RIVER BASIN

GANGA

[INDIA]

SCHEDULE A
ASSESSMENT OF RIVER BASINS (RBS) IN SOUTH ASIA

Sr. No.	Details	Response
1	**Physical Features - General Information**	
1.1	Name of River basin.	Ganga, Ganges (*Anglicised version*) . Indians refer to Ganga as 'Ganga Ma', or Mother Ganga. Also known as the Bhagirathi, based on an ancient legend that King Bhagirath tamed Goddess Ganga and brought her on the earth from *Swarga* (Heaven)
1.2	Relief Map and Index Map of RB with Country/ State/ Province boundary marked to be attached.	Refer Annexure 1
1.3	Geographical location of the place of origin	The Gangotri Glacier, a vast expanse of ice five miles by fifteen, at the foothills of the Himalayas (14000 ft) in North Uttar Pradesh, is the source of Bhagirathi, which joins with Alaknanda (origins nearby) to form Ganga at the town of Devprayag
1.4	Area (in Sq. Kms.),	Total basin area(including Nepal, India, Tibet and Bangladesh): 1,016,124 Km2 (WRI 2003).

1.5	Population (in Millions); Name of population centers/ Cites (duely marked on the map: refer 1.2) having Population - (a) More than 0.5 Million - 1 Million	In India, Ganga flows through 29 cities with population over 1,00,000 (�class-I cities�), 23 cities with population between 50,000 and 1,00,000 (�class-II cities�), and about 48 towns. (Source: http://www.cag.gov.in/reports/scientific/2000_book2/gangaactionplan.htm Approximately one in twelve people in the world (8%) live in its entire catchment area (Newby 1998). Total population of the entire basin is roughly 200 million people (Welcomme & Petr 2004), including the most densely populated Nation of Bangladesh
	(b) More than 1 Million – 10 Million	
	(c) More than 10 Million	
1.6	Approximate areas of upper regime, middle regime and lower regime;	D N A
1.7	Country and States (Province) in which the basin lies (indicate % area covered);	The Ganges flows through northeastern India to the Bangladesh border, east-southeast 212 Km to its confl uence with Brahmaputra, and continues as the Padma River for another 100 Km to its confluence with the Meghna River at Chandpur (Food & Agricultural Organization (FAO) 1997; FAO 1999). The basin occupies 30% of the land area of India (Revenga 1998; United States Central Intelligence Agency 2006)

2	**Hydrological and Land use Features:**	
2.1	Average annual rainfall (in mm);	The average annual rainfall varies between 1500 mm to 400 mm. (Source: Hydrology and Water Resources of India, Springer Link, 2007). Please note: An investigation was carried out to identify trends in the rainfall and temperature regimes of the Ganga basin in India and in India as a whole. The results of this study showed that the rainfall variables had a decreasing trend and the temperature had an increasing trend. (Source: Rainfall and temperature trends in India, Hydrological Processes, Volume 10, Issue 3 , Pages 357 – 372)
2.2	Maximum-minimum temperatures in Degree Centigrade	Ganges Delta: Average temperatures in January range from 57 to 77°F (14 to 25 °C), and average temperatures in April range from 77 to 95°F (25 to 35 °C).
2.3	Average annual yield (discharge) of water in Cubic Meter and the average yield for last past five years	Average monthly discharge of Ganga at Farraka barrage (In India, 18 kms upstream of Bangladesh border): 2,213 m3/s. Average Discharge of the entire basin : 14,270 m3/ s (503,940 ft3/s). Average annual flow of Ganga (MCM) in India: 525023 MCM. (Source: Central Water Commission, Hydrological Databook, 2006)
2.4	Major tributaries	Brahmaputra, Gomti, Kosi, Ghagara (left) , Gandak, Yamuna (right)
2.5	Percentage shares of major water uses & Surface and groundwater abstraction in percentages- Convert intoTable (a.) Agriculture,	Please note that this data (compiled from CGIAR Challenge Program: Indo Gangetic basin) is for the entire basin including Nepal, India and Bangladesh Agriculture: 91.4%

