

## RESEARCH ARTICLE

# Water Sharing Conflicts and Management in the Indus River Basin

Akhtar S\*

*Geography Department, University of Karachi, Pakistan*

\***Corresponding author:** Akhtar S, Geography Department, University of Karachi, Pakistan, Tel: 0333-3536896, E-mail: shamshadgeog@yahoo.com

**Citation:** Akhtar S (2019) Water sharing conflicts and management in the Indus River Basin. *J Aqua Sci Oceanography* 1: 202

## Abstract

Sharing water resources within country and amongst transborder countries often create conflict because of increasing demand of fresh water for their domestic, industrial and agricultural sectors due to growing population and increasing economic activities. As a result every country is interested to build more water storages like dams and barrages to safeguard their water requirements in the lean periods or to protect their areas during flood period. Therefore transboundary conflicts amongst riparian countries on water sharing are obvious fact which is resolved either through bilateral dialogue or by involving international arbitrators. Similarly conflicts of water sharing within a country have also been serious issue particularly during drought and lean period resulting political conflicts and obstacles in construction of dams and reservoirs. Pakistan is country of 207 million population, the sixth of the most populated country of the world has been facing transboundary water sharing conflict with India while within a country inter provinces mistrust over water distribution has created reservation over the construction of new water storages. Pakistan has two agreements which provide legal framework for water distribution and management. Indus Water Treaty is an international agreement signed in 1960 between India and Pakistan and other is national agreement amongst the provinces called Indus water accord signed in 1991 by province. Despite several reservations and hostile territorial conflicts between India and Pakistan the Indus water treaty has been successfully functioning in managing water distribution of Indus River and its eastern tributaries originate from Indian occupied Kashmir. Similarly Indus water accord 1991 provides a mechanism to resolve water sharing conflicts amongst provinces.

**Keywords:** Transboundary; Water sharing; Indus Water Treaty; Indus Water Accord

## Introduction

Many rivers of the world share boundaries of two or more than two countries. For example Danube River, Nile River, Rhine River, Congo River, Niger River, Amazon River, Mekong etc. have more than four riparian countries. Generally upper riparians construct dams and reservoirs for generating hydroelectricity and store water for irrigating crops during lean period. The lower riparian countries face two common problems i) scarcity of water during drought and lean period and ii) Discharge of surplus water through dams and barrages during flood period. In both cases lower riparians are sufferers and looser and upper riparians are gainer. Because of such clash of interest tension develops between upper and lower riparian countries which may cause of war [1,2].

Transborderry water conflicts exist in many region of the world like Turkey, Syria and Iraq have disputes of water sharing and construction of dams on Tigris and Euphrates rivers. Israel, Lebanon and Palestine have conflict over water sharing of Jordon River. Egypt, Sudan and Ethiopia confront over the issues of water sharing of Nile River. In Central Asia Kazakhstan, Turkmenistan, Uzbekistan has disputes of water sharing over Syr Darya and Amu Darya as well as environmental problems of Aral Sea. Similarly Bangladesh, India and Nepal have water sharing disputes over Ganges-Brahmaputra-Meghna rivers system. Indus River basis is also a volatile water sharing conflict zone between India and Pakistan. The constructive aspects of such conflicts amongst riparian countries are that countries have consensus to find out solution peacefully either through bilateral talks or through international arbitrators which are in result of agreements like 1956 agreement on the Jordon River between Israel and Jordon, 1960 Indus Water Treaty agreement between India and Pakistan, 1964 agreement on the Colombia River between Canada and United States etc [3].

Generally there are two main approaches in resolving water sharing conflicts amongst riparian countries. The first approach is based upon sharing mutual benefits from disputed river system rather than sharing water of that river system. This is mostly in cases of generating hydroelectricity which is shared by riparian countries like in case of Canada and United States. The second approach is based upon sharing water of river system mostly in countries where shortage of water in lean period and crops farming depend upon irrigation like Indus Water Treaty between India and Pakistan [4].

## Methodology

The present study is a descriptive study primarily based upon historical facts. The factual information used to evaluate the nature of water sharing conflict between India and Pakistan is based upon secondary sources. Cartographic technique and GIS computer software techniques have been used for drawing maps. Pictures of disputed hydro-power projects have been used to explain the location of conflicts and construction of projects.

