

PILDAT

SEPTEMBER 2003

UPDATED JANUARY 2011

BRIEFING PAPER

FOR PAKISTANI PARLIAMENTARIANS

7

BRIEFING PAPER NO.

Strengthening Democracy & Democratic Institutions in Pakistan

Issues of Water Resources in Pakistan

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PILDAT is an independent, non-partisan and not-for-profit indigenous research and training institution with the mission to strengthen democracy and democratic institutions in Pakistan.

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FOREWORD TO THE 1ST EDITION

Wf all the crises, water crisis is the one that lies at the heart of our survival and that of our planet. Experts project that the global water crisis will reach unprecedented levels in the years ahead with growing per capita scarcity of water in many parts of the developing world. For centuries, human beings have fought wars in which water resources have been contested; the years ahead once again predict the threat of looming water wars between countries.

In Pakistan, availability of water resources and their development has been slowly turning into a crisis situation and has reached a level of inter-provincial conflicts which immediately need to be addressed. The challenge lies in raising the political will to implement water-related commitments; water professionals need a better understanding of the broader social, economic and political context, while politicians need to be better informed about water resource issues.

It is in this backdrop that PILDAT briefing Paper on the Issues of Water Resources in Pakistan has been prepared. The aim of the briefing paper is to present the scenario in its available detail so as to provide concise and objective information to parliamentarians on the importance of water for the future of Pakistan and to enable them to take up the issue in the parliament for better policy initiatives and options.

PILDAT developed the draft briefing paper with technical help from the **Associated Consulting Engineers (ACE) Ltd.**, a private engineering consulting firm renowned for its experience with water-related projects and strategies. A steering Committee was constituted comprising political and technical experts from all provinces of the country. The objective behind constituting the committee was to ensure that the paper should present an objective view of the issue, highlighting major perspectives and provincial concerns and strategies. The draft was modified to add recommendations of the Steering Committee.

Since the exact availability of water in Indus and associated details has become a contentious issue in the country, PILDAT has made every effort to present a range of figures with sources. WAPDA figures have also been quoted at some places with elaborate references in the bibliography. PILDAT, however, does not wish to advocate a certain view and has compiled this paper with a completely non-partisan outlook. The list of issues identified as key issues is not exhaustive as PILDAT has only picked what were thought to be the most crucial issues.

PILDAT thanks the ACE Team and the Steering Committee Members for their support, involvement and guidance in developing this briefing paper. We thank IRSA for providing a copy of the Indus Water Accord of 1991 and Indus Water Commission, Lahore for providing a copy of the Indus Waters Treaty - 1960.

PILDAT and its team of researchers have made every effort to ensure the accuracy of the contents of this paper. PILDAT, however, does not accept any responsibility of any omission or error as it is not deliberate.

Lahore
September 20, 2003

FOREWORD TO THE 2ND & UPDATED EDITION

The first edition of this Briefing Paper on **Issues of water Resources in Pakistan** was published in September 2003 to brief Members of the Parliament and the Provincial Assemblies in Pakistan on a subject which at that time was being hotly debated inside and out of the legislatures but mostly on an emotive plane without much support of the facts and figures. After the lapse of more than seven years since then, the issues not only stand unresolved, new layers of complications and mistrust have further solidified the issues. The need to resolve the issues has grown many folds as the country urgently requires to develop its water resources to meet the increasing needs of water and electric power.

Although the major issues in water resources have not changed in the last seven years, some new data has become available which can help update the paper before it is used to brief the legislators about the issues and possible way forward. We firmly believe that an informed discourse and dialogue is the most effective means to finding a solution and moving forward. We hope that this updated Briefing Paper will be helpful in making the on-going discourse on water issues and inter-provincial differences an informed one.

Acknowledgments

PILDAT had developed the 1st edition of the briefing paper with technical help from the **Associated Consulting Engineers (ACE) Ltd.**, a private engineering consulting firm renowned for its experience with water-related projects and strategies in 2003. A steering Committee was constituted comprising political and technical experts from all provinces of the country to oversee and approve the paper. The second edition of the Briefing Paper has been produced following the review and updating by **Sardar Muhammad Tariq**, Former Member (Water), WAPDA; and Regional Chair Global Water Partnership - South Asia (GWP-SAS) at our request. PILDAT gratefully acknowledges the contribution of Sardar Muhammad Tariq.

We also wish to thank the **British High Commission, Islamabad** for its support to the project aimed at promoting understanding of inter-provincial water issues as a first step towards their resolution through dialogue. This paper has been updated and re-published under the project.

Disclaimer

The authors, the reviewer responsible for updating and PILDAT have made every effort to ensure the accuracy of the contents of this paper. PILDAT, however, does not accept any responsibility of any omission or error as it is not deliberate. The content of this background paper does not necessarily reflect the views of PILDAT or British High Commission, Islamabad.

Islamabad
January 2011

ABBREVIATIONS & ACRONYMS

CCI	Council of Common Interests
GDP	Gross Domestic Product
IPOE	International Panel Of Experts (on review of studies on water escapages below Kotri barrage)
IRSA	Indus River System Authority
IWASRI	International Waterlogging and Salinity Research Institute
IWMI	International Water Management Institute
KP	Khyber Pakhtunkhwa (formerly NWFP)
MAc	Million Acres
MAF	Million Acre Feet
MW	Mega Watts
NWFP	North West Frontier Province (now Khyber Pakhtunkhwa)
NESPAK	National Engineering Services of Pakistan
PIDAs	Provincial Irrigation & Drainage Authorities
SPD	Survey of Pakistan Datum
TOR	Terms of Reference
U/S	Upstream
WAPDA	Water and Power Development Authority
WHO	World Health Organisation
WTO	World Trade Organisation

BRIEFING PAPER

Issues of Water Resources in Pakistan

STEERING COMMITTEE FOR THE 1ST EDITION OF THE BRIEFING PAPER

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NWFP (now Khyber Pakhtunkhwa):

- **Mr. Shams-ul-Mulk**, Former Chairman WAPDA; Former Provincial Minister
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The team of Associated Consulting Engineers (ACE) Ltd which participated in the preparation of the Briefing paper and also attended the Steering Committee meeting included the following:

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The PILDAT team which attended the Steering Committee meeting, conceptualised, reviewed and edited the draft briefing paper included the following:

- **Mr. Muhammad Haneef Ramay**, Member PILDAT Board of Advisors, Former Chief Minister Punjab
- **Mr. Mujib-ur-Rehman Shami**, Member PILDAT Board of Advisors, Renowned Columnist; Editor-in-Chief Daily Pakistan
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EXECUTIVE SUMMARY

Water plays an extremely important role in the economy of Pakistan which chiefly depends on Agriculture accounting for 24 per cent of the national GDP, 48 per cent employment and 70 per cent of country's exports. Per capita availability of surface water is gradually dwindling from 5300 cubic meter in 1951 to 1300 cubic meters in 2002 and is projected to hit 1000 cubic meters making Pakistan a water short country as per the world standards. Pakistan has a total of 77 million acres of land suitable for agriculture out of which 54 million acres (71 per cent) is already cultivated. The remaining 23 million acres (29 per cent) 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 138 to 145 MAF. Some experts calculate this quantity as low as 123.5 MAF. Average water flow downstream Kotri since 1977 has been 35 MAF while Sindh's estimates indicate that roughly 10 MAF is required to flow to the sea. The Indus water quantity, after deducting 10 MAF required to flow downstream Kotri and 5 MAF for headwater uses comes to about 20 MAF which the Federal Government and some experts feel can be stored during floods and used during the lean period. The construction of reservoirs, they argue, is thus a badly needed and viable proposition especially in view of the fact that the existing major reservoirs (Chashma, Mangla and Tarbela) are silting up and have already lost 25 per cent of their total capacity. The design of Kalabagh Dam (Capacity: 6.1 MAF) is ready for execution whereas detailed design of Basha Dam was completed in 2008. The revised cost of Bhasha Dam Project is US \$ 11.17 billion with live storage capacity of 6.4 MAF and power component of 4,500 MW. The estimated time for completion is 9 years. The Project financial arrangements are being negotiated with Asian Development Bank. The Federal Government until recently and the Punjab province strongly feel that these projects should be executed forthwith. The Federal Government, however, in view of the inter-provincial difference of opinion, is non-committal in the case of Kalabagh dam at present.

Some other experts and public figures (mainly from Sindh Province) question this proposition and strongly believe that there is not sufficient water in the Indus to construct additional storage. They believe that average flow is not the correct and scientific basis to ascertain the availability of water for such mega projects as planned by the WAPDA. Khyber Pakhtunkhwa (formerly NWFP) is also opposed to Kalabagh Dam project as it considers Kalabagh reservoir a threat to its lands and populated areas such as Nowshehra town. Sindh province is opposed to the construction of Greater Thal Canal in Punjab and considers it a potential conduit of pilferage of Sindh's share of Indus Water.

The Federal Government's role also has been changing with the political change at the federal level. The Provincial Assemblies of Sindh, Khyber Pakhtunkhwa (formerly NWFP) and Balochistan have passed resolutions, many unanimously, against Kalabagh Dam. Sindh Assembly has unanimously opposed Greater Thal Canal which is under construction in Punjab. Although the four (4) provinces have signed a historical Indus Waters Apportionment accord in 1991, serious differences persist especially between Punjab and Sindh on the interpretation of some of its clauses. A deep distrust between the two provinces is the main reason of water related disputes. The other major water issues which Pakistan faces today include differences on construction of additional storages, mode of sharing water shortages, construction of Greater Thal canal in Punjab, silting of existing reservoirs and wastage of huge quantity of water in the irrigation system. The minimum water required to flow below Kotri has been another contentious issue. It is understood that consultants have completed the study of the subject and quantum of water required to cater for water needs downstream of Kotri has been determined.

Pakistan's political leadership needs to activate constitutional conflicts resolution mechanisms such as the Council of Common Interests (CCI). The Parliament and its standing committees on water and power need to take a pro-active approach to reconcile the inter-provincial differences and develop a national consensus on such a critical issue as water. Elected political leadership in Pakistan has been able to develop consensus on a number of extremely complex issues such as the 1973 Constitution, 1991 Water Accord and 18th Constitutional Amendment and it can do so to resolve the water-related issues.

The other actions recommended for the political leadership in general and parliamentarians in particular include signing an interprovincial accord on new water storages, agreeing on the outcome of the study to ascertain minimum flow required downstream Kotri, an enhanced telemetry system, water conservation, adoption of new irrigation techniques and technologies, adopting modern technology for forecasting of floods and droughts, improvement in drinking water quality which is hazardous to public health, adopting new techniques for extracting groundwater, harnessing hill torrents, checking water pollution, improving institutional structure in water sector, legislating a comprehensive water law and better regulation of ground water usage, moving away from sectoral water management to more holistic approach of Integrated Water Resources Management.

1. BACKGROUND

Water plays a vital role in a country's economy. Although about 88 per cent of water is used in the agriculture sector, the industry, commerce and public health are also greatly affected by the quantity and quality of the available water.

Per capita availability of surface water has been gradually dwindling in Pakistan from 5300 cubic metres in 1951 to 1300 cubic metres in 2002. It is projected that by 2005 per capita availability of surface water may hit 1000 cubic metres, which is a threshold for defining 'a water short country'.

Pakistan's economy mainly depends upon Agriculture. It is the single largest sector and accounts for 24 per cent of the GDP and employs 48.4 per cent of the total workforce. About 68 per cent of country's population lives in rural areas and is directly or indirectly linked with agriculture for its livelihood. Over 70 per cent of our exports rely upon agricultural-based products. Water is the mainstay of agriculture. Irrigated agriculture provides 90 per cent of food and fibre requirements from about 42.5 million acres which is around 80 per cent of the cultivated area, while the remaining is contributed by over 10 million acres of barani (rain-fed) land.

