E D I T O R I A L

THE WATER CRISIS

Dear Fellow Engineers

For the last more than a decade, Economists and Water Resources Specialists have been consistently warning the respective countries to realise in earnest the looming water scarcity, which if not solved will result in stagnation of Socio-economic development, food insecurity, and God Forbid hunger/starvation. The planners were required to take timely action for storage, preservation and optimum utilization of its Water Resources.

Water is a gift of nature available free of any charge for Agricultural, Industrial and Domestic use by the humans, livestock etc. However, these precious resources have been plundered/wasted with impunity with the result that the Nation is faced with dire scarcity of water, in particular in Karachi, Quetta, Islamabad as well as Lahore.

The culpable negligence in preservation of precious water resources becomes even more baffling when the Human Race has no powers to create Water. We quote Quranic Injunctions in this respect.

> *"Have you Considered the water that you drink? Do you Send it down from the Rain-Clouds or we are the sender"?* ***(Surah 56, Al-Waqia)***
>
> *"Have you Considered if Water goes down then who would bring to you flowing water"?****(Surah 68, Al-Qalam)***
>
> *"And sent down from the Clouds Water pouring forth abundantly. So that we may bring forth grains and husks and Gardens thick with Trees and luxuriant".* ***(Surah 78, Al-Naba)***

Per capita water availability has slided to 915 m^3 from 5263 m^3 in 1951. IMF has warned that unless fast track actions to conserve water are not undertaken there will be no water for domestic use by 2025.

The time at our disposal is extremely limited and ticking fast.

- Substantial resources need to be allocated for construction of Mega, Medium and Small Water Reservoirs so that 30-40 MAF of water flowing annually into the sea unused/un-tapped is available for Agriculture, Industrial and Energy resources development
- Flood Waters should be channelized in Dams, Rivers, Canals, Lakes, and Streams to be used for recharging the depleted ground water aquifers.
- Hill Torrents in Pakistan drain approximately 65% of the total area of the country. There are 16 large Hill Torrents in 14-major Torrent areas. As per a recent study, 1200 Number water conservation sites have been identified where 18690 MAF of Hill Torrents waters can be conserved and 1.409 million acres of land can be brought under cultivation. Alas, little efforts are being

made to tap this valuable potential and to stem the rot of floods. that inflict enormous physical and financial losses

- Rain water Harvesting Techniques in cities at High Rise Buildings, Libraries, Museums, Universities etc. is being practiced in several countries for achieving water supply which is clean/potable and can be used in Domestic purposes, gardening, industries and Groundwater recharge. It is the best source of providing low cost decentralized water to urban and Rural Households where safe treated water is not available. It has been successfully implemented in NUST-Islamabad. It is being effectively practiced in Canada, India, United Kingdom, Sri Lanka, and Malaysia etc.
- In drought ridden rain sparse water areas, Cholistan, Thar etc. Rain water should be stored in properly designed water tanks to ensure availability of water for survival of inhabitants of those areas as well as for providing water and fodder for Livestock.
- Ground Water Resources are being enormously mined to the tune of 50-million MAF with Water-Table going down fast. Their use needs to be regulated to put an effective brake for wasteful mining and use of this precious potable water. This action is overdue.
- Domestic water needs to be regulated with specific time for the supply of water, immediate implementation of metering system, proper pricing of water to control wasteful use so that adequate resources could be allocated for the development and maintenance of water resources potential.

WELCOME ADDRESS

BY

ENGR. CH. GHULAM HUSSAIN[1], PRESIDENT, PAKISTAN ENGINEERING CONGRESS

ON

74TH ANNUAL SESSION OF PAKISTAN ENGINEERING CONGRESS

ON DECEMBER 27, 2017

Honourable Chief Guest Engr. Shams-ul-Mulk Sahib, Former Chairman, WAPDA and Chief Minister, Khyber Pakhtunkhah, distinguished delegates and Fellow Engineers of the Pakistan Engineering Congress: Ladies and Gentlemen;

اَلسَّلَامُ عَلَيْكُم وَرَحمَةُ اللهِ وَبَرَكَاتُهُ

1.0 It is a great honour for the Pakistan Engineering Congress and indeed a proud privilege for me to extend very hearty welcome to you all to the 74th Annual Session of the Pakistan Engineering Congress. We cordially welcome you Honourable Chief Guest for sparing some time and coming all the way from Islamabad to grace this occasion. This indeed is a manifestation of your profound relation with the Congress and deep interest in maintaining personal communication with the engineers of Pakistan.

