

RIVER BASIN

YAMUNA

[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 (also indicate regional names);	Yamuna
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 (Country/District)	Yamuna originates from the Yamunotri glacier near Banderpoonch peaks in the Mussourie range of the lower Himalayas at an elevation of about 6387 meters above mean sea level in district Uttarkashi (Uttanchal).(38o 59' N 78o 27' E) (Source: Yamuna Action Plan. http://yap.nic.in/yamuna.asp)
1.4	Area (in Sq. Kms.),	345,850 sq km (Source: The Yamuna Action Plan : http://yap.nic.in/yamuna.asp). The tributaries contribute 70.9% of catchment area and balance 29.1% accounted for direct drainage into the Yamuna river or to the smaller tributaries. On the basis of area, the catchment basin of Yamuna amounts to 40.2% of the Ganga Basin and 10.7% of the total land mass of the country

1.5	Population (in Millions); Name of population centers/ Cities (duly marked on the map: refer 1.2) having Population - (a) More than 0.5 Million - 1 Million	
	(b) More than 1 Million – 10 Million	
	(c) More than 10 Million	Major urban centres: Delhi, Kanpur, Agra. About 57 million people depend on Yamuna waters. (source: Rainwaterharvesting.org)
1.6	Approximate areas of upper regime, middle regime and lower regime;	1. Himalayan Segment: From origin to Tajewala barrage: 172 kms. 2.upper segment: Tajewala Barrage to Wazirabad barrage: 224 Kms. 3. Delhi Segment: Wazirabad barrage to Okhala barrage: 22 kms 4. Eutrophicated segent: Okhla barrge to Chambal Confluence.: 490 kms 5.Diluted segement: Chambal Confluence to Ganga Confluence: 468 kms (Source: Yamuna Action Plan) The river flowsc. 200 km in the hills in the north of the basin before it enters the Indo Gangetic plains, where it covers the rest of its 1200 km route length (MoWR 1989)
1.7	Country and States (Province) in which the basin lies (indicate % area covered);	States of Himachal Pradesh (2,320 km.) ,Uttaranchal, Haryana, Delhi, Rajasthan, UttarPradesh, Madhya Pradesh
2	Hydrological and Land use Features:	

2.1	Average annual rainfall (in mm);	The Yamuna catchment receives around 120 cm of rainfall throughout the year, out of which around 75% is received during the monsoon months only. July and August are the months receiving the major proportion of the annual rainfall. (Source: Methodology for identification of risks to nutrient exposure in large agricultural lands of India: towards better decision making, K.K. Narula, N.K. Bansal, Journal of environmental studies and policy, http://static.teriin.org/division/padiv/wrpm/docs/ft03.pdf)
2.2	Maximum-minimum temperatures in Degree Centigrade	Sub zero in winters at Yamunotri (uttarkashi.nic.in) while temperatures reaching 48 degrees Celsius in Delhi
2.3	Average annual yield (discharge) of water in Cubic Meter and the average yield for last past five years	Yamuna receives water from snowmelt, precipitation and groundwater. Total available surface water in the basin with 75% dependable flows is 62.8 billion cubic metres (source:Teri Vision June 2002 Issue no 46 http://static.teriin.org/news/terivsn/issue46/main.htm)
2.4	Major tributaries	Tons, Rupin, Chambal, Betwa, Sind & Ken (Source: Yamuna Action Plan)
2.5	Percentage shares of major water uses & Surface and groundwater abstraction in percentages-Convert to Table (a.) Agriculture,	Groundwater status: The total utilizable groundwater in the basin is nearly 60 billion cubic metres, 85% of which is allocated for irrigation.(source: TeriVision, 2002 Issue 46) The contribution to total irrigation from surface water sources has also come down from 60 per cent in the 1950s to almost 30 per cent now. As a result, the contribution of groundwater irrigation has risen from c. 20 per cent in the 1950s to almost 60 per cent now. (source: Water resource mangement in Yamuna basin

		in India K.K. Narula, N.K. Bansal, Journal of environmental studies and policy,)
	(b.) Industries,	While there were only a few industries about 40 years back, the total number of large- and medium scale industries in the basin is more than 10000 now. The majority of these belongs to the pulp and paper, sugar, fertilizer, and distillery types. Most of these industries are agrobased and located close to irrigation belts, i.e., in the north-east and north-west. Small-scale industries are a little less than 1 million in number. For calculating industrial requirements of water, norms adopted by the Ministry of Water Resources, Government of India, have been used in the study, and at present the annual industrial water consumption is c. 400 MCM.(Source: Water resource Management in Yamuna Basin in India, KK. Narula, TERI)
	(c). Domestic,	D N A
	e). environmental flows.	Upper Yamuna Water Board manages minimum flows in Yamuna (till upstream of Delhi) (Source: personal communication with Mr. B.S.Ahuja, Chairman, Upper Yamuna Water Board)
2.6	Major cropping pattern	D N A