	(b.) Industries,	0.50%
	(c). Domestic,	7.8%, Livestock: 0.3%
	e). environmental flows.	None allocated
2.6	Major cropping pattern	Net cropped area: 114 million hectares
2.7	Cultivable area under irrigation	D N A
2.8	Cultivable area not under irrigation	D N A
2.9	State other Water Uses- eg. Navigation, power, recreation etc.	Due to its size and extent, Ganga is virtually used for all purposes like drinking water, irrigation water, hydro electricity, navigation, fisheries, flood regulation, sports and leisure activities, habitat for important species, etc
3	**Ecosystem Features**	
3.1	Agro-climatic zones	The major crops that are grown in the Ganges Delta are jute, tea, and rice. Fishing is also an important activity in the delta region, with fish being a major source of food for many of the people in the area.
3.2	Major sub ecosystems (zoogeographical zones)	The Ganges river basin contains high biodiversity. There are over 140 fish species, the richest freshwater fi sh fauna in India (Jones *et al.* 2003; WRI 2003), 90 amphibian species, and fi ve areas supporting birds found nowhere else in the world. The basin is home to fi ve species of freshwater cetaceans including the endangered Ganges River Dolphin which faces an annual mortality rate of 10% (WRI 2003) and the rare freshwater shark, *Glyphis gangeticus* (Martin 2003). The unique Sundarbans delta mangroves are found where the Brahmaputra River and

		Meghna River converge in the Bengal basin (Wilkie & Fortuna 2003; UNESCO 1998) and support over 289 terrestrial, 219 aquatic, 315 bird, 176 fi sh and 31 crustacean species (Ramsar Convention on Wetlands 2001). There are also 35 reptile and 42 mammal species, including the world's last population of the mangrove-inhabiting tigers, *Panthera tigris* (WWF 2005c). Together the Brahmaputra and Ganges watersheds span 10 biomes and contain the widest diversity of all large river systems as classified by Nilsson *et al.* (2005).
3.3	Major soil types	Most of the delta is composed of alluvial soils, with red and red-yellow laterite soils found as one heads farther east. The soil contains large amount of minerals and nutrients, which is good for agriculture.
3.4	National parks/sanctuaries, lakes, wetlands, etc.	Sunderban National Park and Tiger Reserve (delta region of Ganga) is the largest mangrove forest in the world and the last resort to mangrove tigers. It is also a UNESCO World Heritage Site for more information: http://en.wikipedia.org/wiki/Sundarbans
3.5	Brief information about the delta region of the basin (area, location, major urban centers in the delta, etc.)	The Ganges-Brahmaputra Delta (or the Bengal Delta)consists of Bangladesh and the state of West Bengal , India. It is the world's largest delta, and empties into the Bay of Bengal.It covers more than 105,000 km≤, It is also one of the most fertile regions in the world, thus earning the nickname The Green Delta. The delta stretches from the Hugli River on the west to the Meghna River on the east. It is approximately 220 miles (350 km) across at the Bay of Bengal. Kolkata (formerly Calcutta) and Haldia in India and Mongla in Bangladesh are

		the principal seaports on the delta. The Ganges Delta arises from the confluence of the following rivers: ∑ Padma (lower Ganges) (*Pôdda*) ∑ Jamna (Lower Brahmaputra)(*Jomuna*) ∑ Meghna. For details: refer to :http://en.wikipedia.org/wiki/Ganges_Delta. Most of the Ganges Delta has a population density of more than 520 people per square mile (200 people per km≤), making it one of the most densely populated regions on earth.Where the delta meets the Bay of Bengal, Sundarbans mangroves form the world's largest Mangrove ecoregion, covering an area of 20,400 km≤ in a chain of 54 islands
4	**Water Quality**	
4.1	Prevailing water quality standards (e.g. Class I, II, III.etc, indicating permitted uses)	Note on Pollution of the entire Ganges basin: There are some 30 cities, 70 towns, and thousands of villages along the banks of the Ganga. Nearly all of the sewage from these population centres – over 1.3 billion litres per day – passes directly into the river, along with thousands of animal carcasses, mainly cattle. Another 260 million litres of industrial wastewater, also largely untreated, are discharged by hundreds of factories, while other major pollution inputs include