Pakistan has a total geographical area of 196 million acres out of which 77.1 million acres is suitable for agriculture. A total of 54.5 million acres (71 per cent) out of the total agriculturable land is already cultivated either by irrigation or through rain. The remaining 22.6 million acres of land which constitutes 29 per cent of the total area suitable for agriculture can become productive if water is made available for irrigation. It means that a little less than 1/3rd of the agricultural potential of Pakistan remains untapped because of non-development of water resources and associated infrastructure.

Water sector industry of Pakistan is the largest enterprise accounting for approximately US \$300 billion of infrastructural investment and contributing about US \$ 16 billion annually to the GDP of the country.

Irrigated area of Pakistan has enhanced from 20.7 MAc in 1947 to 42.5 MAc in 2000 due to construction of a large number of irrigation works since independence. As a result, Pakistan now has the largest contiguous irrigated area of the world. The Indus River Basin System has three (3) multipurpose dams / reservoirs, nineteen (19) barrages, twelve (12) link canals and forty-five (45) independent main canal commands. Schematic Diagram

of Indus Basin is depicted in Figure 1.

Population growth, rapid urbanisation and industrialisation are imposing growing demands and pressures on water. The rising imbalance between supply and demand has led to shortages and unhealthy competition leading to inter-provincial tension, environmental degradation in the form of persistent waterlogging in certain areas and rapid decline of groundwater levels in other areas. Intrusion of saline water into fresh groundwater aquifer is another problem caused by excessive and imbalanced pumping.

The growing shortage of water which reaches alarming proportions during the drought years requires that a concerted effort be made to conserve water, develop available water resources to the optimum and adapt modern technologies for more efficient irrigation techniques. Unless this is done, self-sufficiency in food, socio-economic amelioration, alleviating poverty and conservation of environment would not be possible and eventually food shortages and even famine-like conditions may arise in the country.

Besides irrigated-agriculture usages, water plays an intrinsic role in many other sectors such as domestic, industrial, mining, livestock, fisheries development, etc. Hydropower is the cheapest and environmentally the cleanest way of generating electricity. Its abundant potential in Pakistan has to be developed on a priority basis if the current trend of rising power tariff is to be reversed.

Table 1: Comparative Status of Development of Water Resources of Pakistan and India

Item	Pakistan	India	Ratio
Population	175 Million	1154 Million	1:7
Area Irrigated by Canals and Tube Wells	42 Million Acres	221 Million Acres	1:5
Large Dams	68	4700	1:69
Storage Capacity	13 MAF	262 MAF	1:20
Hydropower	6500 MW	31000 MW	1:5
Canal Diversions	103 MAF	460 MAF	1:4

Source: Pakistan's Dams and Development by World Commission on Dams (November 2000)

2. WATER AVAILABILITY AND REQUIREMENTS

2.1. Water Resources

Water in Pakistan is becoming scarce, while major parts of conventional water resources have already been developed. In order to meet the needs of growing

population for water supply and sanitation, food and fibre, industry and environment, the conservation of this precious resource and development of next-generation water resource projects would be essential. The cost of these projects is likely to be higher than the cost of relatively simpler projects already completed. Achieving

Table 2: Water Resource Potential (Million Acre Feet per Year)

Uses	Existing Uses (2003)				Gross Development Potential				Additional Development Potential			
	Surface	Ground Water	Rainfall Harvesting	Total	Surface	Ground Water	Rainfall Harvesting	Total	Surface	Ground Water	Rainfall Harvesting	Total
Agriculture at Farm Gate	57.5	37.5	5.0	100.0	70.5	43.5	8.0	122.0	13.0	6.0	3.0 *	22.0
Domestic	2.0	2.5	-	4.5	2.0	8.5	-	10.5	-	6.0	-	6.0
Industry	1.5	2.0	-	3.5	1.5	3.3	-	4.8	-	1.3	-	1.3
Environmental Uses	1.3	0.0	-	1.3	1.3	0.4	-	1.7	-	0.4	-	0.4
Total	62.3	42.0	5.0	109.3	75.3	55.7	8.0	139.0	13.0	13.7	3.0	29.7

* Likely development by 2025

Source: Pakistan's National Water Resource Strategy (2002) by Ministry of Water & Power

Table 3: Water Usage

		Million Acre Feet
A.	Annual Average Flow Below Kotri (Post Tarbela) 1977-2001	35 to 38
B.	Requirement Below Kotri (Tentative 1991 Accord Figure)	10
C.	Likely Uses in the Headwater Areas both on Eastern and Western Rivers	3 to 5 *
	Balance Potential (A-B-C)	20 to 25 MAF at Canal Headworks
	Equivalent availability at farmgate or <i>nakka</i> :	13 to 15 MAF

Source: Pakistan's National Water Resource Strategy (2002) by Ministry of Water & Power

* The Indus Water Treaty Pakistan and India, 1960.

2. WATER AVAILABILITY AND REQUIREMENTS

2.1. Water Resources

Water in Pakistan is becoming scarce, while major parts of conventional water resources have already been developed. In order to meet the needs of growing population for water supply and sanitation, food and fibre, industry and environment, the conservation of this precious resource and development of next-generation water resource projects would be essential. The cost of these projects is likely to be higher than the cost of relatively simpler projects already completed. Achieving sustainable development will, thus, be a major challenge in the 21st century.

The major exploitable water resources of Pakistan are:

- a. Surface Water
 - River Flows
 - Rainfall
- b. Groundwater
 - Useable Groundwater Aquifers
 - Useable Layers Overlying Saline Water

- c. Desalination, Reuse, Recycle

2.1.1. River Flows

Pakistan has three (3) major river basins with the following average annual flows:

MAF (Million Acre Feet)	
1. Indus Basin	138.0 to 145.0 ¹
2. Mekran Coastal Basin	3.0 ²
3. Kharan Closed Desert Basin	0.8

Total	141.8 to 148.8 MAF

Of the total available annual flow in the Indus Basin, 105 MAF³ is already being used through a system of storages and distribution network. Average annual escapage below Kotri, the last Barrage on the Indus River, going to the sea, is 31⁴ MAF. Indeed a provision has to be made for certain flow requirements below Kotri Barrage to meet the requirements of local population, the ecological needs and biodiversity of the coastal area for which a study has been completed to define quantum of water required.

Final report of the International Panel of Experts (IPOE) for Review of Studies on Water Escapages below Kotri Barrage

1. The average value depends upon the period over which the average is calculated and whether exceptional low and high values are disregarded or not. Some consider this value as low as 123.5 considering average flows as unreliable in view of the large variations in flow from year to year.
2. Master Planning of Hill Torrents of Pakistan NESPAK, 1998.
3. Ibid.
4. WRMD WAPDA based on data supplied by the Government of Sindh.

commissioned by the Ministry of Water and Power and concluded in November 2005 concludes that “an escapage at Kotri barrage of 5000 cusecs throughout the year is considered to be required to check seawater intrusion, accommodate the needs for fisheries and environmental sustainability and to maintain the river channel.” In addition the report recommends that “a total volume of 25 MAF in any 5 years period (an annual equivalent amount of 5 MAF) be released in a concentrated way as flood flow (Kharif period), to be adjusted according to the ruling storage in the reservoirs and the volume discharged in the four previous years.” Taken these two recommendations together, 5000 Cusecs translate into 3.6 MAF per year and when added to the required flood flow of 5 MAF per year, the average annual quantity of water required to flow below Kotri works out to be 8.6 MAF.

Assuming a provision of 10 MAF for uses downstream Kotri, a tentative figure (indicated in the 1991 Accord), the additional available flow is about 20 to 25 MAF, excluding further uses by India, is carried in Table 3.

2.1.2. Rainfall

Monsoon and Westerly currents are the two main weather systems that contribute to rainfall over Pakistan. Average annual rainfall over Pakistan is 11.4 inches.

Aside from the useful components of rainfall that occurs on the farmlands or finds its way to the main river system, hill torrents bring in floods of short durations but of high magnitudes. Because of steep slopes, flood flows move with enormous speed, which result in the erosion of banks and beds of channels. Flood flows debouching onto the plain areas, are generally charged with high silt contents, which prohibit their management by conventional dams or reservoirs.

A major portion of hill torrent flows not only goes waste but also causes damages in the areas which are already underdeveloped. The total development potential of hill torrents is estimated as approximately 15⁵ MAF of which 5 MAF has already been conserved through the construction of more than 500 structural interventions such as delay action dams, dispersion structures, retaining walls, etc. Approximately 3 MAF is considered a reasonable quantum for further harnessing by the year 2025.

2.1.3. Groundwater Resources

The vast and readily available groundwater resources of Pakistan have played an increasingly important role in meeting the country's food and fibre requirements. Groundwater now supplies around 45 per cent of crop water requirements in the country since it permits the farmers to exercise greater control over available water in its timely application for crops. This has transformed the

Table 4: Water Requirements according to Population

Sectors	Existing Water Uses 2003 (MAF)	Existing Water Uses 2010 (MAF)	Projected Requirements Year 2025 (MAF)	Additional Requirements (MAF)
Agriculture at the Farmgate	100	100.3	128	27.7
Municipal and Rural Water Supply, Sanitation and Environment	5.8	7.6	12.2	4.6
Industry	2.2	3.0	4.8	1.8
Total	108.0	110.9	145	34.1

Source: Perspective Five Year Development Plan 2010-15 Planning Commission, GOP

5. Master Planning for Flood Management of Hill Torrents of Pakistan - NESPAK 1998
6. Water Resources: Challenges of Pakistan by Sardar Muhammad Tariq, Regional Chair Global Water partnership - South Asia (GWP-SAS) November 2010.
7. Ibid.
8. Ibid.

concept of low and uncertain crop yields to more secure and predictable form of crop production. Even away from the Indus Plains in the highland areas of Balochistan and Khyber Pakhtunkhwa (formerly NWFP), groundwater has been crucial in supporting the agricultural sector. Crop yields have nearly doubled due to use of groundwater in addition to rotational canal water supplies. It is, therefore, imperative that long-term sustainability of groundwater, as a resource, is maintained.

The aggregate groundwater potential after full development of surface water resources is estimated to be approximately 59 MAF⁶ of which 50⁷ MAF is being currently used annually through more than 1,000,000⁸ tube wells installed and operated by the farmers themselves, and about 5,000 public sector operating tube wells.

The pace at which the groundwater exploitation has unfolded has also added to the complexity of its management. In some regions, the impact on the groundwater is alarming; groundwater levels are declining rapidly to unfeasible pumping depths, and there is intrusion of saline water in the fresh groundwater areas through lateral or upward movement of the former. At the same time, there are some areas where waterlogging still persists due to inadequate pumping and/or drainage. It has been estimated that a further potential of some 6 to 14 MAF exists in the development of Pakistan's groundwater resources.

2.2. Projected Water Requirements

Population of Pakistan stands at 175 million and is likely to increase to about 221⁹ million by the year 2025.

Projected food requirements have been estimated based upon population growth and the requisite caloric needs. The per capita consumption of food and fibre, thus, calculated, indicates the projected water requirements at the farmgate, contained in Table 4.

In terms of irrigated agriculture, the additional water requirement by year 2025 would be 28 MAF at the Farmgate. As Table 4 indicates, some 9.0 (6.4+2.6) MAF of water is required for uses other than irrigated agriculture. As opposed to the total quantity of 37.0 MAF, the gross additional water available is 30 MAF (13 MAF from canals at farmgate, 14¹⁰ MAF as groundwater contribution and 3 MAF from rainfall harvesting). In the

circumstances, even after creating additional storages to conserve excess water during the months of mid June to mid September, major effort will have to be placed in water conserving and production enhancement strategies, so as to ensure, for the people of Pakistan, domestic and industrial water as well as food security. The availability of 30 MAF seems to limit our water developmental potential in various sectors. Furthermore, since river flows in the nine-month period mid-September to mid-June, are already short of the demand, the feasibility of additional storage is needed to be studied to conserve the apparently surplus flood flows going to the sea during the three remaining months of most of the year.