We greatly value this opportunity for presenting our views on some matters of vital national importance for consideration of the concerned agencies of the government.

2.0 **Ladies & Gentlemen:** The Pakistan Engineering Congress, established in year 1912, incidentally the same year when American Society of Civil Engineers was founded, is the oldest Engineering body of the Sub-Continent. Major objectives of the Congress are propagation and promotion of engineering knowledge and practices for the advancement of the engineering profession. Selected technical papers of the highest standards, on different subjects of national and global importance, are presented and discussed during its annual sessions and on various other occasions. Symposia on important engineering problems are also held during the Annual and the Mid-term sessions and the resulting recommendations are sent to the concerned quarters of the Government for consideration.

3.0 A large number of papers presented at the Congress platform have won world-wide recognition and acclaim. Many advances, such as Kennedy, Lacy, and Khosla theories, made in the fields of various engineering disciplines, were first presented and discussed at the platform of this Congress. Over the

[1] Engr. Ch. Ghulam Hussain, President, Pakistan Engineering Congress

past 100 years presentation and publication of 791 technical papers have been managed by the Congress. Annual publications of the Congress constitute a valuable treasure of engineering knowledge. These papers have been uploaded on the Congress Website and are being intercepted by thousands of engineers and researchers all over the world. The Congress regularly observes the “World Water Day” and “World Environment Day” where presentations are made to create awareness amongst the masses about the vital resources and their conservation.

Sir, during this Session, which you have very kindly consented to inaugurate, eighteen (18) technical papers are being presented covering various important subjects. A Symposium on the subject of “Impact of Infrastructure Development & Pakistan Economy” is also being held as part of this Annual Session. Besides, visits of delegates to the nine (9) various Projects of National importance were managed. “Engineering News”, a quarterly journal of the Pakistan Engineering Congress is being regularly published since 1958. Proceedings of all he technical papers and the Quarterly Journal are distributed free of cost to various institutions, engineering universities and to the libraries, local as well as foreign to further the cause of development, exchange and dissemination of available technical knowledge on a broad spectrum over the largest possible area.

4.0 **Ladies and Gentlemen:** The activities of “Pakistan Engineering Congress” are devoted solely to the promotion and advancement of engineering knowledge and practices. Its office holders are all honorary workers. The Congress is proud to inform that it has been contributing liberally out of its own resources in the National calamities such as floods and earthquakes. The Congress has the unique privilege of sponsoring 400 scholarships to deserving engineering students for under Graduate and 200 for M.Sc. Engineering Students in the public sector Universities all over the Country and 100 new Scholarships are instituted every year.

During this Session of 2016-2017 of the Congress, twelve (12) technical lectures were delivered by national and international experts on various topics. In these lectures, the experts gave, inter-alia, their recommendations to resolve water and power problems of the country.

Ladies & Gentlemen: In the light of the views expressed by the experts in their lectures, the Congress earnestly recommend that the policy of hydel power generation should be adopted as a long term policy. Construction of a Cascade of mega storage and hydropower projects on the Indus River comprising of Diamer Basha, Kalabagh Dam, Akhori Dams and Dasu, Pattan, Thakot, Bunji Hydropower Projects will provide a very strong base for agricultural and industrial development of the Country. Electricity charges have registered unprecedented higher indices and are further spiraling. Consequently, higher power charges have adversely affected the industrial and agricultural sectors. There is thus dire need to revert to full exploitation of our Hydro Power potential of over 60,000 MW. The mining of coal reserves of Thar to provide affordable energy besides tapping the renewal energy resources such as Wind, Solar and Bio-mass should be given special attention by Federal and Provincial governments.

5.0 **Ladies and Gentlemen:** Our population is growing rapidly and our needs for food and other agricultural products have greatly increased. God has blessed Pakistan with land, large rivers, excellent climate and hardworking people yet, we continue to remain importers of edible oils, tea and other commodities.