## Discussion

### Transboundary Water Conflicts in South Asia

Transboundary water conflicts in South Asia first appeared after the end of British rule in the Indian subcontinent in 1947 and creation of new political boundaries. India and Pakistan emerged as two main countries in the region sharing common rivers and common boundaries. In 1971 the eastern part of Pakistan separated in form of new country called Bangladesh. The transboundary water conflicts mainly related to two major rivers systems; 1) the Ganges-Brahmaputra-Meghna (GBM system and 2) the Indus River system which lie mainly in India, Pakistan and Bangladesh, the 2<sup>nd</sup>, 6<sup>th</sup> and 7<sup>th</sup> most populated countries of the world. In the Himalayan region of South Asia India and Nepal have also a water issue over Gandaki River, a tributary of Ganges. Water conflicts in these countries mainly related to water quantity and sharing, timing of water discharge and water quality and eco-management. In spite of volatile political and militarial charged region the countries have been successfully resolving their water conflicts through agreements and mechanisms of water management. The 1959 India-Nepal Gandak Treaty, the 1960 Indus Water Treaty between India and Pakistan and the 1996 Ganges Treaty between India and Bangladesh are good examples that the countries of the region have realization of cooperation and sense of responsibility to resolve transborderly water sharing conflicts peacefully [5].

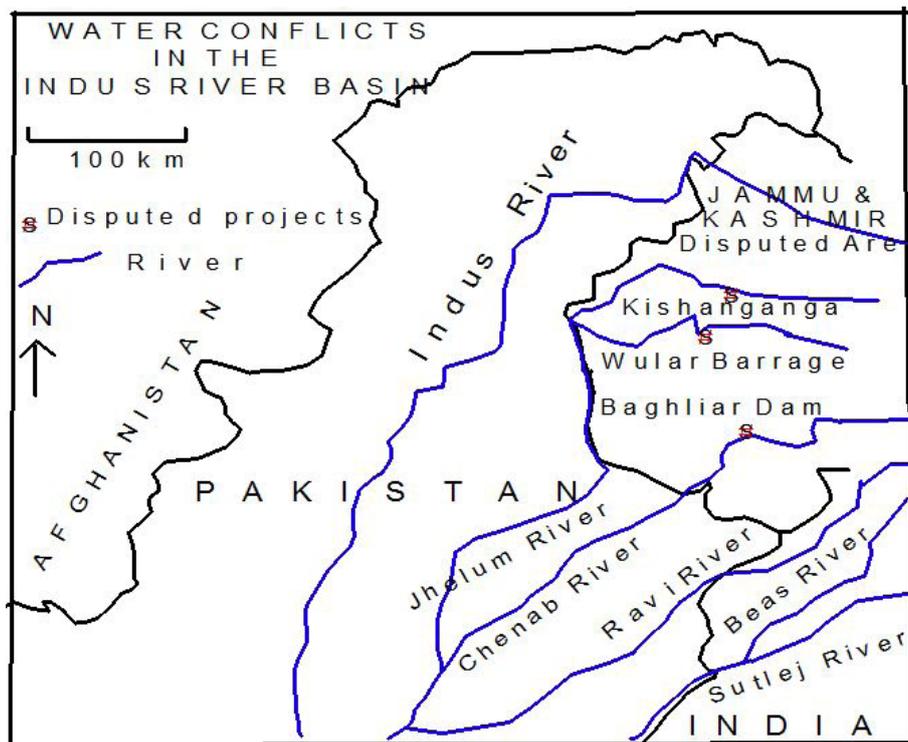
### Water Resources and Problems of Pakistan

Pakistan is a country of 207 million populations, the sixth most populated country of the world. It is located in the subtropical region of northern hemisphere dominated by arid and semi-arid climate with average annual rainfall of 11 inches. About 80 percent of the total rainfall occurs in the summer months (July to September) due to monsoon winds while in winter months (November to March) the remaining 20 percent rainfall occurs in the western parts of Pakistan due to western winds. The northern snow covered glaciated regions of Pakistan and Indian Kashmir are the main sources of water in Pakistan which feed rivers of Indus River System. Pakistan can be divided into two main hydrological regions; the eastern dry and rugged hilly region drained by rivers of Makran coastal basin and Khuzdar inland basin, the western fertile watered plain region drained by rivers of Indus River basin. It is estimated that Pakistan has total amount of 141.5 MAF (million acre feet) water available through three main river basins; about 137 MAF from the Indus Basin, 2.9 MAF from Makran basin and 0.7 MAF from Kharan basin. Pakistan has limited amount of subsurface sweet water which is utilized through tube wells, wells and Karez which irrigate only 12 percent of total irrigated cultivated land.