Pakistan being an arid country requires at least 40% of its total surface water as storage for better water management and to combat drought and floods.

3. PAKISTAN'S INTERNATIONAL AND NATIONAL AGREEMENTS ON WATER DISTRIBUTION

For sharing and distribution of surface water, two (2) major agreements have been made; one at the international level with India known as the Indus Waters Treaty - 1960 and the other at the national level amongst the provinces known as Apportionment of Waters of Indus River System between the provinces of Pakistan - 1991. These are briefly described below:

3.1. The Indus Waters Treaty - 1960

Dispute between India and Pakistan over sharing of Indus Valley River flows could not be settled through bilateral negotiations, and international mediation had to be sought. The dispute was finally resolved with the signing of the Indus Waters Treaty in 1960 after protracted negotiations through mediation by the World Bank.

Under the Treaty, India was given away the exclusive use of three (3) Eastern Rivers (Ravi, Beas and Sutlej), while the Western Rivers (Chenab, Jhelum and Indus) were left for Pakistan except for some specified uses by India. A network of two (2) storage dams, eight (8) inter-river link canals and six (6) barrages was constructed in Pakistan as replacement works under the Treaty to transfer water from Western Rivers to the Eastern Rivers and to the canal systems which were then receiving their supplies from the three (3) Eastern Rivers.

9. Exploitation & Regulation of Groundwater of Pakistan - ACE, Halcrow 2003.

10. Only after full development potential of surface water resources.

Table 5: Proposed Dams

Feature	Proposed Kalabagh Dam	Proposed Diamer-Bhasha Dam
Location	Indus River; 162 miles downstream Tarbela Dam	Indus River; 200 miles Upstream Tarbela Dam
Dam Height	260 Feet	892 feet
Live Storage	6.1 MAF	6.4 MAF
Hydropower	3,600 MW	4,500 MW
Estimated Cost	Rs. 360 billion	Rs. 960 billion
Status	Feasibility & Design completed	Detailed Design and Tender Documents have been completed
Earliest Date when Construction can start	Not yet known	2012*
Possible Completion Date	Not yet known	2021*

Source: Water Resources & Hydropower Development Vision 2025 (Updated Figures)

* Asian Development Bank has not yet approved the loan - construction period is 9 years.

The construction of storages and link canals allowed the operation of the Indus Irrigation System in an integrated and improved manner, with greater control over river water utilisation. The average annual canal withdrawals peaked at 105 MAF in 1979 after the construction of Tarbela Dam and other Indus Basin Replacement Works. The canal withdrawals, more or less stagnated at this level, have now declined to around 103 MAF, partly due to siltation of the reservoirs.

3.2. Apportionment of Indus Waters Accord - 1991

Since the inception of Pakistan, there have been a number of occasions when the provinces showed mutual goodwill and accommodation in resolving long-standing disputes. The construction of Kotri, Taunsa and Gudu Barrages on the main Indus River after independence was the result of such goodwill and cooperation. Similarly, the 1991 Water Apportionment Accord was a major breakthrough and a turning point in its march towards national consolidation. Several attempts had earlier been made such as by Anderson Committee (1935). Indus (Rau) Commission

(1939), Akhtar Hussain Committee (1968), Fazal-e-Akbar Committee (1970), Anwar-ul-Haq Commission (1981) and Haleem Committee (1983), to resolve water distribution issue between the provinces. All these attempts failed except Rau Commission (1939) which resulted in Sindh-Punjab (Draft) Agreement, 1945 which became the basis of water distribution between Sindh and Punjab till the 1991 accord. However due to the exigencies of the partition of India in 1947, the respective provincial assemblies were unable to ratify the draft into an Agreement. The Water Apportionment Accord of 1991, therefore, will go down in the history of Pakistan as a sacrosanct agreement reached through a political process and inter-provincial consensus. For future development in the water sector, the need for a political process to gain inter-provincial consensus cannot be over-emphasised.

The Water Apportionment Accord was signed by the Chief Ministers and other representatives of the four (4) provinces on March 16, 1991 at Karachi. The accord was adopted as a decision of the Council of Common Interests (CCI) on March 21, 1991. The follow-up decisions on the

Table 6: Canals under Construction

1. Raine / Thar Canal, Sindh	
Location	Sanghar & Tharparkar Districts
Offtaking Site	Guddu Barrage (Indus River)
Canal Capacity	10,000 Cusecs
Area to be irrigated	260, 000 Acres
Estimated Cost	Rs. 51 billion
Overall percentage of completion as of December 31, 2010	Phase-I completed. 2010 floods have delayed the other phases.
2. Kachhi Canal, Balochistan	
Location	Sibbi & Dhadar Districts
Offtaking Site	Taunsa Barrage (Indus River)
Canal Capacity	10, 500 Cusecs
Area to be irrigated	560, 000 Acres
Estimated Cost	Rs. 44 billion
Overall percentage of completion as of December 31, 2010	Phase-I completed.
3. Greater Thal Canal, Punjab	
Location	Bhakkar, Jhang, Khushab, Layyah & Muzaffargarh Districts
Offtaking Site	Chashma-Jhelum Link (Indus River)
Canal Capacity	10,500 cusecs
Area to be irrigated	1, 500, 000 Acres
Estimated Cost	Rs. 61 billion
Overall percentage of completion as of December 31, 2010	Phase-I completed
4. Chasma Right Bank Lift Canal, Khyber Pakhtunkhwa (formerly NWFP)	
Location	D I Khan District
Offtaking Site	Chashma Barrage (Indus River)
Canal Capacity	2,500 cusecs
Pumping Lift	60 feet
Area to be irrigated	261, 000 Acres
Estimated Cost	Rs. 38 billion
Status	Design completed
Overall percentage of completion as of December 31, 2010	Not yet started

Table 7: Raising of Mangla Dam

Location	Jhelum River
Increase in Height	30 Feet
Additional Live Storage	2.9 MAF (60 % increase)
Additional Power	180 MW (18% increase)
Estimated Cost	Rs. 101.4 billion
Status	Construction substantially completed by 2010

Source: Water Resources & Hydropower Development Vision 2025 by WAPDA

accord were taken by the CCI in its meeting on September 16, 1991 in which the Annexure II of the accord was adopted which consisted of 10-Day Seasonal System-wise Adjusted Allocations submitted by each province as per section 14a of the accord.

In the Waters Apportionment Accord of 1991, all provinces recognised the need for new storages wherever feasible for planned future agricultural development. The Accord calculated portions of water not on the basis of actual average usages then which stood at 105 MAF but at 117 MAF, perhaps taking into account the surplus which will be created through new storages.

The apportionment agreed under the 1991 Accord, thus, provides a total allocation of 55.94 MAF to Punjab, 48.76 MAF to Sindh, 5.78 MAF to Khyber Pakhtunkhwa (formerly NWFP) and 3.87 MAF to Balochistan. Additionally, KP is entitled to 3.00 MAF being used through ungauged (civil) canals above the rim stations. The Water Accord also lays down the distribution of the balance river supplies, including flood supplies as well as the future storages as 37 per cent each to Punjab and Sindh, 14 per cent to KP and 12 per cent to Balochistan. Full text of the Accord is placed at **Appendix A**.

4. Provincial Consensus and Construction of Reservoirs

Water resources continue to remain the driving engine of the economy of the country and should be developed and used for fuller development of the four (4) provinces of

Pakistan. However, provincial consensus is necessary before the development of any strategy. Table 5 carries salient features of the two of the many proposed dams proposed by WAPDA for construction. An inter-provincial consensus is yet to be developed for the construction of these reservoirs.

Despite a number of provincial concerns regarding future water-resource development strategies, the construction of four (4) canals to provide water to the desert areas have been undertaken. Main features of these canals are shown in Table 6. Due to inter-provincial lack of trust, considerable resistance was directed against the construction of Greater Thal canal, which is still being opposed by the Provincial Assembly of Sindh.

However raising of Mangla embankment (Table 7) is a case which was relatively amicably resolved.

5. KEY ISSUES

There are a number of key issues relating to the water resources which confront Pakistan today. It is extremely important that as a first step these issues are understood by Parliamentarians and other stakeholders; and as a second step, concerted efforts be made by them to resolve these major issues in the larger interest of the country, its people and the future generations. These key issues are listed below:

5.1. Lack of Trust among the Provinces especially between Punjab and Sindh

Lack of trust among the provinces especially between

Punjab and Sindh is at the heart of the water issues in Pakistan. Most of the disputes stem from this crisis of confidence. Sindh (the lower riparian in this case) questions the upper canal withdrawals and feels that it is either being deprived or will be deprived of its share of water by Punjab. It, therefore, views any new project or plan in the water sector with a great sense of scepticism. It feels that because of the historical events its scepticism is justified.

Punjab, on the other hand, questions the 'surpluses' which pass downstream Kotri and considers a major quantity of this escapage as waste which should be stored and put to use. Sindh on the other hand considers the escapage downstream Kotri as essential and feels offended when this flow is termed as 'wastage'.

Sindhi objections to under construction Greater Thal Canal and Kalabagh Dam Project also mainly stem from this lack of trust. The dispute on sharing the water shortages during the drought years has further accentuated this crisis of confidence. This lack of trust is the greatest issue in the context of Water resources.

5.2. Differences among provinces on the interpretation of Water Apportionment Accord of 1991

The main differences relate to the following:

a. Construction of additional storages (Section 6 of the Water Accord-1991):

This is one of the most serious water issues confronting Pakistan today.

Section 6 of the 1991 Water Accord reads: "*The need for storages, wherever feasible on the Indus and other rivers was admitted and recognised by the participants for planned future agricultural development.*"

Due to opposition by three (3) provinces, i.e., Sindh, KP and Balochistan the Federal Government is presently reluctant to construct Kalabagh Dam without the consensus of the federating units. The Provincial Government of the Punjab feel very strongly that this section amounts to an agreement to construct Kalabagh, Bhasha and other dams on the river Indus. Since the feasibility study of Kalabagh dam is already completed and the detailed engineering design is ready, the federal and

Punjab governments would like to see the commencement of construction of this project forthwith. Presently the existing storages are depleting due to silting and a serious irrigation water crisis is looming large. Sindh and KP have serious objections to this project and their Assemblies have passed resolutions against the Project. A number of elements in Sindh apprehended that this project may become a source of withdrawing excess water for Punjab. Some people in the NWFP (now KPK) feel that Kalabagh Dam will threaten some of their cities such as Nowshehra and may damage their agricultural land. WAPDA has been strongly refuting these objections on technical grounds but the opposition continues.

Diamer-Basha Dam's detailed design and Tender Documents have been completed. The project is under review by Asian Development Bank.

b. Study for establishing minimum escapage to sea downstream Kotri (Section 7 of the Water Accord-1991)

The section 7 of the 1991 Water Accord reads: "*The need for certain minimum escapage to sea, below Kotri, to check sea intrusion was recognised. Sindh held the view, that the optimum level was 10 MAF, which was discussed at length, while other studies indicated lower/higher figures. It was therefore decided that further studies would be undertaken to establish the minimum escapage needs down stream Kotri.*"

This study was subsequently undertaken by the Federal Ministry of Water and Power through the National Flood Commission and was completed in November 2005. The Study was later reviewed by an International Panel of Experts (IPOE). The IPOE report calls for allowing 5,000 cusecs downstream Kotri throughout the year to check the sea water intrusion, accommodate the needs for fisheries and environmental sustainability and to maintain the river channel.