We have virtually clamped down on further development of major water storages for the last 40 years. The cumulative storage capacity of the major water reservoirs including Mangla, Tarbela and Chashma has decreased by 25 percent because of the natural phenomenon of sedimentation.

5.1 Over 30 MAF of water flows downstream of Kotri Barrage every year. This necessitates increase in water storage capacity of Pakistan by constructing new dams. WAPDA through various studies has identified that Pakistan has potential of 60,000 MW hydel generation, which needs to be harnessed to its maximum for injecting low cost hydel electricity in the national grid to provide cheaper electricity to the masses and boost up the industrial and agricultural development in the country. Within another five to ten years, shortage of canal irrigation supplies would become serious issue besides compelling demands for urban water supplies and industry.

5.2 **Ladies and Gentlemen:** The historic **WATER ACCORD** signed between the Provinces, way back in 1991, aimed at rapid development of our water and hydro power resources, still remains to be fully implemented. About thirty three (33) million acre-feet of precious river water continues to escape to the sea without delivering its economic value to the nation enroute and rather causing flood devastation and miseries on the way. We must harness this surplus water by constructing multi-purpose storage dams at all available sites. It would improve and increase canal irrigated areas to achieve not only autarky in food and other agricultural products, but would also generate cheap hydel-power, control devastating floods and create millions of new jobs all over the country. This will also ensure year round environmental flow regime for the health of delta and the Indus basin as a whole.

5.3 The Congress urge upon and appeal the political leadership on the issue of storage dams which cannot brook any further delay as **history and posterity never forgive the Nations for missed opportunities.**

6.0 **Ladies and Gentlemen:** A policy decision was taken in 1989 to declare at least seven Federal Ministries as technical necessarily to be headed by engineers. However, the implementation of this decision has been thwarted and technical experts have gradually been removed from the key positions. Continued appointments of non-engineers against top engineering posts have negated the policy of supporting promotion of science and technology. Rules are being modified to accommodate non-engineers in key technical jobs. Situation in the provinces is even worst. This trend of de-professionalization of highly technical jobs in the public sector, both at the federal and provincial levels, has already led to disastrous results. In view of the vital significance of the matter for economic and scientific development of the country, I take this opportunity to appeal to the Prime Minister and the Chief Ministers to give this matter their genuine consideration.

7.0 **Honourable Sir,** we have been stressing that without a properly organized indigenous engineering consultancy and construction industry with-in-built checks and balances for quality assurance, cost and time control, we will not be able to build our technological skills and construction capacity to undertake major development projects. Self-reliance is not only the demand of the engineering profession, but it is the compelling requirement for the country to develop rapidly. This can be achieved by encouraging the local construction industry in technical, managerial and financial fields. There is a dire need to enforce a minimum Pakistani component for any construction / consultancy contract awarded to a foreign company. Pakistan has a wealth of experienced and competent engineers, managers and financial experts who are capable of performing to the highest standards. The Congress strongly recommend to the Government to set-up a suitable mechanism to reverse the growing trend of reliance on foreign resources in consultancy and construction sectors.

7.1 **Ladies and Gentlemen:** Construction was declared as an industry a few years ago but no follow-up decisions were taken to get this policy implemented. We request that all back-up support required for any industry be made available to the construction industry.

8.0 **Honourable Sir,** a number of cadres in the Government service structure such as doctors, lecturers and others have recently been provided with improved service structures. The engineers, however, are being denied the same. Promotions in engineering departments are blocked for many years, Graduate engineers entering the service, in Grade-17, are not promoted to next grade in most of the cases even after fifteen years of service. Finding no place the best engineering talent is leaving the country in disgust and frustration. The Pakistan Engineering Congress has been advocating better service conditions and structure for the engineers in Government services at least at par with other services. A five-tier service structure plan was proposed by the Congress and was sent to the Government and despite being agreed in Public pronouncements by the then Prime Minster, has yet to be implemented. We once again impress upon the Federal and Provincial Governments to implement the five-tier service structure and scheme of time-scale promotions for engineers as has been done in the case of some other professions.