2.7	Cultivable area under irrigation	The net irrigated area in the basin has gone up from c. 47000 km ² in the 1950s to c. 110000 km ² in the 1990s, at a rate of approximately 1.8 per cent per annum. (Source: Water resource mangement in Yamuna basin in India K.K. Narula, N.K. Bansal, Journal of environmental studies and policy,
2.8	Cultivable area not under irrigation	D N A
2.9	State other Water Uses- eg. Navigation, power, recreation etc.	Religious significance, Ecological importance, the basin has a good hydropower potential, especially in the upper reaches. For example: hydropower potential of 485 MW in Himachal Pradesh (untapped)
3	Ecosystem Features	
3.1	Agro-climatic zones	Upper Reaches: Alpine Forests, Lower Yamuna: Sal, Khair Sissoo trees and the Shivalik chir- pine forests
3.2	Major sub ecosystems (zoogeographical zones)	Topographically, the catchment is characterized by three regions. The hilly region lies in the northern part of the basin at an average elevation of 600 m amsl and forms 3 per cent of the total catchment area. The foothills and plateau regions lie in the western, eastern, and central parts of the basin at an elevation of 300-600 m amsl and form 50 per cent of the total catchment area. The plain regions lie in the centre and to the south of the basin at an elevation of 100-300 m amsl and form 47 per cent of the total area. (Source: Water Resource Development in Yamuna Basin of India K.Narulaet al, TERI, Journal of env studies and policy)

3.3	Major soil types	sand, loam, clay and their combinations such as sandy loam, silty clay etc. (Source: Upper Yamuna Water Board)
3.4	National parks/sanctuaries, lakes, wetlands, etc.	Gobind Pashu Vihar Sanctuary, (Indicative)(Upper reaches of Tons).Yamuna is the frontier of the Indian elephant.The forests of the lower Yamuna offer ideal corridors for elephant movement and the principal forests to be found here are of Sal, Khair Sissoo trees and the Shivalik chir-pine forests. Keoladeo Ghana Bird Sanctuary (Bharatpur Sanctuary): On the tributary of Chambal
3.5	Brief information about the delta region of the basin (area, location, major urban centers in the delta, etc.)	<p>Though the river Yamuna does not form a delta (as it meets the river Ganges) it does form a fertile plain between Yamun and Ganga known as the Ganga Yamuna Doab (Source: www. britannica.com) Ganges Yamuna Doab: segment of the Indo-Gangetic Plain in western and southwestern Uttar Pradesh state, northeastern India, with an area of about 23,360 square miles (60,500 square km). It lies between the Ganges and Yamuna rivers, west of the Upper Ganges Plain. The doab is about 500 miles (800 km) in length and 60 miles (100 km) in width and consists of a wide trough between the Great Himalayas to the north and the Deccan Plateau to the south. It was formed by sediment deposited by rivers flowing southward from the Himalayas.</p> <p>The doab can be divided into three sections: Upper, Middle, and Lower. The Upper Doab extends from Haridwar town on the north to Aligarh town on the south. It has a gentle slope and is crisscrossed by a number of streams.</p>

		<p>Secondary transverse slopes on older floodplains have developed in the Middle Doab. The topography flattens out in the Lower Doab, where the Sind, Betwa, and Ken streams run parallel to each other. Geologically, the whole region forms part of the alluvial Indo-Gangetic trough. Forests, occurring in patches, are composed of acacia and teak. The regional economy is dominated by agriculture based on intensive cultivation and crop rotation; crops include cereals, pulse (legumes), sugarcane, fruits, and vegetables. Livestock raising and dairy farming are also important. The region is highly industrialized and produces refined sugar, printed calico, fans, automobile radiators, insulated wire, textile machinery, textiles, brass and copper utensils, and railroad equipment. Roads and railways link the regional centres, and there are airports at Kanpur and Allahabad. Meerut, Aligarh, Saharanpur, and Ghaziabad are other important towns. The doab is one of the most fertile and densely populated regions in India</p>
4	Water Quality	
4.1	Prevailing water quality standards (e.g. Class I, II, III.etc, indicating permitted uses)	In the upper reaches, the water quality is good, at places , Class I, in the lower reaches, from Delhi, th quality deteriorates and reaches class IV. Quality improves again downstream of Delhi.
4.2	Stretches in Kms. with water quality indicated	