In addition, the report recommends that "*a total volume of 25 MAF in any 5 years period (an annual*

equivalent amount of 5 MAF) be released in a concentrated way as flood flow (Kharif period), to be adjusted according to the ruling storage in the reservoirs and the volume discharged in the four previous years.” Taken these two recommendations together, 5000 cusecs translate into 3.6 MAF per year and when added to the required flood flow below Kotri works out to be 8.6 MAF. Some experts point out that this minimum flow can be guaranteed only after storage is added on river Indus. There is a need to take practical steps to implement the recommendations of the Study.

c. The mode of sharing shortages (Section 14b of the Water Accord-1991)

Section 14b of the accord reads, “*The record of actual average system uses for the period 1977-82 would form the guide line for developing a future regulation pattern. These ten daily uses would be adjusted pro-rata to correspond to the indicated seasonal allocations of the different canal systems and would form the basis for sharing shortages and surpluses on all Pakistan basis.*”

Pakistan has experienced serious shortages of Indus water during 1994-95, 1997-98 and then during the four (4) years (1999-2000, 2000-01, 2001-02 and 2002-03). During this period, Sindh and Punjab differed seriously and sometime even acrimoniously on their share of water during the shortages. In the 1991 Accord, Punjab had agreed on its share of water that was 2.7 per cent less than its historical share; Sindh, on the other hand, was given a share of water that was 1.2 per cent higher than its historical share. Punjab contention was that it had agreed to a reduced share for itself because of a 'package deal' in 1991 under which additional storages were also to be constructed. Since, according to Punjab, the 1991 Accord was not implemented in entirety and storages were not constructed, Punjab sought its share of water on pre-1991 historical average basis. Sindh contested this position bitterly and considered 1991 Accord sacrosanct. But water continued to be shared on the basis of the pre-91 basis in the light of a “1994 Inter-provincial ministerial agreement.” Many in Sindh called this as theft of their water. This serious difference of opinion and the associated bitterness continues.

Currently the water is being shared according to a 3-tier formula agreed at IRSA. Although Sindh opposes this formula, IRSA continues to implement it.

5.3. Construction of Greater Thal Canal in Punjab

The construction of Greater Thal Canal is in progress in the Punjab. So is the construction of Raine-Thar Canal in Sindh, Kachhi Canal in Balochistan and Chashma Right Bank Lift Canal in KP. The Provincial Assembly of Sindh has passed two (2) unanimous resolutions against the construction of the Greater Thal Canal. Sindh feels that since sufficient water is not available in Indus River to supply water to Greater Thal Canal, the new canal will eventually become a means of siphoning off extra water beyond the due share of the Punjab. Although the Federal Government and the Punjab Government claim that the Greater Thal Canal will only use flood water for about 90 days in a year, Sindh feels that once the land owners and tillers start depending on the canal water for irrigation, they will develop sufficient pressure and clout to make the canal perennial, withdrawing extra water beyond its due share. Sindh also complains that due process and procedure was not adopted in approving the Greater Thal Canal project and its construction was hurriedly started despite the objections of the Sindh province.

Punjab and the Federal Governments contend that according to the 1991 Water Accord, each province is allowed to develop water-related projects within its share of water as agreed in the accord. In addition, Greater Thal Canal is specified by the Punjab province in its 10 daily records submitted to the Council of Common Interest as a part of the 1991 Accord and this record is appended to the accord as Annexure II as its integral part.

Unfortunately the telemetric system installed to give real-time flow data to all the provinces to build trust among provinces is a victim of technical flaws and needs to be put into proper function as soon as possible.

The Federal Government points out that the Greater Thal Canal project was approved by IRSA and ECNEC. While the construction of the Greater Thal Canal proceeds, street protests have been organised in Sindh against the construction of the Greater Thal Canal generating more bitterness in the inter-provincial relations.

5.4. Reduction in the availability of surface water due to silting of existing reservoirs

The state of technology at the time of construction of the three (3) main reservoirs, Tarbela, Mangla and Chashma did not provide for any de-siltation of the reservoirs. It was therefore anticipated that these reservoirs would have a limited life and substitute arrangements would have to be made.

By 2010 Tarbela has lost live storage capacity of 3.02 MAF i.e. 31% of its original live capacity of 9.69 MAF. Built up of Delta close to Tunnels imposes further constraints on its minimum operating levels. Tarbela is now being operated at restricted minimum level of 1378 ft. SPD instead of original 1220 ft. SPD. This amounts to further 0.565 MAF of live storage which cannot be utilized. With such operational constraints Tarbela has lost total live storage amounting to 3.585 MAF which is 37% of the original live storage. Mangla has lost live storage capacity of 0.84 MAF by 2010 i.e. 16% and Chashma has lost storage capacity of 0.50 MAF i.e. 69%. The accumulated loss of live storage by 2010 is (4.36 MAF + 0.565 MAF) 4.925 MAF. This storage loss by 2025 would be more if Tarbela's minimum operational levels are further increased. All indicators are that to avoid Delta's failure, the minimum operational levels of Tarbela would be increased in future as the Delta develops further. Such loss of live storage means that by the time Basha or Kalabagh Dams come on line, Pakistan would have lost live storage more than any of these new storages.

This development would have grave ramifications for the agriculture and overall economy of Pakistan. The Federal Government is responsible for coming up with an effective response to this situation. Some opponents of the new storages suggest that instead the possibility of de-silting of the reservoirs should be explored. Most of the experts, however, feel that de-silting and the subsequent disposal of the removed silt is simply not feasible. The design of the proposed Kalabagh reservoir, however, has a provision of silt flushing.

5.5. Wastage of water in the irrigation system

Pakistan has the largest contiguous irrigation system in the world. It is estimated that 40 to 50 per cent of water is lost between the canal headworks to the farmgate. Lining of Canals is considered a good solution to this problem. Conventional methods of canal lining are tedious and time-consuming, requiring prolonged closure of canals affecting agricultural productivity which is not generally acceptable to the farmers. WAPDA is presently exploring alternate lining technology of using geotextile membrane to be placed under running water.

The irrigation application rates within the farms are also high because of reliance on the conventional flood irrigation. With the passage of time, water as a commodity is becoming more and more precious. Above all it is a finite source. This high percentage of wastage, therefore, can not be afforded for long. Wastage of water through poor infrastructure or poor water management constitutes a major issue related to the water resources of Pakistan. Another aspect of this issue is the productivity of the farms against per cusec of irrigation water. Pakistan has a much lower rate of production. The irrigation efficiency, therefore, needs to be enhanced.

6. STRATEGY FOR ADDRESSING VARIOUS ISSUES

6.1. An active Conflict Resolution Mechanism

Pakistan has always faced water shortages and will continue to do so, except in the monsoon wet months. In order to utilise the surplus flood waters in a timely and effective manner, there is a need to develop provincial consensus on water conservation and development strategies while removing any prevailing misgivings. Despite the Constitutional provision of "Council of Common Interests," there is a lack of sound conflict resolution mechanism among the provinces. Such a mechanism needs to be evolved on a practical and sustainable basis. There are two possible ways to do this:

a. Sensitisation of Council of Common Interests - CCI to Water Issues:

Articles 153 to 155 of the Constitution of Pakistan relate to the appointment and functions of the Council of Common Interests (CCI). Article 155 specifically relates to water-related complaints of the federal government or provincial governments. It is important that we make use of the constitutional institutions and mechanisms to resolve our issues instead of creating more mistrust among the provinces.

b. Parliament and Parliamentary Committees should play their rightful role:

Parliament is the most important and the appropriate forum to debate national issues and develop consensus among the people, political parties and the provinces. Both houses of the Parliament, i.e., the National Assembly and the Senate should take steps

to discuss, debate and develop consensus on water related issues in Pakistan. A special responsibility lies with the standing committees on Water and Power in the two houses to do the basic work in this regard before the full Parliament takes up the issue for resolution. The standing committees in the two houses can either take up the issue separately or as a joint effort. The committees should call water experts as witnesses and hold public hearings on the question of water issues. These hearings should be open and preferably televised for creating public awareness. We lose more by trying to keep issues under wraps. Open discussion may seem chaotic in the beginning but ultimately leads to the development of national consensus. As the successful conclusion of the 1991 Accord and framing of the constitution of Pakistan by consensus in 1973, passage of the 18th Constitutional Amendment by consensus in 2010 and the 7th National Finance Commission Award in 2010, demonstrate, elected representatives can develop lasting and sustainable consensus at national level even on extremely complex and contentious issues. Parliament should be the most active player in the quest for a national consensus along with civil societies and stakeholders involvement.

6.2. Regulation of Groundwater Usage

There are frequent instances of excessive and unregulated pumping of groundwater for irrigation which result in the fall of water table in some areas and persistent waterlogging and salinity in others. Moreover Sweet groundwater is getting increasingly polluted due to lateral or upward movement of saline groundwater through water mining that is taking place in all the country. The arsenic and fluoride have also been observed.

A regulatory framework for optimal exploitation of groundwater is also required to be enforced in the four (4) provinces and the Azad Jammu and Kashmir. Unsystematic and uneven pumping of groundwater has to be checked to avoid large scale mining in some areas and to avoid pollution as a result of contamination of saline water bodies.

6.3. Water Conservation

In view of the huge (around 45 to 50 per cent) losses of irrigation water between canal-heads and the farmgate, water conservation should be accorded a high priority. Lining of Canals and Water courses should be taken in hand more vigorously in the sandy areas and where there is saline groundwater. It should be kept in mind that canals

play major role in recharging the ground aquifers.

6.4. Efficient use of irrigation water and application of modern technologies

About 90 per cent of water is used for producing agricultural crops. A greater emphasis should, therefore, be placed on growing and producing more with less quantities of water. Feasibility Studies should be commissioned, and based on positive results of these studies, pilot projects may be initiated in the use of Drip and Sprinkler systems of irrigation to assess the practicability and cost-benefit ratio of such technologies. In countries like Israel, these irrigation technologies are being implemented with success. Pakistan should pursue such technologies now in order to be able to use those 10 to 15 years later. Farmers also need to be educated in land levelling and economical water usages. More effort and resources need to be directed towards research and development.

6.5. Legislation on Water-related issues

Legislators should concentrate on bringing new legislations to replace the outdated laws and to address the new issues. Safety of Dams, contamination of surface and ground water and safe drinking water are some of the issues which require new and more effective legislation. (Please see the following sections for recommendations on specific legislation)

7. LEGISLATIVE AND INSTITUTIONAL ASPECTS

One of the vital legal questions that still remain unresolved globally is: who owns the water resources, or who should own the water resources? The next question; perhaps even more important, is: who has the usage rights over waters of rivers, streams, canals, groundwater, karezes, and springs, etc. Many different categories of water rights exist in Pakistan, yet legal cover in most cases is absent.

There are a large number of provincial acts passed from time to time to cover the water-related needs spread over more than a century. Starting with Punjab Irrigation Act legislated in 1873 and similar laws enacted later on in the other three (3) provinces, there are also four (4) Provincial Soil Reclamation Acts pertaining to waterlogging and drainage, Water Users Association Ordinances of 1981 and 1982, PIDA Acts of 1997, and a host of city development legislations covering, inter alia, domestic water supply. At the Federal level, WAPDA Act of 1958 and

IRSA Act of 1992 provide guiding principles for development and distribution of water. On the one hand, the existing laws have overlapping and conflicting provisions in many provincial and federal laws. On the other hand, certain crucial laws such as the Dam Safety Acts, which exist in most countries with large dams, do not exist in Pakistan.

There is, thus, a need to add, delete and modify various provisions, and to cover the drastically changed conditions and ground realities. Preferably, all water-related provincial laws should be combined into one comprehensive act, which would make the laws concise and clearer, more-readily understandable and less susceptible to misinterpretations.

On the institutional side, there is need to enhance delegation of powers and organisational capacities of the newly-created autonomous provincial irrigation and drainage authorities (PIDAs). The intended concepts including autonomy, decentralisation and participatory management involving the water users, have not been implemented by the provinces. Active involvement and participation of the users in planning and operation of the public-sector utility services is of crucial importance in minimising inefficiencies and malpractices in the system. Water has to be treated at par with other community development services, and there is a dire need for effective regulatory bodies to exercise proper quality controls.