9.0 Research and Development is another area which has been neglected for too long. Pakistan is spending hardly 0.15% of the GDP, on Research and Development whereas in developed countries, the ratio is more than 1.5% of GDP. Lack of support to Research and Development is, unfortunately, widening technological gap between the developed and developing countries. There is an urgent need to accelerate our efforts in Research & Development by providing extra budgetary allocations and by reorganizing and reinvigorating the research bodies which are spending major parts of their allocations on salaries of staff only.

10.0 **Honourable Sir,** another important issue which deserves the special attention of the Government is the plight of unemployed engineers of the country. Number of engineers working in a country is a useful indicator of the rate of its economic growth. In Pakistan, we have one engineer for a

population of over 7,000 people whereas in the developed countries the ratio is one for two hundred. The irony of the situation is that in-spite of such a low ratio in Pakistan, about 50% of the engineers; qualifying from the universities each year, remain unemployed for a number of years. An unemployed engineer is not only a problem of personal inconvenience, to say it politely, it tantamounts to a national tragedy. It shows that not only considerable financial resources in educating an engineer have gone waste, but a resource potential remains unused. We know that unemployment has taken a national dimension, and to overcome it is a matter of high priority with the present Government but as employment of an engineer adds to the national production and economy, this issue warrants the highest priority. Sir, in this content, we would request the Government to amend the relevant laws requiring every industry, contractor and consulting firm to employ a suitable number of probationary engineers at least for one year on the pattern of house jobs for doctors. Provision for such appointments could be made obligatory for them to quote in their bids when seeking award of large contracts.

11.0 **Ladies & Gentlemen:** Before I close my submissions, I once again thank you Sir, and all other distinguished guests and participants for joining us on this occasion. This is a source of immense encouragement for the Engineers of Pakistan. We place our services at the disposal of the Nation for any responsibility for the good of the Country. We assure our best endeavors to live upto the expectations of any Government and those of the Nation.

I would now request the Honourable Chief Guest to kindly inaugurate the74th Annual Session of the Pakistan Engineering Congress.

PAKISTAN PAINDABAD

Inaugural Address by

ENGR. SHAMS UL MULK

Former Chairman WAPDA

At the

74TH ANNUAL SESSION

PAKISTAN ENGINEERING CONGRESS

Held at

P.C. Hotel, Lahore

On

27th December, 2017

Addressing the opening session of Pakistan Engineering Congress, former WAPDA Chairman Shams ul Mulk said that Pakistan is losing around Rs. 196 billion almost every year due to non-existence of KBD which can produce power at Rs. 1.5 per unit even today.

Enumerating the benefits of water reservoirs to cater the country's water needs and hydro-power generation, he stressed the need for initiating construction work on Kalabagh Dam (KBD) without any further delay. He stated so far, the country had to bear an accumulative loss of Rs. 196 billion annually – Rs. 100 billion to Punjab, Rs. 60 billion to Sindh and Rs. 36 billion to KP – in the absence of KBD.

Shams ul Mulk said water policy is simply non-existent in Pakistan. He said that the authorities appear to lack the political will to tackle the problem. There are no proper water storage facilities in the country. Pakistan has not built new dams since the 1960. Not only high cost of electricity has retarded Pakistan's Industrial development rather the gas required for Industries and domestic use is not available due to its excessive use in power generation. The additional availability of water due to KBD would increase the crops cultivable area in Pakistan thus helping poor farmers. The biggest beneficiary of KBD would be D.I. Khan area of KPK, where around 800,000 acres of arable land would be able to be cultivated. The area being 150 feet higher than Indus River can only be cultivated economically with the construction of KBD. The KBD would save D.I. Khan, Punjab and Sindh from floods. KBD would help reduce electricity shortage to a great extent by providing cheap and environment friendly electricity.

He went on to say that unfortunately, the time is running out fast, any further delay in the construction of KBD and other big dams, especially in the face of Indian water aggression, would be catastrophic for the country. The ultimate sufferers would be the farmers and poor people.

After completion of KBD, Bhasha Dam should be pursued, which would provide additional electricity and further reduce dependence on fuel generated electricity.