4.3	Sources of Pollution, with data indicating quantum and/or severity.	Domestic Sewage Pollution (75%) Industrial and Agricultureal polltuion: (25%). (Source: yap.nic.in) Note:Large and medium industrial units - 22 in Haryana, 42 in Delhi and 17 in Uttar Pradesh have been identified as directly discharging and polluting the river Yamuna under the Action Plan area. These industries include paper, sugar, chemical, leather, distillery and pharmaceuticals etc.The Central Pollution Control Board (CPCB), on its part, had found endosulphan residues — alpha and beta isomers — in the Yamuna in 1991. An earlier study by H C Agarwal (Delhi University) had traced ddt residues amounting to 3,400 nanogram per litre (ng/l). However, later cpcb studies showed reduced ddt levels.(source: www.rainwaterharvesting.com, Centre for Science and Environment)
4.4	Prevailing abatement techniques e.g: ETP, STP, legislation,etc.	A bunch of techniques have been adopted by the YAP: for Sewerage Componenet and Non Sewerage Component of the pollution .(Source: Yamuna Action Plan)
5 Current status of the resource development & potential for development		
5.1	Water availability: a. Per capita water availability (in lpcd)	Note: Out of 80 districts that make up the basin, 29 (including Delhi) were in the category of high and medium water stress in 1947; in the 1990s, the number went up to 62. The number of highly stressed districts went up from 1 in 1947 to 20 in the 1990s.(source Teri Vision)
	b. Per hectare water availability (in Cubic meters for cultivable command area):	The present irrigation water requirement in the Yamuna basin is 68.18 billion cubic metres (Source: Teri Vision)
	c. Availability of environmental flows (Current	approximately 10 Cumecs annually, upstraem of Tajewala

	reserve, if any):	barrage (upstream of Delhi) (Personal communication with Dr. B.S. Ahuja, UYWB)
	d. Availability of ground water/ Average annual ground water abstraction/recharge.	
5.2	Structures: a. Major dams/barrages (with utilization categories):	
	b. Proposed dams:	
	c. Live storage of major dams:	Live storage from major and medium water storage projects such as dams, barrages, etc. in the entire basin is c. 17000 MCM . The major contribution to storage is from the southern part of the basin while the northern and central parts contribute to about 15 per cent of the total storage potential.(Source: Water resource mangement in Yamuna basin in India K.K. Narula, N.K. Bansal, Journal of environmental studies and policy)
	d. Live storage through proposed dams:	Data not found
	e. Inter basin transfer systems:	Proposed links: Ghaghra-Yamuna link Sarda-Yamuna link Yamuna-Rajasthan link Karnali - Yamuna Yamuna-Sirsa branch of Western Yamuna canal (Rajasthan) (source: National Water Development Agency, NWDA) Note: For more details, Refer to Yamuna: Interlinking
	f. Any Other:	
5.3	Command area of major dams	

5.4	<p>Agencies functioning in the basins:</p> <p>a. Public agencies/ CSOs which construct/ implement the infrastructures projects:</p> <p>b. Private agencies/ CSOs involved in infrastructure development</p>	<p>Yamun Action Plan : With the objective of improving the Water Quality of River and restoring it to the 'Desired Bathing Class' Yamuna Action Plan was launched in 1993.supported by Government of Japan and Government of India (source: yap.nic.in).The Centre for Management of Degraded Ecosystems (CEMDE), Delhi University, along with the DDA, is working on the Yamuna Biodiversity Park, on 440 acres of river basin land near the Wazirabad barrage, in a bid to revive natural ecosystems of Delhi.</p> <p>Uppper Yamuna River Board</p>
6	<p>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</p>	<p>Yamuna Action Plan, Upper Yamuna Water Board</p>

7	Key Issues:	Pollution issues, especially in Delhi. Interstate water disputes, Interlinking, Rising pressures on groundwater due to non-availability of good surface water is a serious situation. These trends and the increasing dependence on groundwater for irrigation since 1947 indicate the rising pressures in the basin.
8	Enabling instruments- Law/ Policy/ Economic & Financial Measures for introducing IWRM in the basin	Upper Yamuna Water Board acts like a statutory RBO for Yamuna until it reaches Delhi.