8. RECOMMENDED ACTIONS

In order to efficiently develop and manage water resources of Pakistan and to ensure quality as well as availability of water to meet the growing needs across all sectors, there are a number of actions that need to be taken, which are outlined below.

In order to efficiently develop and manage water resources of Pakistan and to ensure quality as well as availability of water to meet the growing needs across all sectors, there are a number of actions that need to be taken, which are outlined below.

1. **Role of Council of Common Interests (CCI):** The Council of Common Interests (CCI) that is a constitutional body should be the apex body in addressing inter-provincial and transboundary water issues and disputes. It should have technical

support of experts in water management and international water laws.

2. **Parliament and its committees to be more proactive:**

Parliamentarians should play a more active role in developing a sustainable consensus on such vital national issues as development of water resources. The Standing Committees on Water and Power should invite expert witnesses to understand and clarify the issues. The Government should also understand the importance and value of the Parliament as a consensus-building forum.

3. **An inter-provincial accord on new storages:**

In order to meet the growing needs of agriculture, industries, growing population and urbanization, an inter-provincial consensus on development of water resources for constructing additional storage/carryover storage reservoirs and canals is necessary for conservation and effective use of badly needed water. There is also need to evolve a sound "conflict resolution mechanism" on a practical and sustainable basis. Since lower riparians appear agreeable to the concept of constructing carry-over dams, an inter-provincial accord needs to be entered into on this part of the water resource development.

4. **Study to ascertain water flow required downstream Kotri:**

As required in the 1991 water accord, the International Panel of Experts (IPOE) appointed by the Ministry of Water and Power through Federal Flood Commission has completed the study in 2005. Executive Summary of the Final Report containing findings of IPOE is given as **Appendix E**. It is important that water required downstream Kotri is released to build up inter-provincial trust. Some experts believe that recommended discharge below Kotri can not be released until new storages are constructed as sufficient water is not available in the river during most of the year.

5. **Enhanced Telemetry System:**

Improvement and expansion in the telemetry system is required to ensure transparency in water distribution amongst the provinces and ensure that real time data is available.

6. **Water Conservation:**

A comprehensive plan for optimum conservation of water should be prepared and put into action in all water sectors. Recycling, reuse and desalination technologies should be introduced.

7. Adoption of New Technologies:

Feasibility study and pilot projects should be launched to assess the sustainability of new and effective irrigation technologies in Pakistan.

8. Forecasting of Floods & Droughts:

Introduction of reliable data collection mechanism and upgradation of Pakistan Meteorological Department is essential for better weather forecasting. Proactive community-based adaptation plans should be prepared to combat and mitigate floods and droughts. Adaptation plans should take into account the anticipated climate change impacts.

9. Improving Domestic Water Quality:

Improvement in the quality of domestic water in urban as well as rural areas is required besides ensuring satisfactory drinking quality water for assemblies standing committees on health or other divisions should take cognisance of this question of great public interest.

10. Adopting new technologies for ground water extraction:

Development and use of latest state-of-the-art technologies is in order to maximize groundwater pumpage through skimming freshwater lenses overlying the saline groundwater. Detailed survey is required to be carried out in all the Provinces of Pakistan and Azad Jammu and Kashmir to assess the aquifer and availability of groundwater along with water quality, extraction and recharge. Technologies to recharge aquifer needs to adopted on priority basis. Areas contaminated with arsenic and fluoride should be delineated. Farmers need to be educated to avoid over extracting and use of saline groundwater as this degrades the land and negatively impacts the crop productivity.

11. Harnessing Hill Torrents:

Development of flood flows of hill torrents is necessary which offer great potential for conservation primarily in areas located outside the Indus plain.

12. Checking Water Pollution:

A system of effective check and control of pollution in all water bodies is required.

13. Improved Institutional Structure:

Establishment of improved institutional structure both at federal and provincial levels is required for integrated management of water for all sectoral uses including municipal, rural domestic supply, agriculture, industry, mining and environmental, in addition to an effective regulatory framework.

14. Strengthening of IRSA:

Although Indus River System Authority (IRSA) is charged with a delicate responsibility, it lacks the institutional capacity, the budget and powers to carry out these responsibilities effectively. The experience during the past years should guide the future strengthening of IRSA especially in terms of early completion and later operation of a credible Telemetry System.

15. Sustained Dialogue to understand inter-provincial issues and to develop consensus on resolution of issues:

There is a need to undertake a sustained dialogue between the provinces involving a range of stake holders like Agriculturists or Farmers, Government Officials, independent experts, political leaders, parliamentarians and media.

16. A comprehensive Water Law:

Preparation of a comprehensive Water Law is needed which should update and replace more than two dozens of existing Provincial Acts covering the subject of Water, as legislated from the Year 1873 to Year 1997. A comprehensive legislation would make the water-related laws concise and more-readily understandable and less susceptible to misinterpretations.

17. Regulation of Groundwater Usage:

A system needs to be evolved to regulate pumping of ground water to check lowering of water table in some areas and water logging in the other. Groundwater laws need to be framed and enforced strictly.

18. National Water Policy:

Despite passage of over 60 years, Pakistan is one of very few countries of the World which does not