		runoff from the more than 6 million tonnes of chemical fertilizers and 9,000 tonnes of pesticides applied annually within the basin.(Source: Managing Rivers Wisely, Ganges Case Study, WWF, 2006)
4.2	Stretches (along the River) in Kms. with water quality classes indicated (may be marked on the map)	D N A
4.3	Sources of Pollution, with data indicating quantum and/or severity.	D N A
4.4	Prevailing abatement techniques e.g: ETP, STP, legislation,etc.	1. Ganga Action Plan: Ganga Action Plan or GAP was a program launched by Government of India in April 1985 in order to reduce the pollution load on the river Ganga. The program was launched with much fanfare, but is considered to have failed in decreasing the pollution level in the river, after spending 901.71 Crore(approx. 1010) Rupees over a period of 15 years. The project was launched in major cities along the Ganga like Haridwar, Varanasi, Allahabad, Kanpu. Pollution abatement techniques include:Mainly sewage treatment plants. For more information, please refer to: http://www.ecofriends.org/gap/default.htm and http://www.cag.gov.in/reports/scientific/2000_book2/gangaactionplan.htm
5	**Current status of the resource development & potential for development**	
5.1	Water availability: a. Per capita water availability (in lpcd)	Water demand for India (2000): 338 billion m3 (Source: CGIAR Challenge Prgram, Water for Food)

	b. Per hectare water availability (in Cubic meters for cultivable command area):	Estimated Utilisable Water (excluding groundwater) : 250.00 BCM
	c. Availability of environmental flows (Current reserve, if any):	None presently
	d. Availability of ground water/ Average annual ground water abstraction/recharge.	For more information, please refer to http://www.pubs.asce.org/WWWdisplay.cgi?8902988
5.2	Structures: a. Major dams/barrages (with utilization categories):	1. The Haridwar dam diverts melted snow from the Himalayas to the Upper Ganges Canal which was built by the British in 1854. 2. TheTehri Dam on the major tributary of Ganga, the Bhagirathi (when completed, Tehri will be world's fourth largest dam): The main dam will produce 2000 MW of electricity when completed. This dam has been the object of intense protests from environmental groups and the people of this region. (For more information of Tehri project, Please refer to : International Rivers Network publication: http://www.irn.org/pdf/india/TehriFactsheet2002.pdf) 3. Farakka Barrage: 18 kilometers upstream of the India-Bngladesh Border, Farakka barrage is a reason for tensions between Indi and Bangladesh over water sharing. The dam was built to divert the Ganges River water into the Hoooghly River during the dry season, from January to June, in order to flush out the accumulating silt which in the 1950s and 1960s was a problem at the major port of Calcutta on the Hooghly River
	b. Proposed dams:	The capacity of proposed projects will be 30083.92 MCM (Source: Water and related Statistics, 2006, Central Water Commission)

	c. Live storage of major dams:	Capacity of completed projects: 39445.2 MCM (Source: Central Water Commission). Projects under construction: 21215.18 MCM
	d. Live storage through proposed dams:	The capacity of proposed projects will be 30083.92 MCM (Source: Water and related Statistics, 2006, Central Water Commission)
	e. Inter basin transfer systems:	Elaborate transfer systems planned for the Ganga and Brahmaputra river systems. Please find more details at: National water Development Agency Website (www.nwda.gov.in)
	f. Any Other:	
5.3	Command area of major dams	
5.4	Agencies functioning in the basins: a. Public agencies/ CSOs which construct/ implement the infrastructures projects: b. Private agencies/ CSOs involved in infrastructure development	1. Irrigation and Water Resource Departments of Uttaranchal, Uttar Pradesh, West Bengal, etc, National Water Development Agency for Interlinking, Various CSOs and NGOs working on issues related to water sharing, dams and dislocation and pollution. 2. Ganga Flood Control Board (GFCB) and Ganga Flood Control Commission (GFCC): The Ganga Flood Control Board was set up in 1972 by a resolution of Government of India. The Ganga Flood Control Commission was set up as per Clause 5 of the resolution to undertake specific works in the Ganga Basin and for assisting the Ganga Flood Control Boards. The GFCC is expected to prepare master plan of the basin to deal with problems emerging from flood erosion and water-logging in the region. The implementation of these will be carried out by the appropriate riparian state. A chairman appointed by the GOI