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Held on 27th December 2017 to 30th December 2017



(From Left) Engr. Syed Nafasat Raza, Engr. Capt. (R) M. Qadir Khan, Engr. M. Anwar Qaseem Qureshi, Engr. Husnain Ahmad, Engr. Ch. Ghulam Hussain, Engr. Ch. Muhammad Arif, and Engr. Akhtar Abbas Khawaja



(From Left) Engr. Najam Waheed, Engr. S.M.A Zaidi, Engr. Muzaffar Hussain Choudhry, Engr. Muhammad Ibrahim Malik, Engr. Iftikhar Ahmad, and Engr. Dr. Muhammad Saeed



(From Left) Engr. M. Anwar Qaseem Qureshi, Engr. Capt. (R) M. Qadir Khan, Engr. Iftikhar Ahmad, Engr. Muhammad Ibrahim Malik, Engr. Nayyar Saeed, Engr. Najam Waheed and Engr. Amjad Saeed



(From Left) Rana Imran Arshad, Engr. Iftikhar Ahmad, Engr. Husnain Ahmad, Engr. Nayyar Saeed, Engr. Muhammad Ibrahim Malik, and Engr. M. Anwar Qaseem Qureshi



(From Left) Engr. Tariq Rashid Wattoo, Engr. Akhtar Abbas Khawaja, Engr. Riaz Ahmad Khan, Engr. Capt. (R) M. Qadir Khan, Engr. Dr. Muhammad Saeed and Engr. M. Anwar Qaseem Qureshi



(From Left) Engr. Iftikhar ul Haq, Engr. Ch. Ghulam Hussain, Engr. Husnain Ahmad, Engr. Irfan Qazi, Engr. Muhammad Usman, Engr. Iftikhar Ahmad, Engr. Muhammad Sharif Shah, Engr. Najam Waheed, Engr. Ijaz Ahmad Cheema, Engr. Muhammad Ibrahim Malik, Engr. Syed Nafasat Raza, Engr. Syed Anwar ul Hassan and Engr. M. Anwar Qaseem Qureshi



The Chief Guest Engr. Shams ul Mulk Former Chairman WAPDA/Former Chief Minister KPK on arrival at P.C. Hotel, Lahore



(From Left) Engr. Husnain Ahmad Vice President-PEC, Engr. Riaz Ahmad Khan Member Executive Council with other Members of Executive Council waiting for the arrival of Chief Guest Engr. Shams ul Mulk



Engr. Husnain Ahmad Past President / Vice-President PEC Welcoming the Chief Guest Engr. Shams ul Mulk on arrival at P.C. Hotel Lahore on December 27, 2017



(From Left) Engr. Nafasat Raza, Engr. Akhtar Abbas Khawaja, Engr. Husnain Ahmad, Engr. Nayyar Saeed, Engr. Ch. Ghulam Hussain, Engr. Shams ul Mulk, the Chief Guest, Engr. Ch. Muhammad Arif, and Engr. Iftikhar ul Haq



Group Photo of the Members of Executive Council (74th Session) with the chief Guest Engr. Shams ul Mulk Former Chairman WAPDA/Former Chief Minister KPK

1st Row: Engr. Iftikhar Ahmad, Engr. Ch. Muhammad Arif, Engr. R. K. Anver, Engr. Ch. Ghulam Hussain, Engr. Shams ul Mulk, Engr. Husnain Ahmad, Engr. Riaz Ahmad Khan, Engr. Nayyar Saeed, Engr. Akhtar Abbas Khawaja and Engr. Ijaz Ahmad Cheema

2nd Row: Engr. Anwar ul Hassan, Engr. Tahir Anjum Qureshi, Engr. Iftikhar ul Haq, Engr. Muhammad Ibrahim Malik, Engr. M. Anwar Qaseem Qureshi, Engr. Najam Waheed, Engr. Nafasat Raza, Engr. Tariq Rashid Wattoo, and Engr. Muhammad Usman

3rd Row: Engr. Capt. (R) M. Qadir Khan, Engr. Amjad Saeed, Engr. Dr. Muhammad Saeed, Engr. Muhammad Sharif Shah, and Engr. S. M. A. Zaidi



(From Left) Engr. Nayyar Saeed Secretary-PEC, Chief Guest Engr. Shams ul Mulk Former Chairman WAPDA/Former Chief Minister KPK, Engr. Ghulam Hussain President-PEC