Figure 1: The Indus Basin Irrigation System

Figures in 000 Cusecs unless indicated otherwise

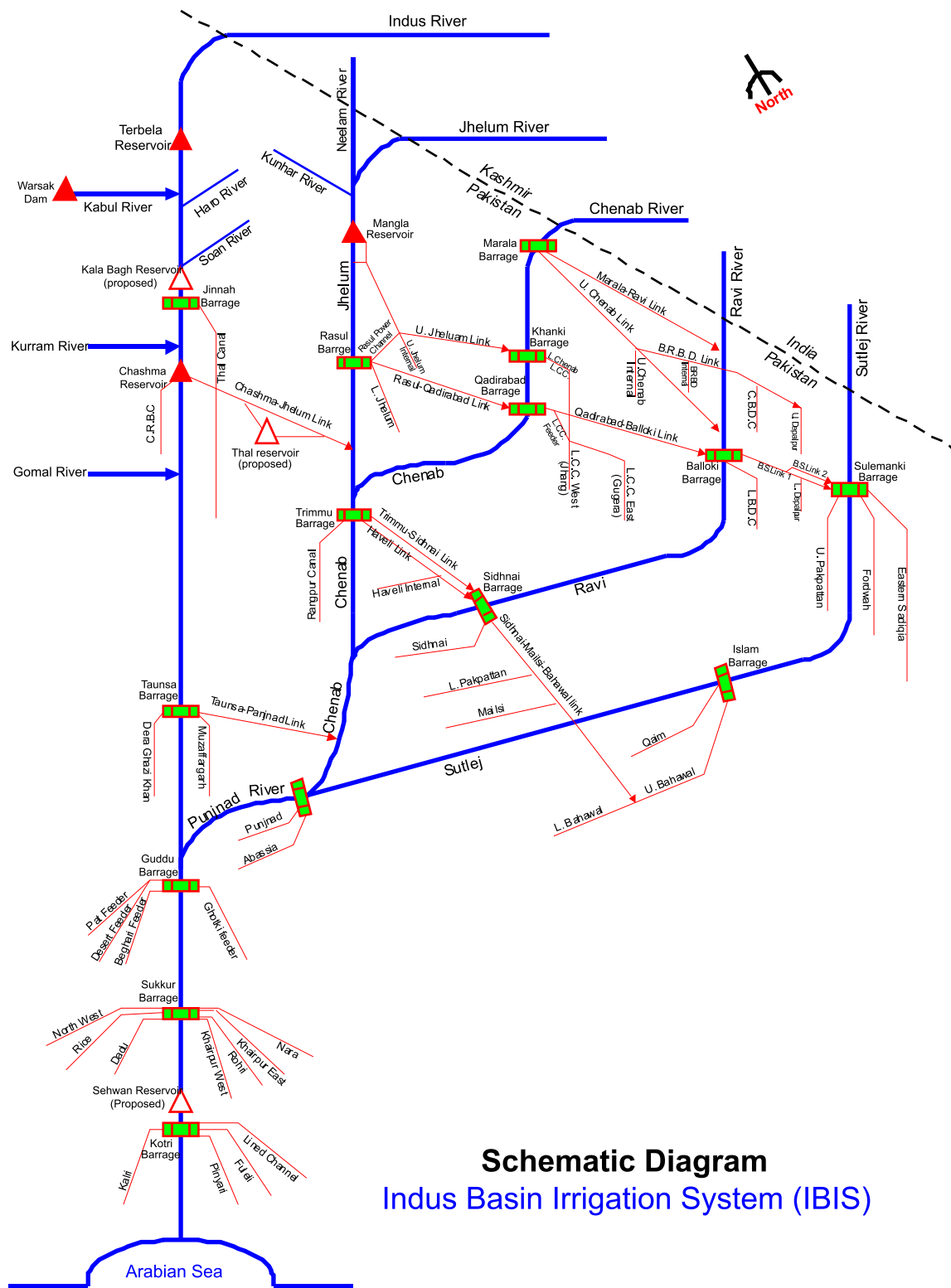


Figure 2: Pakistan's Rivers and Main Streams

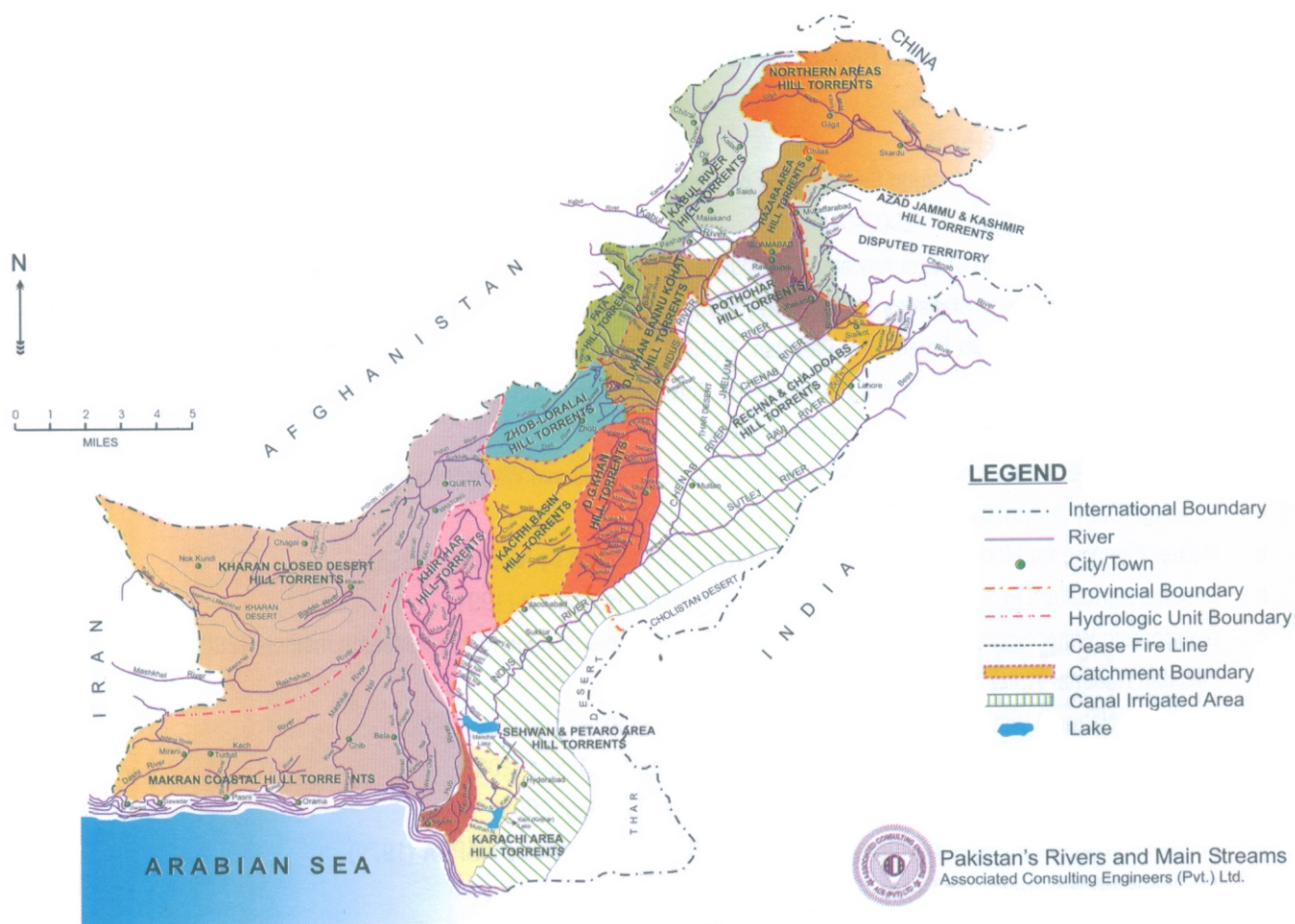


Figure 3: The Indus Basin Map

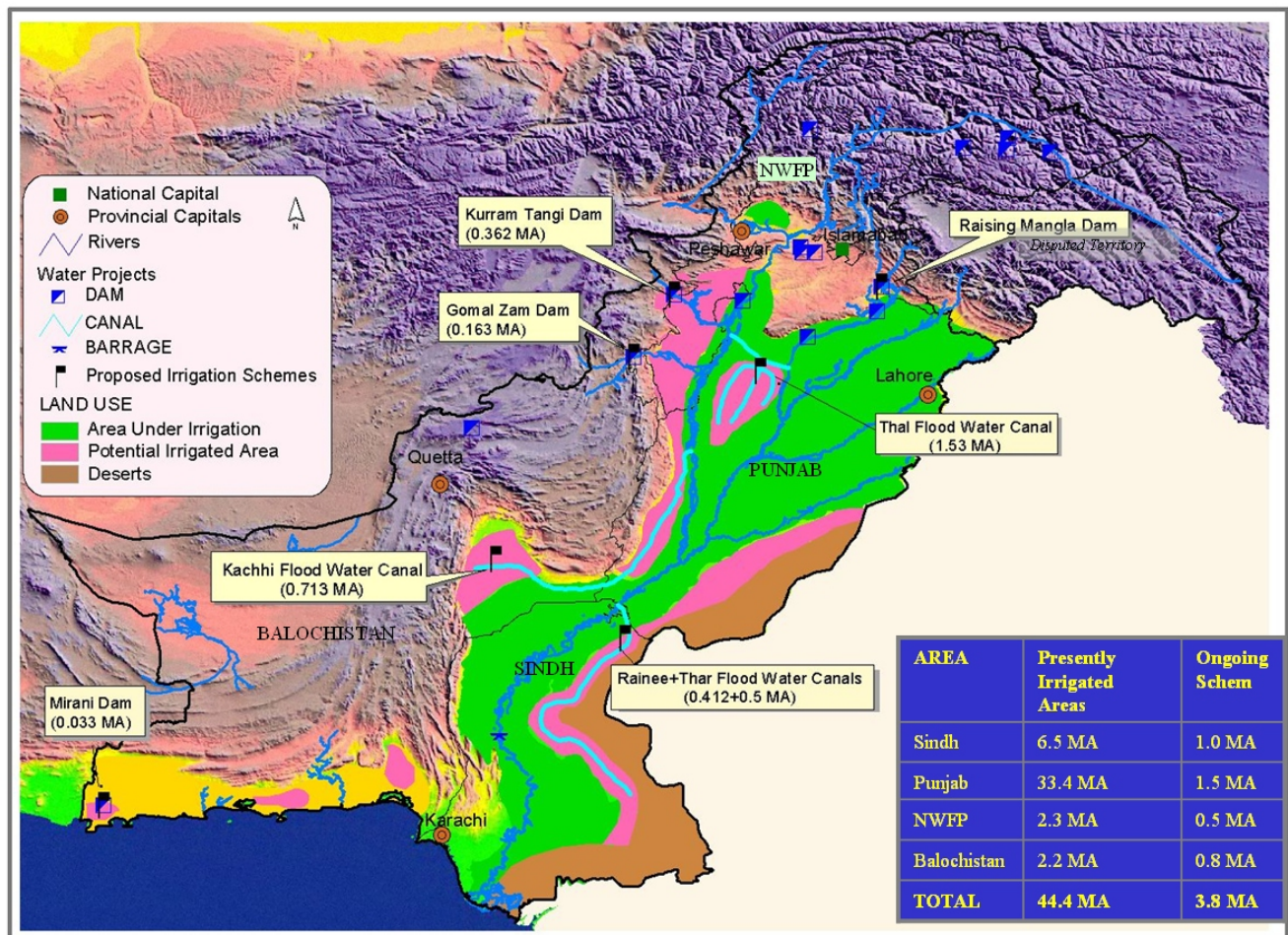
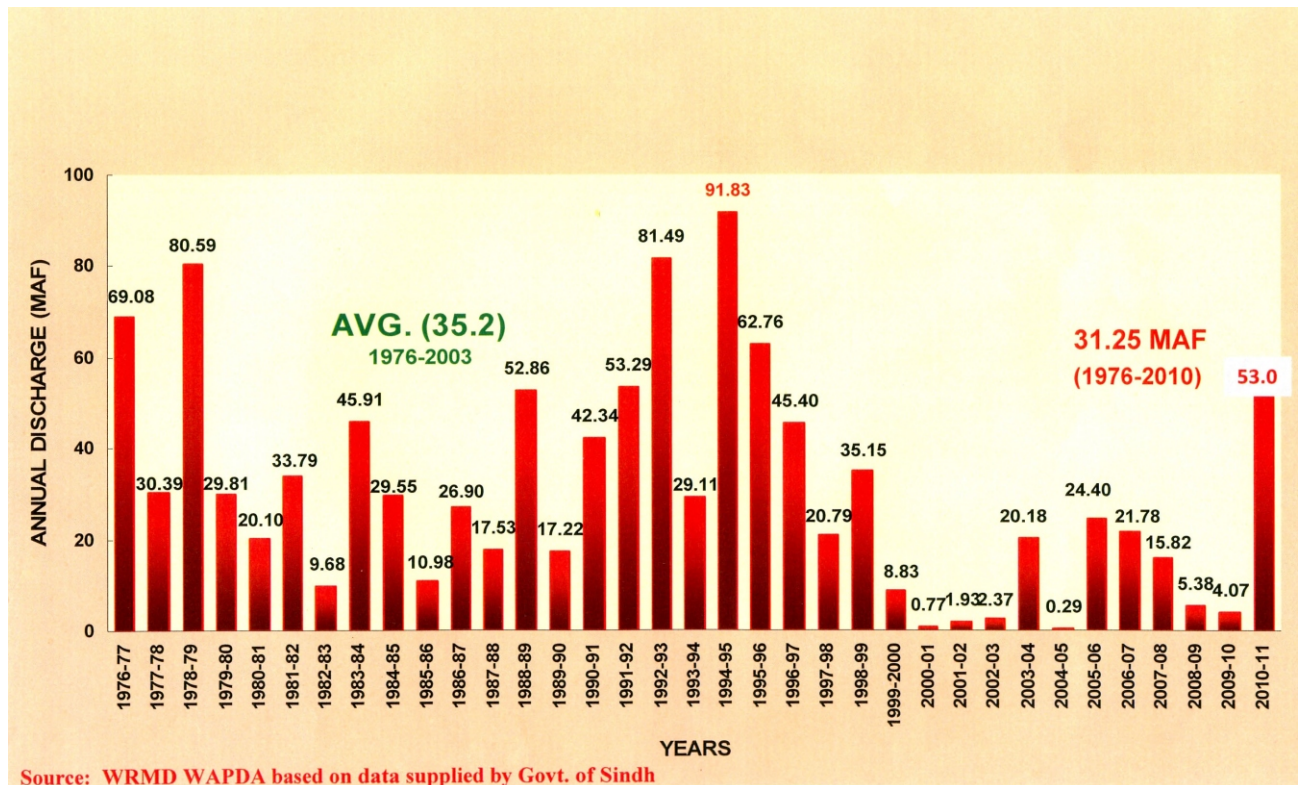


Figure 4: Escapage below Kotri (MAF)



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APPENDICES

APPENDIX A

**Text of the Apportionment of Waters of Indus River System
between the Provinces of Pakistan - Agreement 1991**

SECRET

**APPORTIONMENT OF THE WATERS OF THE INDUS RIVER SYSTEM
BETWEEN THE PROVINCES OF PAKISTAN**

As a follow-up to the meeting of the Chief Ministers at Lahore on March 3, 1991, a meeting of the representatives of the four provinces was held at Lahore on March 04, 1991. Another meeting was held at Karachi on March 16, 1991. The list of participants is attached.

The participants agreed on the following points:-

1. There was an agreement that the issue relating to Apportionment of the Waters of the Indus River System should be settled as quickly as possible,
2. In the light of the accepted water distributional principles the following apportionment was agreed to:

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 16/3/91
 14/3

(Fig. in MAF)

PROVINCE	KHARIF	RABI	TOTAL
PUNJAB	37.07	18.87	55.94
SINDH*	33.94	14.82	48.76
N.W.F.P. (a)	3.48	2.30	5.78
(b) CIVIL CANALS**	1.80	1.20	3.00
BALUCHISTAN	2.85	1.02	3.87
	77.34	37.01	114.35
	+	+	+
	1.80	1.20	3.00

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 14/3

* Including already sanctioned Urban and Industrial uses for Metropolitan Karachi.
 ** Ungauged Civil Canals above the rim stations.

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 14/3
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BRIEFING PAPER

Issues of Water Resources in Pakistan

3. N.W.F.P/Baluchistan Projects which are under execution have been provided their authorised quota of water as existing uses.
4. Balance river supplies (including flood supplies and future storages) shall be distributed as below:

<u>Punjab</u>	<u>Sindh</u>	<u>Balochistan</u>	<u>NWFP</u>	<u>Total</u>
37	37	12	14	100%

5. Industrial and Urban Water supplies for Metropolitan city, for which there were sanctioned allocations will be accorded priority.
6. The need for storages, wherever feasible on the Indus and other rivers was admitted and recognised by the participants for planned future agricultural development.

7. The need for certain minimum escapage to sea, below Kotri, to check sea intrusion was recognised. Sindh held the view, that the optimum level was 10 M.A.F., which was discussed at length, while other studies indicated lower/higher figures. It was, therefore, decided that further studies would be undertaken to establish the minimal escapage needs down stream Kotri.

*Shah Mahmood
16/3/91
RSP*

8. There would be no restrictions on the Provinces to undertake new projects within their agreed shares.

16/3/91

9. No restrictions are placed on small schemes not exceeding 5000 acres above elevation of 1200 ft. SPD.

14/3

10. No restrictions are placed on developing irrigation uses in the Kurram/ Gomal/Kohat basins, so long as these do not adversely affect the existing uses on these rivers.

16/3/91

11. There are no restrictions on Baluchistan, to develop the water resources of the Indus right bank tributaries, flowing through its areas.

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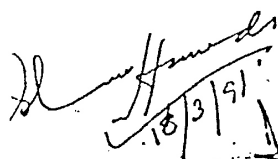
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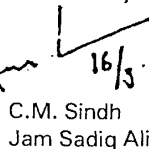
BRIEFING PAPER

Issues of Water Resources in Pakistan

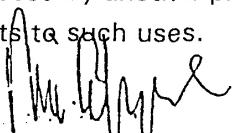
12. The requirements of LBOD will be met out of the flood supplies in accordance with the agreed sharing formula.
13. For the implementation of this accord, the need to establish an Indus River System Authority was recognised and accepted. It would have headquarters at Lahore and would have representation from all the four provinces.
14.
 - a) The system-wise allocation will be worked out separately, on ten daily basis and will be attached with this agreement as part and parcel of it.
 - b) The record of actual average system uses for the period 1977-82, would form the guide line for developing a future regulation pattern. These ten daily uses would be adjusted pro-rata to correspond to the indicated seasonal allocations of the different canal systems and would form the basis for sharing shortages and surpluses on all Pakistan basis.
 - c) The existing reservoirs would be operated with priority for the irrigation uses of the Provinces.
 - d) The provinces will have the freedom within their allocations to modify system-wise and period-wise uses.
 - e) All efforts would be made to avoid wastages. Any surpluses may be used by another province, but this would not establish any rights to such uses.