The Indus irrigation system comprises 3 large dams, several small dams, barrages, link canals and thousands of kilometers long canals. It is estimated that the country has a total of 60 million hectares of land suitable for agriculture out of which 42 million hectares (71percent) is already cultivated. The remaining 18 million hectares (29 percent) can become productive if water is made available for irrigation. Irrigation in Pakistan mainly depends upon Indus River, which has an average annual flow of about 130 to 141 MAF. Average water flow downstream Kotri since 1977 has been 35 MAF while it is estimated that roughly 10 MAF is required to flow to the sea. The Indus water quantity, after deducting 10 MAF required to flow downstream Kotri is estimated about 25 MAF which can be stored during flood period and can be used during the lean period. The construction of new reservoirs is essentially required particularly when the existing major reservoirs (Mangla and Tarbela) are silting up and have already lost 25 per cent of their total capacity. The design of Kalabagh Dam is still disputed while execution of Diamir Bhasha Dam is very slow. It is estimated that 5 to 6 new large dams and storages can be constructed on the Indus River System to store flood water for hydroelectricity and irrigation. Pakistan has been facing serious problems of water related issues in various forms, like scarcity of water for irrigated agriculture, water supply to cities, supply of water to industries, water for hydropower, water rights and allocations to provinces and transboundary water sharing disputes, groundwater depletion, flood management, drought management, water quality, wetland ecology, water management, etc. The government has announced first national water policy in May, 2018.

Since 1985 Pakistan has been facing serious challenge of transborder water sharing conflict with India over the implementation and interpretation of Indus water treaty, the water sharing agreement between India and Pakistan over water use of rivers of Indus River basin originates from Indian Kashmir. Pakistan has threat that water coming to Pakistan through River Jhelum and Chenab will be reduced to 40 percent by constructing dams and hydro power projects started by India which will badly affect the agriculture of Indus plain particularly in the province of Punjab (Figure 1).

Let's examine the water sharing conflict between India and Pakistan and its resolving mechanism in historical perspective.



(source: drawn by authors)

Figure 1: Water conflicts in the Indus River System

### Water sharing conflict and Management

**In the Indus River System:** The Indus River system consists of several tributaries that collect snowmelt and rain from the highest peaks of the Himalayas and carry it to the Arabian Sea. Seven of the rivers in this system cover catchment area of nearly 460,000 square kilometer in four countries, Afghanistan, China (Tibet), India, and Pakistan. The Indus River originates in the Tibetan plateau, making its 2700km journey southwards crossing Khyber Pukhtunkhawa, Punjab and Sindh provinces finally drain into the Arabian Sea. The river basin is divided amongst Pakistan, India, Afghanistan and China (Tibet) comprising total catchment area of 61 percent, 20 percent, 4 percent and around 15 percent respectively. The two major riparians, Pakistan and India have extensively dammed the Indus River to provide water for irrigation and hydro-electricity. The Indus has five main eastern tributaries. The Jhelum, the largest of these, originates in the Valley of Kashmir. The Chenab, a second tributary, flows through the Jammu region of the state of Jammu and Kashmir before entering the Indian state of Punjab. The remaining three tributaries (Ravi, Sutlej and Beas) either originate or flow through India's state of Himachal before entering Indian Punjab (Figure 1). Therefore India is upper riparian and Pakistan is the lower riparian of the Indus River and all of its tributaries. The Indus is a river system, important for the people of both India and Pakistan. In Pakistan, it is the only river system which irrigates 94 percent of the agriculture land. In India, it is one of two main river systems which irrigate agriculture land of Haryana and Rajasthan.

### Historical Background

Water sharing conflicts and agreements in the Indus River System dates back to the British Colonial Indian rule when in 1870s ruler of Kashmir state and British government signed a water sharing treaty for irrigation. In the beginning of 20<sup>th</sup> century under canals colonization schemes several irrigation projects, headwork and canals were constructed in joint Punjab. As a result Sindh expressed their deep concerns over such irrigation projects and British government formed judicial commission to resolve such conflicts which was finally resolved through Rao Commission report in 1940s but not properly implemented due to creation of India and Pakistan [6].

The main conflict of water sharing of Indus River System started in 1947 when British India was divided in two riparian countries, India, the upper riparian and Pakistan, the lower riparian. Sir Cyril Radcliffe was appointed as a chairman of boundary commission to demarcate the borders of two countries. The most difficult task was to divide united Punjab in Pakistan and India where rivers, canals and head works of Indus River System worked as an integrated irrigation network. To resolve this problem a "Stand Still Agreement" between the two governments was signed in 1947 to maintain status quo of water distribution through head works located in the Indian Punjab up to 31<sup>st</sup> March 1948. After 31<sup>st</sup> March 1948 India stopped water to the Dipalpur Canal and Upper Bari Doab canal. India agreed to resume water supply on the condition of annual payment charged for supply water.