(From Left) Engr. Shams ul Mulk the Chief Guest, Engr. Ch. Ghulam Hussain President-PEC (74th Session)



Engr. Nayyar Saeed Secretary-PEC proceeding with the Program of the Inaugural Session of 74th Annual Session



Engr. Ch. Ghulam Hussain President-PEC delivering the Welcome Address at the Inaugural Session (74th Session) at P.C Hotel Lahore



Chief Guest Engr. Shams ul Mulk Former Chairman WAPDA/Former Chief Minister KPK delivering the Inaugural Address at 74th Annual Session held at P.C. Hotel Lahore



(From Right) Engr. Ghulam Hussain, President-PEC, Engr. Shams ul Mulk Former Chairman WAPDA/Former Chief Minister KPK awarding prominence Medal to Engr. Iftikhar ul Haq Managing Director of Engineering General Consultants (EGC) in recognition of his services to “Engineering Profession”



(From Right) The Chief Guest Engr. Shams ul Mulk and Engr. Ch. Ghulam Hussain President-PEC awarding Shield to Engr. Nayyar Saeed Secretary-PEC



(From Right) The Chief Guest Engr. Shams ul Mulk awarding Shield to Engr. Ch. Ghulam Hussain President-PEC



(From Left) Engr. Nayyar Saeed Secretary-PEC and Engr. Ch. Ghulam Hussain President-PEC presenting shield to the Chief Guest Engr. Shams ul Mulk



(From Left) Engr. Ahtezaz-ul-HaqS/O of the Late Engr. Asrar ul Haq receiving the "Congress" Medal Awarded to Engr. Asrar ul Haq for the best paper on the topic of "FLOOD MANAGEMENT CHALLENGES IN PAKISTAN: SHAPING IMPROVEMENT STRATEGIES IN THE CONTEXT OF PREVAILING CONSTRAINTS, CONFLICTING INTERESTS AND GLOBAL EXPERIENCES" presented at 73rd Annual Session held on December 24, 2015



(From Right) The Chief Guest Engr. Shams ul Mulk and Engr. Ch. Ghulam Hussain President-PEC awarding Gold Medal to Engr. Riaz Nazir Tarar for "Professional Excellence" in the field of Engineering



Engr. Mirza Asif Baig Former Commissioner Indus Waters being interviewed by the Media



Dr. Arshad Choudhry Ex M.D, NTDC being interviewed by the Media



(From Right) Engr. Iftikhar ul Haq Managing Director M/s. EGC (Pvt.) Ltd. With Dr. Arshad Chaudhry Ex-MD, NTDC (in the Middle)



Engr. M. Mushtaq Chaudhry Former Member WAPDA/Advisor MMP presenting paper on the topic of **"Tarbela 4th Extension Hydro-Power Project"** authored by Engr. Dr. Izhar ul Haq Advisor WAPDA & Engr. M. Mushtaq Chaudhry



(From Right) Engr. S.M.A Zaidi Former Secretary-PEC and Member Executive Council and Engr. Riaz Nazir Tarar presenting Shield to Engr. Mahmood Ahmad for presenting his paper on the topic of "**WATER ACCOUNTING AND AUDITING TO MANAGE WATER SCARCITY -- GLOBAL EXPERIENCE AND POSSIBLE GUIDELINES FOR PAKISTAN"**



(From Left) Engr. Riaz Ahmad Khan Past President-PEC and Engr. Riaz Nazir Tarar presenting Shield to Dr. Allah Bakhsh Sufi for presenting his paper on the topic of "**CLIMATE CHANGE IMPACT ON WATER RESOURCES OF PAKISTAN"** Engr. S.M.A Zaidi Former Secretary-PEC and Member Executive Council is at Right



(From Left) Engr. Riaz Ahmad Khan Past President-PEC & Engr. Muhammad Amin Vice-President-PEC presenting Shield to Engr. Masroor Ahmed Shahwani for presenting his paper on the topic of "**FARMER MANAGED IRRIGATION SYSTEM AND ITS IMPACT ON WATER SERVICE DELIEVERY: A CASESTUDY OF SINDH-PAKISTAN"**