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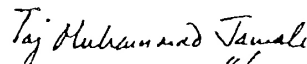
C.M. Punjab
Ghulam Hyder
Wyne


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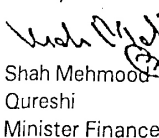
C.M. Sindh
Jam Sadiq Ali



C.M. NWFP
Mir Afzal Khan



C.M. Baluchistan
Taj Mohammad Jamali


16/3-91

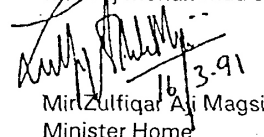
Shah Mehmood
Qureshi
Minister Finance



Muzaffar Hussain
Minister Law



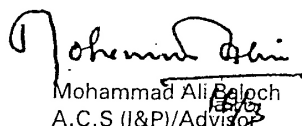
Mohsin Ali Khan
Minister Finance


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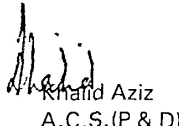
Mir Zulfikar Aji Magsi
Minister Home



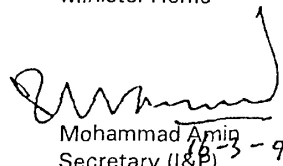
Mazhar Ali
Adviser


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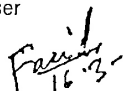
Mohammad Ali Baloch
A.C.S (I&P)/Adviser

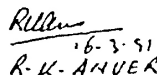

16/3/91

Khalid Aziz
A.C.S.(P & D)


16-3-91

Mohammad Amin
Secretary (I&P)


16-3-


16-3-91
R. K. ANVER

LIST OF PARTICIPANTS

1.	Mr. Ghulam Hyder Wyne	Chief Minister, Punjab
2.	Mr. Jam Sadiq Ali	Chief Minister, Sindh
3.	Mr. Mir Afzal Khan	Chief Minister, N.W.F.P.
4.	Mr. Mir Taj Muhammad Jamali	Chief Minister, Balochistan
5.	Mr. Shah Mehmood Qureshi	Minister Finance, Punjab
6.	Mr. Muzaffar Hussain Shah	Minister Law, Sindh
7.	Mr. Mohsin Ali Khan	Minister Finance, N.W.F.P.
8.	Mr. Zulfiqar Ali Magsi	Minister Home, Balochistan
9.	Mr. Mazhar Ali	Advisor, Government of Punjab
10.	Mr. Muhammad Alam Baloch	ACS (I&P)/Advisor, Government of Sindh
11.	Mr. Khalid Aziz	ACS (P&D), Government of N.W.F.P.
12.	Mr. Muhammad Amin	Secretary (I&P), Government of Balochistan
13.	Mr. Farid Khan	Government of Punjab
14.	Mr. Rana Khursheed Anwar	Secretary (I&P), Government of Punjab
15.	Mr. Pervez Masud	Chief Secretary, Government of Punjab
16.	Mr. M.H. Siddique	Director Regulation, Government of Punjab
17.	Mr. Abdul Aziz Shaikh	Advisor (WD), Government of Sindh
18.	Mr. Allah Bux Baloch	XEN, Government of N.W.F.P.
19.	Mr. Muhamamd Ibrahim	XEN, Government of Balochistan
20.	Mr. Faqir Ahmed Paracha	Secretary (I&P), Government of N.W.F.P.

APPENDIX B

**Text of the Balochistan Assembly Resolution
on Kalabagh Dam**

قرارداد 50

مورخہ : 6-10-1994

منجانب :- سردار اختر مینگل، رکن صوبائی اسمبلی، بلوچستان

اس ایوان کی رائے ہے کہ صوبائی حکومت، وفاقی حکومت سے درخواست کرے کہ کالا باغ ڈیم کی تعمیر کا منصوبہ ترک کیا جائے کیونکہ اس ڈیم کی تعمیر سے ایک طرف صوبہ سندھ آبپاشی کے لئے پانی سے محروم ہو جائے گا اور دوسری طرف شمال مغربی صوبہ سرحد کے بیشتر علاقے زیر آب آجائیں گے جس کی وجہ سے وہاں کی زمینیں پانی کی زیادتی کی وجہ سے سیم اور تھور کا شکار ہو جائیں گی اس طرح دونوں صوبوں کی قابل کاشت اراضی بخر ہو جائے گی۔ نیز بلوچستان کی قابل کاشت اراضی آبپاشی کے لئے پانی سے محروم ہو جائے گی۔

قرارداد منظور ہوئی

نیاز محمد

ڈپٹی سیکرٹری

بلوچستان صوبائی اسمبلی

RESOLUTION NO 50 PASSED UNANIMOUSLY
IN THE PROVINCIAL ASSEMBLY OF BALOCHISTAN
IN THE MEETING HELD ON 6-10-1994

APPENDIX C

**Text of the Khyber Pakhtunkhwa Assembly Resolutions
on Kalabagh Dam**

قرارداد نمبر 251

منجانب: جناب عبدالاکبر خان صاحب، رکن صوبائی اسمبلی سرحد

”یہ اسمبلی صوبائی حکومت سے سفارش کرتی ہے کہ وفاقی حکومت سے سفارش کرے کہ کالا باغ ڈیم کے منصوبے کو ترک کیا جائے کیونکہ اس سے صوبہ سرحد کے عوام کو کافی نقصان پہنچنے کا اندیشہ ہے۔“

RESOLUTION NO 251 PASSED UNANIMOUSLY
IN THE PROVINCIAL ASSEMBLY OF NWFP
IN THE MEETING HELD ON 30-5-1991

قرارداد نمبر 4

منجانب: محترمہ بیگم نسیم ولی خان صاحبہ، رکن صوبائی اسمبلی سرحد

”اس ایوان کی رائے میں کالا باغ ڈیم کا منصوبہ صرف فنی لحاظ سے ناقص بلکہ مجموعی لحاظ سے اس صوبہ کے علاوہ پاکستان کے اکثریت صوبوں کے مفاد کے منافی ہے۔“

لہذا یہ ایوان مرکزی حکومت سے پرزور سفارش کرتا ہے کہ کالا باغ ڈیم کے منصوبے کو ترک کیا جائے۔ خصوصاً جب کہ متبادل منصوبوں کی افادیت مثلاً بھاشا ڈیم اس منصوبہ سے زیادہ بہتر اور منافع ہے۔“

RESOLUTION NO 04 PASSED UNANIMOUSLY
IN THE PROVINCIAL ASSEMBLY OF NWFP
IN THE MEETING HELD ON 20-12-1988

قرارداد 26

- منجانب:- (1) جناب حاجی محمد عدیل صاحب، رکن صوبائی اسمبلی سرحد
- (2) جناب عبدالاکبر خان صاحب، رکن صوبائی اسمبلی سرحد
- (3) جناب سردار عنایت اللہ خان گنڈاپور صاحب، وزیر زراعت سرحد
- (4) جناب بہرام خان ملک صاحب، رکن صوبائی اسمبلی سرحد
- (5) جناب انور کمال صاحب، رکن صوبائی اسمبلی سرحد
- (6) جناب ملک میاں نور صاحب، رکن صوبائی اسمبلی سرحد
- (7) جناب مولانا محمد عصمت اللہ صاحب، رکن صوبائی اسمبلی سرحد

یہ ایوان متفقہ طور پر وفاقی حکومت سے مطالبہ کرتا ہے کہ چونکہ کالا باغ ڈیم کا منصوبہ خصوصی طور پر ہمارے صوبے کے مفاد کے خلاف ہے اور عمومی طور پر پاکستان کے تمام صوبوں کے لئے نقصان دہ ہے۔ یہ ایوان اس سے بیشتر بھی کئی بار متفقہ طور پر یہ قرارداد پاس کر چکا ہے کہ کالا باغ ڈیم نہ بنایا جائے اور بجلی کی کمی کو دیگر ذرائع سے پورا کیا جائے۔

جس میں ہمارے صوبے میں بھاشا کے علاوہ کئی ایسے مقامات ہیں جہاں چھوٹے اور بڑے ڈیم بنائے جاسکتے ہیں۔

**RESOLUTION NO 26 PASSED UNANIMOUSLY
IN THE PROVINCIAL ASSEMBLY OF NWFP
IN THE MEETING HELD ON 18-11-1993**

APPENDIX D

**Text of the Sindh Assembly Resolutions
on Kalabagh Dam & Greater Thal Canal**

Resolution No. 409**PUT BY DR. ABDUL WAHID SOOMRO**

This House resolves that the proposed Kalabagh Dam being detrimental to the interest of Pakistan in general and Sindh Province in particular be dropped. Provincial Assembly of Sindh had already passed two resolutions in this regard in the past and this House reaffirms the same. The House therefore recommends to the Federal Government to abandon this project once for to remove the misgivings of the people of Pakistan.

RESOLUTION NO 409 PASSED UNANIMOUSLY
IN THE PROVINCIAL ASSEMBLY OF SINDH
IN THE MEETING HELD ON 14-06-1994

Resolution No. 414**PUT BY DR. SIKANDAR MANDHRO, MPA**

This House resolves that the proposed Kalabagh Dam being detrimental to the interest of Pakistan in general and Sindh Province in particular be dropped. Provincial Assembly of Sindh had already passed two resolutions in this regard in the past and this House reaffirms the same. The House therefore recommends to the Federal Government to abandon this project once for to remove the misgivings of the people of Pakistan.

RESOLUTION NO 414 PASSED UNANIMOUSLY
IN THE PROVINCIAL ASSEMBLY OF SINDH
IN THE MEETING HELD ON 14-06-1994

Resolution No. 413**PUT BY MR. AHMED ALI KHAN PITAFI, MPA**

This House resolves that the proposed Kalabagh Dam being detrimental to the interest of Pakistan in general and Sindh Province in particular be dropped. Provincial Assembly of Sindh had already passed two resolutions in this regard in the past and this House reaffirms the same. The House therefore recommends to the Federal Government to abandon this project once for to remove the misgivings of the people of Pakistan.

RESOLUTION NO 413 PASSED UNANIMOUSLY
IN THE PROVINCIAL ASSEMBLY OF SINDH
IN THE MEETING HELD ON 14-06-1994

Resolution No. 423

PUT BY MR. GHULAM QADIR PALIJO, MPA

This House resolves that the proposed Kalabagh Dam being detrimental to the interest of Pakistan in general and Sindh Province in particular be dropped. Provincial Assembly of Sindh had already passed two resolutions in this regard in the past and this House reaffirms the same. The House therefore recommends to the Federal Government to abandon this project once for to remove the misgivings of the people of Pakistan.

RESOLUTION NO 423 PASSED UNANIMOUSLY
IN THE PROVINCIAL ASSEMBLY OF SINDH
IN THE MEETING HELD ON 14-06-1994

Resolution No. 01

PUT BY MR. MUMTAZ ALI BHUTTO, MPA

This Assembly resolves and recommends to the Government of Sindh to approach the Federal Government to discontinue the construction of Kala Bagh Dam Scheme as the same will cause very serious harm to Sindh.

