sensitise local communities on the importance of environmental flows

Long-term actions (5-10 years)

- Implement environmental flows an established procedure
- Monitor and adapt management
- Apply widely efficient water use techniques and technologies

Annex 1: Workshop Programme

WORKSHOP PROGRAMME

Environmental Flows for Strategic Planning for the Ganga Basin

Le Meridien Hotel, New Delhi, February 5–6, 2015

Day 1	
Session 1	**Opening Session**
Chair: Additional Secretary, MoWRRDGR	
09:00 – 09:30	Registration
09:30 – 09:35	Welcome note
09:35 – 09:45	Address by Chief Guest – Minister, MoWR, RD&GR
09:45 – 09:55	Address by MoWR, RD&GR
09:55 – 10:05	Address by MoEF
10:05 – 10:20	Keynote Address–Strategic Basin Planning in India, *Shri A B Pandya, Chairman, CWC*
10:20– 10:30	Workshop Background and Objectives – *Bill Young, World Bank*
10:30 – 11:00	**Tea Break**
Session 2	**International Experience in Environmental Flow Assessments**
Chair: William Young, World Bank, Vinod Tare, IIT Kanpur	
11:00 – 11:30	Eflows in Water Policies, Plans and Projects; *Rafik Hirji, World Bank*
11:30 – 12:00	Eflow Assessment Experiences in Developing Countries; *Jay O'Keeffe, South Africa*
12:00 – 12:30	River Basin Planning & Eflow Assessment Experience in China; *Robert Speed, Australia*
12:30 – 13:00	Questions and Facilitated Discussion
13:00 – 14:00	**Lunch Break**
Session 3	**Ganga River Basin – Hydrology and Environmental Values**
Chair: Vinay Kumar, CWC and Rafik Hirji, World Bank	
14:00 –14:20	Ganga River Basin – Hydrological Regime, *Dr. Sandhya Rao, IIT Delhi, tbc*
14:20 – 14:40	Ganga River Basin – Socio-Economic Values; *Ritesh Kumar, Wetlands International*
14:40 – 15:00	Ganga River Basin – An Ecosystem Services Perspective; *Vinod Tare, IIT Kanpur*
15:00 – 15:30	Questions and Facilitated Discussion
15:30 – 16:00	Tea Break

Session 4	**Ganga River Basin– Identification of Key Constraint and Issues**
Facilitators: Mike Acreman, United Kingdom, and Jay O'Keeffe, South Africa	
16:00 – 17:00	Facilitated discussion of key issues in two break-out groups: 1. Legislative and policy content 2. Data, knowledge and technical expertise 3. Social and cultural dimensions
Rapportuers: (a) A.K. Kharia, Director, CWC and (b) M. Raghuram, Director, CWC	
Session 5	**Ganga River Basin– Towards Solutions**
Facilitators: Mike Acreman, United Kingdom, and Jay O'Keeffe, South Africa	
17: 00 – 18:00	Facilitated discussion of potential ways forward in two break-out groups: 1. What objectives should be set (short and long term)? 2. Who should be involved (which stakeholders)? 3. What collaborations are required? 4. How is expertise built and strengthened?
	Rapportuers: (a) Bhopal Singh, Director, CWC and (b) Rishi Srivastava, Director, CWC
18:00 – 21:00	**Cocktails and Dinner**
Day 2	
09:30 – 10:00	Tea and Coffee on Arrival
Session 6	**Case Studies in EFA Implementation**
Chair: William Young, World Bank	
10:00 – 10:30	EU Water Framework Directive and Eflows; *Prof Mike Acreman, United Kingdom*
10:30 – 11:00	Management of Environmental Water in the Murray-Darling; *David Papps, Australia*
11:00 – 11:30	Questions and Facilitated Discussion
	Rapporteur: *Robert Speed, Australia*
11:30 – 12:00	**Tea Break**
Session 7	**Panel Discussion – Effectively Supporting Ganga Basin EFA**
Chair: Shri A D Mohile, Dr Amita Prasad, Prof Mike Acreman	
12:00 – 12:20	Past and ongoing Eflow Assessments; *Suresh Babu, WWF*
12:20 – 12.40	Eflows Issues in Ganga Basin, *N.N. Rai, Director, Hydrology, CWC*
12:40 – 13:30	Panel-led Discussion • Ganga River Basin - Environmental Management Plan; *D Nidfi, Director NMCG* • Ganga River Basin – Eflows and Irrigation, *Vijay Labhsetwar, ICID*
13:30 – 14:30	**Lunch Break**

Session 8	**Break-out group discussions – Ganga Basin EFA next steps**
Facilitators: Mike Acreman, United Kingdom and Jay O'Keeffe, South Africa	
14:30 – 15:30	Facilitated discussions in two break-out groups to develop plans for Ganga eflows assessments/planning/implementation using outputs from Sessions 4 and 5 1. Short- and long-term ecological and social objectives? 2. Key stakeholders to involve and how? 3. Policy, legislative and institutional arrangements? 4. Research and capacity building needs? Rapportuers: (a) *Yogesh Paithankar, Director, CWC* and (b) *GL Bansal, Director, CWC*
15:30 – 16:00	Reports back from break-out groups
16:00 – 16:30	**Tea Break**
Session 9	**Recommendations**
Chair: Additional Secretary, MoWR, RD&GR	
16:30 – 17:00	Panel: Summary Comments and Recommendations for Ganga Basin Eflows Programme; *Joint Secretary Ministry of Water Resources; Chairman, CWC; Mission Director, NMCG; William Young, World Bank; Mike Acreman, United Kingdom*
17:00 – 17:15	Closing remarks and vote of thanks; MoWRRDGR

Annex 2: List of participants

List of participants - Environmental Flows for Strategic Planning for the Ganga Basin - Le Meridian Hotel, New Delhi

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Annex 3: Working Group Outputs

Three working group sessions led to the ten point plan detailed in section 9 of the main report. The process for identification, discussion and prioritization of issues was as follows. Working group members individually wrote their idea on post-it notes and stuck them to the flip charts. In turn the content of each post-it note was introduced by the writer and then discussed in the group. After all the discussion had finished, group member voted on the top priority issues by applying red dots to the post-its.

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