(From Right) Engr. Riaz Ahmad Khan Past President & Engr. Muhammad Amin Vice-President-PEC presenting shield to Dr. Qazi Tallat Mahmood Siddiqui for presenting his paper on the topic of "**A WAY FORWARD FOR FLOOD RISK MANAGEMENT IN PAKISTAN"**



(From Left) Engr. Riaz Ahmad Khan Past President-PEC presenting Shield to Engr. Muhammad Mohsin Munir for presenting his paper on the topic of "**CROP WATER BUDGET ESTIMATION USING GIS"**



(From Left) Engr. Riaz Ahmad Khan Past President-PEC presenting Shield to Engr.S.M.A Zaidi Former Secretary-PEC and Member Executive Council for chairing Technical Session, Engr. Riaz Nazir Tarar is at Right



(From Left) Engr. Riaz Ahmad Khan Past President-PEC and Engr. S.M.A Zaidi presenting Shield to Engr. Riaz Nazir Tarar for Chairing Technical Session



(From Left) Engr. Riaz Ahmad Khan Past President-PEC and Engr. Ch. Ghulam Hussain President-PEC presenting Shield to Engr. Muhammad Amin Vice President-PEC for Chairing the Technical Session



(From Left) Engr. Ch. Ghulam Hussain President-PEC presenting Shield to Engr. Riaz Ahmad Khan Past President-PEC for Chairing the Technical Session

Questions/Answers Session





Engr. Riaz Nazir Tarar (above) and Engr. Usman Dar (Below) discussing issues with the Speakers of the Session

Questions/Answers Session





Engr. Ghulam Zakir Hassan Sial (Above) and Engr. Masroor Ahmad Shahwani (Below) making queries on the issue under Discussion

Questions/Answers Session



Engr. Zubair Masood Pirzada (Above) and Engr. Iftikhar Ul Haq (Below) in discussion with the speakers

Glimpses of the Audiences





Glimpses of the Audiences





Glimpses of the Audiences





Glimpses of the Audiences





Glimpses of the Audiences





Glimpses of the Audiences





Glimpses of the Audiences





Glimpses of the Audiences





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Glimpses of 28th December 2017



(From Left) Engr. Muhammad Arif Vice President-PEC, Engr. Husnain Ahmad Past President / Vice President-PEC and Engr. Syed Mansoob Ali Zaidi Former Secretary-PEC/Member Executive Council



(From Left) Engr. Faqir Ahmad Paracha Former Vice President-PEC, Engr. R. K Anver Vice President-PEC and Engr. Syed Mansoob Ali Zaidi Former Secretary-PEC/Member Executive Council presiding over Technical Session



(From Right) Engr. Syed Mansoob Ali Zaidi Former Secretary-PEC/Member Executive Council, Engr. Muhammad Amin Vice President-PEC, and Engr. M. Anwar Qaseem Qureshi presiding over a Technical Session



(From Right) Engr. Syed Mansoob Ali Zaidi Former Secretary-PEC/Member Executive Council, Engr. Iftikhar ul Haq Managing Director M/s. EGC (Pvt.) Ltd. Member Executive Council and Engr. Dr. Mahmud Ahmad Visiting Researcher, Centre for Water Informatics & Technology LUMS Lahore



Engr. R.K Anver, Vice President-PEC and Session Chairman expressing views on the Technical Issues discussed in the Presented Papers



(From Left) Engr. Husnain Ahmad Past President/Vice President-PEC and Engr. Ch. Muhammad Arif presenting Shield to Engr. Abdul Rehman for presenting his Paper on the topic of **"FINANCIAL AND ECONOMIC ANALYSIS OF PROJECT OF UP-GRADATION / REHABILITATION OF MAIN LINE-2 of PAKISTAN RAILWAYS"**



(From Left) Engr. Husnain Ahmad Past President/Vice President-PEC and Engr. Ch. Muhammad Arif Vice President-PEC presenting Shield to Engr. Mazhar ul Islam for presenting his Paper on the topic of **"AWARDING CONTRACT WITHOUT COMPETITIVE BIDDING: IMPLICATIONS"**



(From Left) Engr. Husnain Ahmad Past President/Vice President-PEC and Engr. Ch. Muhammad Arif Vice President-PEC presenting Shield to Engr. M. Suleman Khan for presenting his Paper on the topic of **"WATER & ENERGY RESOURCES OF PAKISTAN"**