It was under suggestion of US sponsored American experts the president of World Bank intervened and the issue was started to negotiate between India and Pakistan under the auspicious of World Bank then called International Bank for Reconstruction and Development (IBRD) in 1953. Both India and Pakistan presented two proposals of water sharing agreement. In the first proposal India proposed out of total available 119 MAF water in the Indus River System, 90 MAF water to Pakistan and 29 MAF to India while Pakistan proposed 103 MAF water to Pakistan and 16 MAF to India. In the second proposal India offered to Pakistan 93 percent water of Western Rivers (Indus, Jhelum and Chenab) and no water from the Eastern Rivers (Ravi, Sutlej and Beas) which India kept 7 percent water of the Western Rivers and all water of the Eastern Rivers. In the second proposal Pakistan offered to India 30 percent water of the Eastern Rivers and no water from the Western River while Pakistan kept 70 percent water of the Eastern Rivers and all water of the Western Rivers. These two proposals presented by India and Pakistan were not accepted by both countries. As a result experts of the World Bank in 1954 proposed their proposal. According to World Bank's proposal India was given complete right of water utilization of Eastern Rivers (32.6 MAF) and limited right of water of Western Rivers for irrigation of 69,000 acres land and building storages up to 1.6 MAF capacity for generating hydroelectricity on run of the river basis. Pakistan was given complete right of water use of Western Rivers and no right of water supply from the Eastern Rivers. However water discharged by India during flood period can be utilized. The World Bank made the proposal more acceptable with the offer of financial assistance to Pakistan for constructing two dams, five barrages and link canals. For this purpose India had to pay 174 million US \$ during 10 years in ten annual installment. A consortium of USA, Canada, West Germany, Britain, Japan provided 900 million US \$ for completion of projects during 10 years of period. World Bank also provided 54 million US \$ additional loan to Pakistan. The proposal of World Bank was accepted by both countries and Indus Water Treaty (IWT) was signed on September 19, 1960 in Karachi.

### Mechanism of Implementation

Implementation of Indus Water treaty started in 1960 while 10 years period was given to Pakistan for construction of 2 large dams, 5 barrages and 8 link canals to divert water of western rivers into the eastern rivers. The period of 10 years may be extended up to March 1973. During this period India would supply water of eastern rivers. Under the Indus Water Treaty agreement Mangla Dam, Tarbela Dam, 5 barrages (Chashma, Rasul, Marala, Qadirabad and Mailsi) and 8 link canals were constructed in Pakistan.

The treaty provides mechanism of water sharing cooperation between the two countries which are as follows:

1. Countries exchange daily river inflow data, daily release of water from dams, daily withdrawals at the heads of canals and link canals operated by government.
2. Installation of new meteorological and hydrological stations to provide data on request in case of any threats like flood, torrential rains, thunderstorms, cyclones etc. If any country constructs any engineering work on the rivers, details of the plans must be provided to other country.
3. A permanent Indus Water Commission is set up to address issues related to the treaty. The members or advisors of Commission may tour or inspect any works and sites of rivers of either side. The Commission will hold meeting regularly at least once a year, alternately in India and Pakistan. The Commission will also meet when requested by either Commissioner.
4. The most important part of the Indus water treaty is its mechanism of future resolving disputes. Any question raised by either country in application or interpretation of treaty first it is resolved through bilateral discussion. If the Commission does not reach agreement on any of the dispute it may be resolved at the request of either Commissioner through Neutral Expert under the supervision of the World Bank. In case the dispute is neither resolved bilaterally nor through neutral expert of World Bank than the dispute would be settled through International Court of Arbitration.

### Success and Failure

Despite hostile relationship and Kashmir dispute between Pakistan and India, fought two wars of 1965 and 1971 and deadly clash of Kargil in 1999, Indus Water Treaty has been the only international agreement which has resolved transborder water disputes successfully since 1960. This is the success of Pakistan because as a lower riparian country Pakistan has weak position to force India for implementation on the treaty with letter and spirit. However with the increase of water use each country is under stress to safeguard its water resources by constructing reservoirs for water storage and for generating hydroelectricity. As a result emergence of India-Pakistan transborder dispute is obvious fact. Let's examine some of the important disputes emerged since 1985.