RESOLUTION NO 01 PASSED UNANIMOUSLY
IN THE PROVINCIAL ASSEMBLY OF SINDH
IN THE MEETING HELD ON 14-06-1994

**JOINT RESOLUTION BY MR. NISAR AHMED KHUHRO, LEADER OF THE OPPOSITION, AND
SYED SADAR AHMED, SENIOR MINISTER HOME**

We move a joint Resolution that the Assembly does recommend to the Government of Sindh to make a complaint to the CCI under Art 155- of the Constitution of the Islamic Republic of Pakistan against the construction of the Greater Thal Canal and to request the Federal Government to stop the construction of the said canal as the province of Sindh has legitimate grievances which need to be redressed.

(Signed)

Nisar Ahmed Khuhro

(Signed)

Syed Sardar Ahmed

RESOLUTION PASSED UNANIMOUSLY
IN THE PROVINCIAL ASSEMBLY OF SINDH
IN THE MEETING HELD ON 28-02-2003

**RESOLUTION BY MR. MUHAMMAD HUSSAIN KHAN
MINISTER FOR LOCAL GOVERNMENT, KATCHI ABADIES & SPECIAL DEVELOPMENT**

I, Muhammad Husain Khan move this resolution of recent public interest that the unanimous resolution passed by this Assembly on 28.02.2003 has not been given due weight and consideration by the Federal Government. On the contrary in the PSDP document a sum of Rs. 1500 million has been earmarked for construction of Greater Thal Canal meaning thereby that no importance is given to the unanimous resolution of this Assembly.

And therefore this house is of the opinion and recommends to the Federal Government that the unanimous resolution passed by this Assembly on 28.2.2003 be implemented in letter and spirit as early as possible.

This house is also of the opinion and hereby resolves that the Construction of Greater Thal Canal should be discontinued immediately, failing which further line of action in this regard would be announced as Construction of Greater Thal Canal is depriving this Province of its legitimate water.

(Signed)

(MUHAMMAD HUSSAIN KHAN)
Minister for Local Government,
Katchi Abadies and Spatial Development,
Government of Sindh

RESOLUTION PASSED UNANIMOUSLY
IN THE PROVINCIAL ASSEMBLY OF SINDH
IN THE MEETING HELD ON 19-06-2003

APPENDIX E

**Executive Summary of the
Final Report of International Panel of Experts (IPOE) on
Water Escapages below Kotri Barrage**

Final Report of IPOE for Review of Studies on Water Escapages Below Kotri Barrage

EXECUTIVE SUMMARY

I. Three studies were commissioned to reach consensus on the minimum required escapages below Kotri Barrage, which is the main outstanding item of the Water Apportionment Accord (WAA). It concerns:

- Study I: *Water escapages below Kotri Barrage to check seawater intrusion;*
- Study II: *Water escapages downstream of the Kotri Barrage to address environmental concerns;*
- Study III: *Environmental concerns of all the four provinces.*

In order to have an independent external review of the studies an international panel of experts (IPOE) was appointed. The IPOE took good note of the historical developments and the WAA, especially of para 7 on The need for certain minimum escapages to the sea, below Kotri, to check sea intrusion. The IPOE reviewed the studies at relevant stages, had in depth discussions with government staff at Federal and Provincial level, as well as with the consultants, and analysed international experiences and practices.

II. The following aspects primarily justify the need for water escapages below Kotri Barrage: (i) salinity encroachment in the river, aquifer and coastal zone; (ii) requirement of coastal stability; (iii) requirement of a sustainable environment; (iv) fisheries; (v) prevention of salinity accumulation in Indus Basin. In addition other factors may play a role: riverine forests, riverine agriculture, pollution control and drinking water supply.

III. In the determination of the IPOE's recommendations on the minimum escapages the following considerations have played a role: (i) to check seawater intrusion downstream of Kotri Barrage as identified in Study I; (ii) the needed environmental flows upstream of Kotri Barrage as provisionally indicated in Study III; (iii) the impact of the recommended environmental flows on the availability of water for economic and social needs (irrigation, domestic and industrial water supply) as indicated in Study III; (iv) the minimum needs for fisheries and maintenance of mangroves in the Expanded Delta as indicated in Study II; (v) flows to keep the river morphology in good condition; (vi) the international developments and practices with respect to environmental flows; (vii) the recognition that a structural solution will not be feasible.

IV. An escapee at Kotri Barrage of 5000 cfs throughout the year is considered to be required to check seawater intrusion, accommodate the needs for fisheries and environmental sustainability, and to maintain the river channel. The IPOE likes to stress that seawater intrusion only concerns problems related to surface water, because salinity in the aquifer is predominantly due to fossil water salinity from geological origin.

V. The IPOE understands the problem of sea intrusion/coastal erosion as occurring in the Indus Delta area and considers this as a National problem. The reasons for this problem are primarily: (i) reduction in sediment supply by Indus River as indicated in Studies I and II; (ii) reduction in the mangrove vegetation as indicated in Study II; (iii) prevention of flooding of the outlying delta areas due to the river bunds; (iv) sea level rise; (v) recent extreme weather conditions possibly due to climate change. With respect to the required sediment supply and mangrove vegetation the IPOE likes to give the following observations and recommendations.

VI. As far as the sediment supply is concerned a substantial reduction has taken place over the years due to the diversion of most of the water for irrigation. The original supply of sediment is estimated at 400 million tons/year. Then the coastal accretion was about 30m/year. A substantially smaller amount of sediment is needed to establish a stable coastline, especially when this supply is combined with coastal protection measures. By far most of the sediment is supplied during peak flows. It is recommended that a total volume of 25 MAF in any 5 years period (an annual equivalent amount of 5 MAF) be released in a concentrated way as flood flow (Kharif period), to be adjusted according to the ruling storage in the reservoirs and the volume discharged in the four previous years.

- VII. As far as the mangrove vegetation is concerned a certain flow and sediment supply will be required, together with control of camel grazing and fire wood cutting, and mangrove replanting. In order to spread the water over the flats a concentrated high flow would be needed during the Kharif season. The amounts of fresh water as mentioned under item VI will be sufficient for a sustainable mangrove growth. It is considered to be of utmost importance to manage the mangroves in such a way that a sufficiently wide mangrove belt is being maintained in front of the coastline. The IPOE recommends that this be considered to be a National responsibility.
- VIII. Based on the above considerations the IPOE recommends the escapages below Kotri Barrage as shown in Table I. The flows can be adjusted according to the proportions of the allocations delivered to irrigation. In addition the IPOE recommends that peak discharges during the Kharif period, as explained in item VI, will be made to supply sediment to the delta, sustain mangrove vegetation and preserve river morphology.

Table I. Recommended escapages below Kotri Barrage in cfs and MAF

Kharif	Rabi *)												Totals		
	April	May	June	July	Aug.	Sept	Oct.	Nov.	Dec.	Jan.	Feb.	March	Year	Rabi	Kharif
In cfs	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000			
In MAF	>=03	>=03	>=03	>=03	>=03	>=03	0.3	0.3	0.3	0.3	0.3	0.3	3.6 +**)	1.8	1.8 +**)

*) In a dry year the amount can be proportionally reduced in relation n to the reductions in irrigation water supply

***) A total volume of 25 MAF in any 5 years period (an annual equivalent amount of 5 MAF) to be released in a concentrated way as flood flow (Kharif period), to be adjusted according to the ruling storage in the reservoirs and the volume discharged in the four previous years

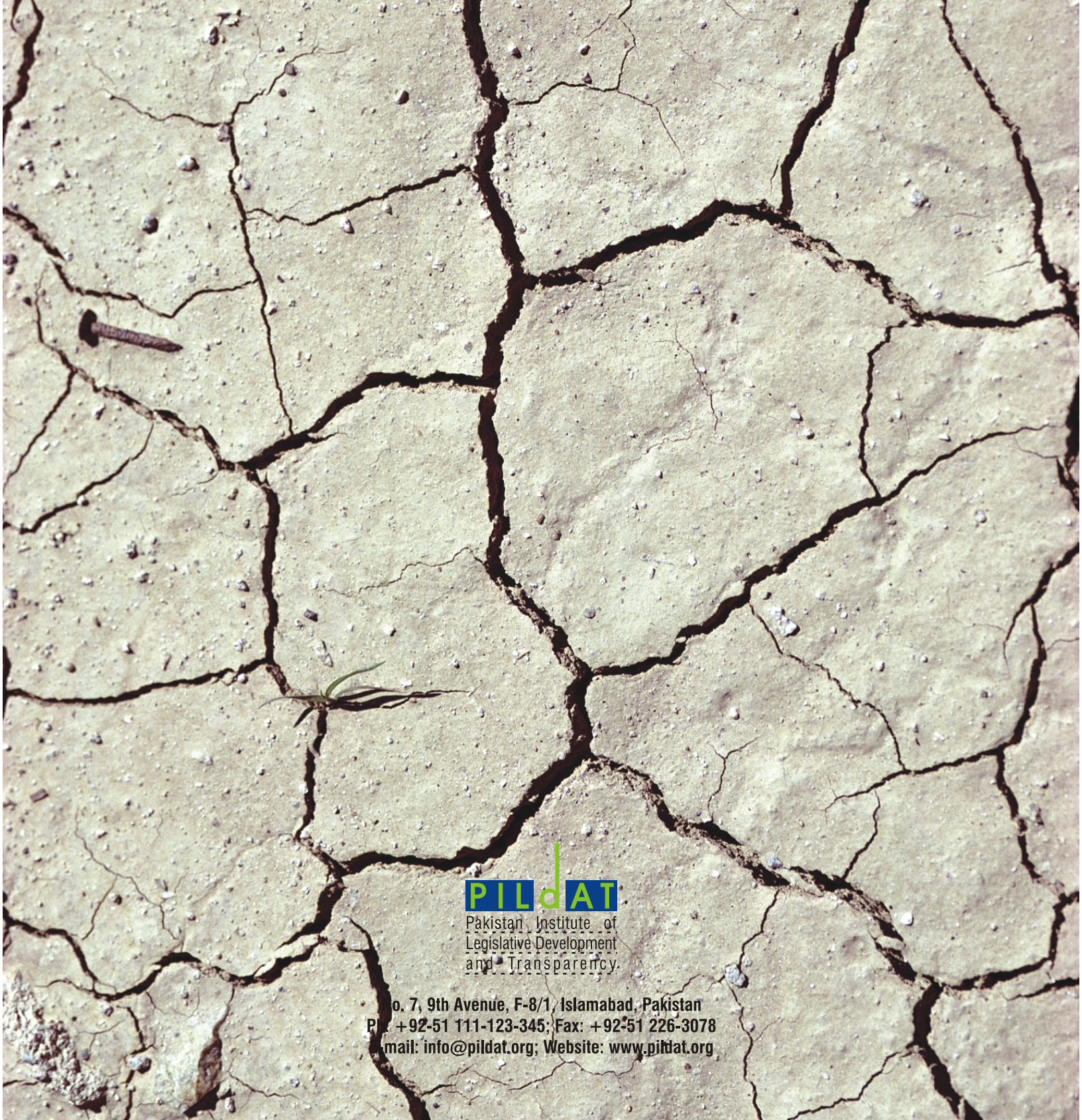
- IX. Based on the post Tarbela flow data the above recommendations would result in a required additional release downstream of Kotri Barrage during low flow months of 1.26 MAF in an average year and 2.20 MAF in a typical dry year. This will require additional storage capacity to prevent a reduction of water availability for irrigated agriculture. Environmental flows would as and when appropriate be routed via upper rivers before release downstream of Kotri Barrage.
- X. The IPOE recommends that the proposals as made by Study III with respect to the environmental concerns of the provinces, not reducing the escapages downstream of Kotri Barrage as recommended in item VIII and acceptable to the concerned province, be prioritised for implementation.

IPOE:

Signed on behalf of the IPOE

- * Dr. Fernando J Gonzalez
- * Dr. Thinus Basson
- * Dr. Bart Schultz

Delft 20th of November, 2005
Bart Schultz



PILDAT

Pakistan Institute of
Legislative Development
and Transparency

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