		heads the Commission. GOI also appoints two full time members. Basin states appoint part time members of the commission.
6	Existence of National/State/Provincial Laws or Notifications relating to water- Management / use/ development/opportunity for private sector participation or for privatization of water resources	Some important laws and notifications: "Treaty Between the government of the Republic of India and the government of the People's Republic of Bangladesh on Sharing of the Ganga/Ganges Waters at Farakka" signed on December 12, 1996, but a permanent settlement has not yet been attained. (Source: The Water Page. com)
7	Key Issues: **1.**	Over Abstraction: Water withdrawal poses a serious threatto the Ganges. In India, barrages control all of the tributaries to the Ganges and divert roughly 60% of river flow to largescaleirrigation (Adel 2001). Over-extraction for agriculture in theGanges has caused the reduction in surface water resources. This has increased dependence on ground water, the loss of water-based livelihoods, and the destruction of habitat for 109fish species, and other aquatic and amphibian fauna (Adel 2001). The projected annual renewable water supply for 2025 indicates water scarcity (Revenga *et al.* 2000). Although the Ganges catchment drains virtually all of the Nepal Himalayas and water supply per person in the basin ranges from adequate to ample46, its dry season outflow (from December to February) to the sea is non-existent (FAO 1999;

		Revenga *et al*. 2000). Overall, excessivewater diversions threaten to eliminate natural flows and severely damage people's livelihoods in the Ganges. **2.** Pollution: The Ganges collects large amounts of human pollutants as it flows through highly populous areas. The major polluting industries on the Ganges are the leather industries, especially near Kanpur, which use large amounts of chromium and other chemicals, and much of it finds its way into the meagre flow of the Ganga. Nearly all the pollution control plans in India have failed due to lax implementation. Groundwater water pollution due to Arsenic is a problem in India and Bangladesh. **3.** Climate Change: One of the greatest challenges people living on the Ganges Delta may face in coming years is the threat of rising sea levels caused mostly by subsidence in the region and partly by climate change. An increase of half a meter could result in six million people losing their homes in Bangladesh. Higher temperatures related to climate change could also bring about more severe flooding of the delta, because of increased melting of snow and glaciers in the Himalayas 4. Flood Management 5. Conflict Resolution: Between the riparian countries of Nepal, India and Bangladesh

8	Enabling instruments- Law/ Policy/ Economic & Financial Measures for introducing IWRM in the basin	1. Some limited progress has been made in basin-wise planning under the auspices of the Central Water Commission, the Ganga basin water studies organisation has in 1987 prepared a report on "Ganga Basin: Water Resources Development - A Perspective Plan"(Source: http://planningcommission.nic.in/plans/planrel/fiveyr/8th/vol2/8v2ch3.htm)

SCHEDULE B
ASSESSMENT OF RIVER BASINS (RBS) IN SOUTH ASIA

Sr. No.	Details	Response
1	**Legal / Political Mandate**	
1.1	Is there any RBO? If yes, Give Name.	There is no statutory RBO or a river basin council operating in the Ganga Basin, though the **Ganga Flood Commission** works on the entire basin (mainly India's part) for preparing and implementing flood control plans.
1.2	How has it been constituted? (Statutory/ Voluntary/ Any other form).	
1.3	State objectives and organizational structure of the RBO in outline & enclose brochures	The Commission has been assigned the task of preparing comprehensive plan for flood management of the river system in the Ganga basin, drawing out the phased programme of implementation of various schemes, monitoring of important flood management schemes, assessment of adequacy of waterways under road and rail bridges and providing other technical guidance to the basin States. The Commission also accords technical clearance to flood management schemes for the Ganga Basin. Source: Ministry of Water Resources, Governmentiof India, http://wrmin.nic.in/writereaddata/linkimages/anu156988494413.pdf

1.4	Functioning level of the RBO	
1.5	What are the major activities carried out by the RBO since inception?	
1.6	What are the proposed activities of the RBO?	
1.7	Details of Contact person/s (Name, designation and contact numbers, address, & emails).	
1.8	Presence of a regulatory framework wherein national or regional supra basin authority regulates the functioning of the RBO (eg. Indus Commission).	
1.9	Legal/political mandate wherein stakeholders can appeal for redress/decision and conflict resolution	
1.1O	Does the RBO have an appellate authority?	
1.11	Is the RBO an autonomous body?	
1.12	Is it regulated by a supra basin authority, if so, how?	
1.13	Is the RBO authorized to raise capital for management and/or implementation in open market? (Please elaborate the authorization).	
1.14	Does the RBO receive direct budgetary grants? (From Govt./ Statutory Bodies/ Public donations/ Any Other Agencies.)	