1) The issue of Wullar barrage was first noticed by Pakistan in 1985 when India announced construction of barrage under the name Tulbul Navigation Project while Pakistan named it Wullar barrage. The barrage was planned to be constructed on the Jhelum River below Wullar Lake. Pakistan claimed the Wullar barrage adversely affected the entire system of the canals project within Pakistan, namely the upper Jhelum Canal, upper Chenab Canal and the lower Bari Doab Canal. India claimed that the purpose of Wullar Barrage was to construct a control structure for improving navigation in the Jhelum River during winter to connect Srinagar with Baramulla for transportation of fruits and timber. Pakistan objected it is violation of Indus Water Treaty which prohibits both parties to construct any structure which obstruct flow of water in the western rivers unless Pakistan has approved the design of storage capacity which does not exceed 10,000 acre feet while according to Pakistan storage capacity of Wullar barrage is 300,000 acre feet which is 30 times more than permitted capacity. Regarding the hydro-power plant Pakistan alleged that according to the treaty India is only allowed to construct small runoff water plant with maximum discharge of 300 cusecs through turbines while

India planned to build 960 MW electricity through Wullar project which needed more water. The control of the flow of Jhelum River by India through storage work would be serious threat to Pakistan if India would hold water for long period during dry season and increase the risk of flood by releasing water, affected Mangla dam hydroelectricity and irrigation system. India would be able to control the mobility of military across the river during confrontation by closing the gates of barrage. India is already in control of the Chenab River through the Salal Dam constructed in 1976 [7].

In 1986 Pakistan took the case of Wullar barrage in the Indus Water Commission but the Commission failed to resolve it. Pakistan decided to take the issue to the International Court but India stopped construction. In 1989 Pakistan agreed on the construction of barrage conditionally but India rejected. The two sides almost reached an agreement in October 1991 whereby India would keep 6.2 m of the barrage ungated with the crest level of 5167 feet. However the agreement could not be signed because India launched Kishanganga hydropower project on the tributary of Jhelum River which is called in Pakistan Neelum River while Indians called Kishanganga River. As a result Pakistan introduced another condition to stop Kishanganga project which would affect power generation of Neelum-Jhelum power project in Pakistan. On the other hand India in 2012 indicated seeking international arbitration under Indus Waters Treaty, after the failure of the 2012 round of bilateral talks between India and Pakistan over the controversial Tulbul Navigation Project or Wullar Barrage Project.

After Wullar Barrage dispute another dispute emerged in 2015 when Pakistan raised issue of Baglihar dam project constructed by India on the Chenab River in the meeting of Indus Water Commission. Pakistan claimed that the dam would obstruct water of the Chenab River. India claimed it is built on the run-of-river basis which is allowed in the IWT. Failure to resolve the question Pakistan approached to World Bank to appoint Neutral Expert to resolve the difference over Baglihar Dam. As result in 2007, the Neutral Expert submitted report to the World Bank. The report provided permission for construction of dam with gated spillway to India and rejected Pakistan's objection that gated spillway was unnecessary which would allow India to control the flow of the river. In the opinion of Neutral Expert that the hydrology, geology and seismicity of the site needed gated spillway. The ungated spillway could increase the risk of flooding. In the report Pakistan's objection of reducing crest elevation of dam was accepted.

3) Kishanganga hydroelectricity Project is the third major dispute came under discussion under Indus Water Treaty agreement. Pakistan has raised technical and legal objections on Kishanganga hydro power Project which has been completed 90 percent by India on the diverted water of Kishanganga or Neelem River (Photos 1 and 2).



Photo 1: Baglihar hydro-power project

Pakistan raised objection in bilateral talks on the ground that it will reduce flow of water for its Neelum--Jhelum Power Project and water in Mangla reservoir. India rejected all objections. In 2016 Pakistan approached to World Bank for its objections, eventually World Bank permitted power project and paused other related project for taking issue to the international court "Court of Arbitration. The project has been inaugurated by Indian Prime Minister in May 2018. Pakistan protested and announced that issue would be taken to International Court of Justice. It is also important that despite disputed status of Jammu and Kashmir India has been working on 26 hydro-power projects in Kashmir. In the last meeting of Indus Water Commission held in April, 2017 Pakistan raised issues of new hydro power projects Ratle (850 MW), Pak Dul (1000 MW) and Lower Lalnai (48 MW) projects located in the Chenab basin contending violation of Indus Water Treaty. India rejected on the ground that all of them will be operated on the run of river basis which is permitted in the treaty [8].