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.	Upper Yamuna Water Board: The river Yamuna originates in Yamunotri Glacier in the Himalayas and traverses through the States of Himachal Pradesh, Uttar Pradesh, Uttaranchal, Haryana, Rajasthan and Delhi till its confluence with Ganga. The stretch of the river from its origin to Okhala near Delhi is called "Upper Yamuna". Water management in this stretch of Upper Yamuna is managed by UYWB
1.2	How has it been constituted? (Statutory/ Voluntary/ Any other form).	A Memorandum of Understanding (MoU) was signed amongst the five basin states on 12th May, 1994 for sharing of the water of Upper Yamuna. Clause 7(iii) of the MoU dated 12.5.94 provides that "The allocation of available flows amongst the beneficiary States will be regulated by the Upper Yamuna River Board within the overall framework of this agreement". Accordingly, the Central Government constituted the Upper Yamuna River Board vide Resolution No. 10(66)/74-IT dated 11.3.95. After the creation of the State of Uttaranchal, the MoWR partially

		modified the relevant resolution to include the State of Uttaranchal also in the board
1.3	State objectives and organizational structure of the RBO in outline & enclose brochures	<p>Organisational Structure: attached seperately.The functions of UYRB include:</p> <p>a) The regulation and supply of water from all storages and barrages upto and including Okhla Barrage, having regard to the agreements entered into or the arrangements made between the Governments of Basin States in pursuance of MoU dated 12.5. 1994 with the proviso to resolve any dispute with the approval of Review Committee.</p> <p>b) Maintenance of minimum flow, in proportion of completion of upstream storages, going upto 10 cumec downstream of Tazewala/Hathnikund and downstream of Okhla headworks throughout the year from ecological considerations.</p> <p>c) Monitoring return flows from the waters withdrawn by Delhi from Yamuna after allowing for consumptive use for the Municpal and drinking water purposes as agreed to and after providing treatment to ensure the proper quality of the effluent as per standards of Central Pollution Control Board.</p> <p>d)Monitoring return flows from the water withdrawn from Yamuna by the States of UP and Haryana for the purpose</p>

		<p>of silt exclusion.</p> <p>e) Monitoring flows from tail race of Khara hydel station into river Yamuna upstream of Hathnikund.</p> <p>f) Framing of Rules and Regulations for water accounting and determination of the shares of water for each State for every 10 days for regulation.</p> <p>g) To maintain records of flow of the river Yamuna at all stations and determination of volume in river Yamuna in water year.</p> <p>h) To maintain record of withdrawals for irrigation, domestic, municipal and industrial or any other purpose or water going down the river below.</p> <p>i) To ensure delivery of supply to all concerned States in accordance with their entitlements.</p> <p>j) Coordination of activities relating to and giving all appropriate directions for the following.</p> <ol style="list-style-type: none">1. Construction of different works.2. Integrated operation of the schemes for various uses including withdrawals.3. Monitoring conservation and upgrading quality of surface and ground water.4. Smooth implementation of inter-State projects. <p>k) Overview of plans for catchment area treatment, water shed management, rehabilitation and conservation of environment.</p> <p>l) Monitoring and review of the progress of all projects upto and including Okhla Barrage.</p>
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1.4	<p>Functioning level of the RBO (watershed/micro basin/sub-basin/basin, etc.) (eg. Upper Bhima Water Partnership, restricted to Bhima river flowing through the State of Maharashtra – A reference literature can be provided by Gomukh for comparison.</p> <p>1. Does the RBO have the responsibility and technical capacity to coordinate integrated water resources planning in the basin?</p> <p>2. Does the RBO have a proactive and efficient data management and information dissemination process to inform all stakeholders of basin conditions, water resource availability, and major issues?</p>	<p>UPWB manages water allocations for states: Himachal Pradesh, Uttar Pradesh, Uttaranchal, Haryana, Rajasthan and Delhi. Though the RBO does not specifically work on IWRM, it does have the potential of working on IWRM</p>
1.5	<p>What are the major activities carried out by the RBO since inception?</p>	
1.6	<p>What are the proposed activities of the RBO?</p>	
1.7	<p>Details of Contact person/s (Name, designation and contact numbers, address, & emails).</p>	<p>Attached in organisational profile</p>
1.8	<p>Presence of a regulatory framework wherein national or regional supra basin authority</p>	

	regulates the functioning of the RBO (eg. Indus Commission).	
1.9	Legal/political mandate wherein stakeholders can appeal for redress/decision and conflict resolution	
1.10	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. (Kindly elaborate upon 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? (e.g.: farmers, academics, CSO representatives, etc.)	
2.2	Elaborate the nature and frequency of public consultation initiated by the RBO (for example: Annual Public hearings, representations from individuals/public,etc.)	
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 (eg. Interaction of RBO with Water User Groups).	
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);	Data about organisations working on integrated issues of Yamuna could not be found. However, there are many initiatives on curbing the pollution of the river. Notable Amongst these are [a] <i>Yamuna</i> See : http://www.weforyamuna.8m.com/ [b] ' <i>Yamuna Jiye Abhiyan</i> '
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)	