1.15	Nature of mandate for delegation of powers and/ or functions (within RBO's constitution) to the lowest possible scales so as to encourage stakeholder participation. (Kindly elaborate the mode of delegation).	
1.16	Policy of the RBO on – (i) Water allocation between users/sectors/sub-basins; and	
	(ii) Procedures and processes for determining the above.	
1.17	Presence of Trans-boundary Water Agreement or Treaty in case of a trans-boundary basin, (and a common RBO representing the countries/provinces) (eg. Indus Treaty in case of River Indus flowing through India and Pakistan) (Kindly indicate the agreement/ treaty. Also, indicate RBOs are representing Trans boundary Basins.)	
1.18	Presence of a 'Tribunal' appointed in case of intra basin or inter basin disputes (eg. Krishna Water Disputes Award Tribunal established between states of Maharashtra, Karnataka, and Andhra Pradesh);(Kindly indicate name & nature of tribunal).	
1.19	Is the RBO responsible for preparing Basin Management Plan. If yes, please enclose a copy	
2	**Processes of community/stakeholder participation in the functioning of the RBO**	

2.1	Are the stakeholders from the basin included in the governing body of the RBO?	
2.2	Elaborate the nature and frequency of public consultation initiated by the RBO	
2.3	Elaborate efforts at outreach/communication by the RBO.	
2.4	Elaborate efforts made for creation of participatory platforms at minor/major tributary or watershed levels for encouraging participation .	
2.5	Interaction of the RBO with organizations working in water management at different watershed/ micro basin, sub-basin or basin level	
2.6	Stakeholder participation sought by the RBO for preparing Basin Management Plan	
3	**Conflict resolution and negotiations**	
3.1	Involvement of the RBO in negotiations between stakeholders at various levels through an appellate authority mentioned above;	
3.2	Negotiation and participation encouraged at mini/ micro basins for consensus building and/or conflict management.	

SCHEDULE C

ASSESSMENT OF RIVER BASINS (RBS) IN SOUTH ASIA

Civil Society RBOs **(** CSOs working in River Basin issues or those physically involved in infrastructure development and articulating / advocating a River Basin perspective maybe be considered as Civil Society RBO. Please note that some of these organisation may not be calling themselves as RBOs. This is despite the fact that they function in most, if not all areas in which a statutorily constituted RBO operates)		
Sr. No.	**Details**	**Response**
1.1	Constitution of the organization in terms of involvement of local action groups/initiatives, stakeholders, water users groups, and irrigation groups/ committees, traditional water groups urban and industrial users etc. are a part of the organization);	No agency is working on the entire basin with IRBM as the main perspective, some projects have been undertaken by agencies like :- 1. CGIAR: Challenge Program for Food: http://www.waterandfood.org/basins/indo-gangetic-river-basin.html 2. 2. WWF: Managing Rivers Wisely, under the WWF IRBM Program. 165 kms stretch of the river was taken as a pilot and programs related to conservation, awareness generation, good governance, etc were planned. Ganga Sanrakshan Samiti was formed as a part of the project which is a multi-stkeholder platform. More information can be obtained at: http://assets.panda.org/downloads/mrwgangacasestudy.pdf 3. Swtacha Ganga Abhiyan: is a community effort championed by spiritual leaders from Varanasi for controlling pollution of the Ganga.
1.2	Reflection of basin perspective in the organization's constitution/past/planned work and activities?	

1.3	Scale of work: Sub-basin/basin scale?	
1.4	Consideration of upstream and downstream impacts of water management activities in the RB and issues like inequitable distribution of water between intra and inter sectors;	
1.5	Has the organization prepared a Basin Master(Management) Plan? Does it contain elements different from or alternative to that of the government organizations?	
1.6	Efforts taken by the Civil Society RBO to upscale the vision/activities at basin level	
1.7	Participation in lobbying and advocacy at appropriate levels (provincial, national, international)	