Despite such ongoing conflicts Indus Water Treaty has proved the only successful and peaceful mechanism of resolving dispute between India and Pakistan particularly in the volatile region of Jammu and Kashmir. Due to increasing demand of water in both countries wrath and frustration come from both sides on the revisit of the Indus Water Treaty. It is suggested that Pakistan should go to the World Bank to revisit the treaty in the light of new environmental challenges of global warming, climate change and threat

of ecosystem in the lower riparian region. On the other hand the present Indian government is threatening to convert Pakistan into desert and come out from the obligations of Indus Water Treaty because Pakistan is waging terrorism against India.



**Photo 2:** Kishanganga hydro power project

In return Pakistan alleges India for launching water war by constructing number of hydro-power projects in the Indus River basin of Jammu and Kashmir. Apart from this tension the 146<sup>th</sup> meeting of Indus Water Commission was held on March, 2018 in Delhi with the objective to respect the Indus Water Treaty and resolve issues peacefully and under the mechanism given in the treaty [9].

### Intra Country Water Sharing Conflict and Management

Water sharing disputes within country is common in countries and these are resolved bilaterally or intervention of central government through agreements. In Pakistan water sharing conflict in the Indus River system is between the two provinces the Punjab, the upper riparian and Sindh, the lower riparian. The conflict has been historic and complex because both the provinces extensively depend upon Indus River System for their canals irrigation network which provides water to their croplands [10,11].

Development of irrigation system in Punjab and Sindh started during British rule of India in 1880. British introduced a new irrigation system to convert inundation canals of Punjab and Sindh into perennial canals system first in East Punjab and then in the districts of Multan and Sahiwal. The pace of canal colonization was accelerated and up to 1905 and about 7.5 million acres of desert lands were converted into irrigated agriculture lands. The farmers were encouraged to grow cash crop instead of food crops for generating revenue. The building of canals was also related to British political control of the region. Many Sikh soldiers who helped British ruler to suppress the 1857 rebellion were settled in those canal colonies. Similarly British granted extensive lands who supported British rule. In 1914 British announced schemes to grant lands of Lower Bari Doab who provided military personals and loyalist to British. These schemes created big land holders families in Punjab. The same policy was also introduced in Sindh when canals irrigated lands were developed. As a result loyalist feudals and tribal chiefs were introduced as political elites [12].

Due to construction of canals in Punjab supply of water to Sindh, the lower riparian was affected. In 1919, the government of Punjab (United) started Sutlaj Valley project for construction of several canals and head works on the Sutlej River. Sindh launched its protest and British government appointed a committee to assess the problem. The Committee reported that the Punjab government should not be allocated water from the Indus River system till the construction of Sukkur Barrage. In September 1919 government of Punjab presented Thal project in response of Sukkur Barrage project. In April 1923, the Sukkur Barrage Project was sanctioned by the Secretary of State for India to safeguard the water supply of the Indus River to Sindh. After the construction of Sukkur Barrage on the Indus River, the Thal canal project was in operation and a barrage and canals were constructed on the Indus River down to Kalabagh in 1939 with the purpose to irrigate desert lands of Sindh Sagar Doab which include desert lands of Bhakkar, Khushab, Layyah, Mianwali and Muzaffargarh districts. The Government of Sindh strongly protested. As a result British government formed a Commission in 1941 headed by a Justice B.M. Rau, a Judge of the Calcutta High Court. The Commission proposed the solution that two new barrages in Sindh on the Indus River above and below the Sukkur barrage must be constructed to safeguard the water supply to Sindh. It was also suggested that Punjab should bear the cost of construction.

In 1945 Chief Engineers of Sindh and Punjab started negotiations and an agreement was signed in 1945. According to the agreement in future Punjab could not construct any dam on the Indus River or on any of its tributaries without the consent of the government of Sindh. The agreement gives detailed schedules for sharing of supplies when the availability of water in the river was less than the allocation. The agreement also provides the framework for all future projects and sharing of all surplus water supply. This agreement was the milestone in the known history of British India when sensitive riparian problems were resolved by mutual agreement [13].

The partition of the irrigation system in 1947 affected Punjab more than the Sindh because the former’s hydrological headworks were divided between two sovereign countries. After the creation of Pakistan the first conflict emerged between Sindh and Punjab when Punjab constructed a link canal called as “Bambanwala– Ravi–Bedian (BRBD) link canal” without the consent and approval of Sindh which is a clear violation of Sindh–Punjab Agreement of 1945. Political leaders of Sindh also objected on the 1960 Indus Water Treaty on the ground that Sindh was not taken in confidence when dams and barrages were planned to be constructed proposed in the Treaty to protect Punjab and neglect right of water to Sindh according to 1945 Sindh-Punjab agreement. To resolve the internal water disputes, in 1968 Water Allocations and Rates Committee was constituted by the Governor of (then) West Pakistan. The main objectives were to review water allocation and discharge from barrages and reservoirs. The committee submitted its report in July 1970, but no attention was given. Again in 1970, Justice Fazl-e-Akbar committee was constituted but again the recommendations of water distribution were not addressed. In the mean period Mangla Dam, Tarbela Dam, five barrages and link canals were constructed in Punjab under Indus Water Treaty (Figure 2).

In Sindh two new barrages Guddu at the upper part of Sukkur barrage and Kotri barrage at the lower part of Sukkur barrage were constructed (Photos 3 and 4).

In Khyber Pukhtunkhawa (then NWFP) Warsak dam was constructed on the Kabul River, a tributary of the Indus River. In 1977, the government of Pakistan established another commission comprising chief justices of the High Courts of the Province, headed by the Chief Justice of Pakistan to examine the issue of water distribution. All these commissions and committees failed to find a permanent solution to address the water disputes between Punjab and Sindh. In 1980s water sharing conflict became worse when WAPDA restarted feasibility works of controversial



Figure 2: Rivers, dams and barrages in Pakistan



Photo 3: Tarbella dam and reservoir

Kala Bagh dam on the Indus River and associated Greater Thal Canal Project located at Kalabagh in Punjab province. Because of strong resistance of the politicians of Sindh and KPK, the project was stopped [14].

After series of discussions and debates, in 1991 Prime Minister Nawaz Sharif led government finally reached an agreement of the Indus Water Accord to resolve all.



**Photo 4:** Kotri Barrage

Indus water-sharing-related disputes. This accord was signed on March 16, 1991 at Karachi, in a meeting of the chief ministers of Punjab, Sindh, Balochistan, and Khyber Pakhtunkhwa (then North West Frontier Province). It was approved by the Council of Common Interests (CCIs) on March 21, 1991 [15].

Under this accord, the IRSA (Indus River System Authority), with its headquarter at Lahore, was established in 1993 to monitor the distribution pattern among the provinces. According to the accord, the reservoirs of Tarbela, Mangla, and Chashma and inter-river link canals are the main controlling elements of water supply and management of Indus river system. The allocation of water shared by provinces was centrally monitored. According to the formula of water distribution given by IRSA, the total water available in the system is estimated 114.35 MAF. Out of this 55.95 MAF is allocated to Punjab, 48.76 MAF to Sindh, 5.78 MAF to Khyber Pakhtunkhwa and 3.87 MAF to Balochistan. The accord provided provision for the distribution of any surplus water and the shortfall as well. The surplus or flood water would be distributed amongst Punjab 37 percent, Sindh 37 percent Balochistan 12 percent and NWFP(now KPK) 14 percent. About 10 MAF water is allocated for down kotri barrage flow to sea for the protection of Indus estuary ecosystem. The accord provides provision to cut the share in case of shortfall due to reduction of snowfall and snow cover area in the catchment area. No restriction was put by the accord on the provinces to undertake new projects within their agree shares, on small schemes not exceeding 5000 acres. No restriction was imposed on the construction of Gomal, Kuram dams etc. which do not affect the existing shares. In case of any inter-province water distribution and new projects conflict if not be resolved by IRSA then it would be decided by the Council of Common Interests (CCIs) where the Chief Ministers of provinces and the Prime Minister would resolve the issues (Table 1).

Province	Kharif (Summer crops)	Rabi (Winter crops)	Total
Punjab	33.07 MAF	18.87 MAF	55.94 MAF
Sindh	33.94 MAF	14.82 MAF	48.76 MAF
KPK (NWFP)	3.48 MAF	2.30 MAF	5.78 MAF
Total	77.34 MAF	37.01 MAF	114.35 MAF

Source: Water Apportionment Accord 1991, IRSA

**Table1:** Indus Water apportionment amongst provinces in summer (Kharif) and winter (Rabi)

Soon after the signing of accord controversy emerged in 1994 when Sindh alleged that Punjab was not releasing its agreed quantity of water. Sindh was also blamed for not releasing water to Balochistan. IRSA was dissolved in 1998, after the then Prime Minister announced controversial plans to build the Kalabagh Dam on the Indus River over the objections of Khyber Pakhtunkhwa and Sindh. The IRSA was revived in 1999, but as an agency attached to the Federal Ministry of Water and Power, with headquarters in Islamabad. During the droughts of 2001 and 2002, IRSA failed to generate consensus over water allocation.

In 2002 Executive Committee of the National Economic Council approved Thal flood canal project which would be taken from the Chashma Jehlum Link Canal to irrigate 1.5 million acres land of Southern Punjab. Sindh protested against it. Punjab rejected and claimed that it would be constructed within the allocated share of water. During this period WAPDA again took the initiative of

developing consensus among provinces over the construction of Kalabagh Dam but failed. Ultimately WAPDA launched project of Diamir Bhasha Dam project on the Indus River at the boundary of KPK and Gilgit Baltistan. The pace of the project is very slow (Photos 5 and 6).



**Photo 5:** Down Kotri barrage inflow of Indus River in lean period (winter season)



**Photo 6:** Sea water intrusion in the Indus Estuary at Sajawal Bridge in lean period

Sindh has also been complaining that IRSA has failed to make sure 10 MAF, down Kotri Barrage release of water eventually sea water intrusion has damaged fertile cultivated land and destroy ecosystem of Indus estuary. Punjab has rejected this allegation and give figure of releasing water up to average 35 MAF including discharge of water during flood periods (Photos 5 and 6).

## Conclusion

Transboundary water sharing conflict exist in many countries of the world where rivers cross international boundaries. The water right of lower riparian countries is internationally accepted. Therefore even hostile countries like Jordon and Israel, India and Pakistan have resolved conflicts through international agreements. Pakistan since its creation has been facing water aggression of India. Through intervention of World Bank the agreement of water utilization of the rivers of Indus River System was signed in 1960. Despite transborder conflicts over Kashmir and wars of 1965, 1971 and 1999 the treaty is still an important mechanism of bilateral and peaceful solution of disputes of the construction of new projects and their interpretation.

Intra country water sharing disputes is very common. In Pakistan water dispute between the two upper and lower riparian provinces Punjab and Sindh is deep rooted and historic. The water Accord of 1991 provides a mechanism of water distribution amongst provinces. The mistrust and clash of interest are two main factors behind this conflict.

## References

1. Feitelson E, Chenoweth J (2002) Water poverty: towards a meaningful indicator. *Water Policy* 4: 263-81.
2. Shammy P, Aureli A (2008) Transboundary aquifers: A global program to assess, evaluate, and develop policy. *Ground Water* 43: 661-8.

3. Kibaroglu A (2002) Building a Regime for the Waters of the Euphrates-Tigris River Basin. *Int Natl Water Law Policy*.
4. Wolf AT (2007) Shared waters: conflict and cooperation. *Annu Rev Environ Resour* 32: 241-69.
5. Wolf AT, Natharius JA, Danielson JJ, Ward BS, Pender JK (1999) International river basins of the world. *Int J Water Resour* 15: 387-427.
6. Bandyopadhyay J (2002) Water management in the Ganges-Brahmaputra basin: emerging challenges for the 21st century. *J Water Resour Dev* 26: 179-218.
7. Kishor UP, Salman MA (2011) Legal aspects of sharing and management of transboundary waters in South Asia: preventing conflicts and promoting cooperation. *Hydrological Sci J* 56: 641-61.
8. Jarvis T, Giordano M, Puri S, Matsumoto K, Wolf A (2005) International borders, ground water flow, and hydroschizophrenia. *Ground Water* 43: 764-70.
9. Cooley J (1984) The war over water. *Foreign Policy* 54: 13-26.
10. Giordano M, Wolf A (2003) Sharing waters: post Rio international water management. *Nat Resour Forum* 27: 162-70.
11. Gabriel E (2017) *The international law of transboundary groundwater resources*. Routledge 174.
12. Giordano M, Giordano M, Wolf A (2002) The geography of water conflict and cooperation: Internal pressure and international manifestations. *Geogr J* 168: 293-312.
13. Starr J (1991) Water wars. *Foreign Policy* 82: 17-36.
14. Shamshad A (2011) *The South Asiatic Monsoon and Flood Hazards in the Indus River Basin*. *J Basic Appl Sci* 7: 100-15.
15. Fazle KK (2006) *Pakistan: geography, economy and people*. Oxford Univ Press, Karachi.