(From Left) Engr. Husnain Ahmad Past President/Vice President-PEC and Engr. Ch. Muhammad Arif Vice President-PEC presenting Shield to Engr. Dr. Ghulam Nabi for presenting his Paper on the topic of **"ROOF TOP RAINWATER HARVESTING OPTIONS FOR WATER CONSERVATION-A CASE STUDY OF LAHORE"**



(From Left) Engr. Faqir Ahmad Paracha Former Vice President-PEC and Engr. R.K Anver Vice President-PEC presenting Shield to Engr. Adnan Hassan for presenting his Paper on the topic of **"AN IMPACT OF SOIL CHARACTERISTICS ON FAILURE OF FLOOD BUNDS- CASE STUDY FROM PUNJAB PAKISTAN"**



(From Left) Engr. Faqir Ahmad Paracha Former Vice President-PEC and Engr. R.K Anver Vice President-PEC presenting Shield to Engr. Amjad Saeed for presenting their Paper on the topic of **"BARRAGE PROJECTS-FLOOD MANAGEMENT"**



(From Left) Engr. S.M.A Zaidi Former Secretary-PEC and Engr. R.K Anver Vice President-PEC presenting Shield to Engr. Sajid Nazir for presenting their Paper on the topic of **"BARRAGE PROJECTS-FLOOD MANAGEMENT"**



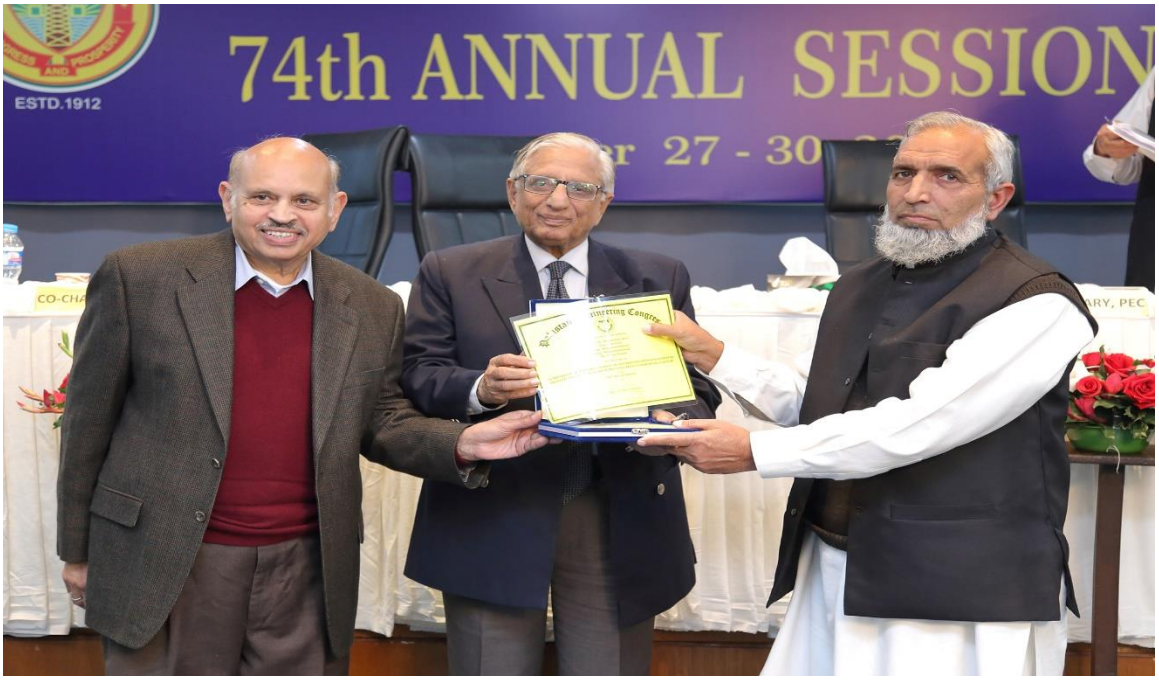
(From Left) Engr. Muhammad Amin Vice President-PEC and Engr. M.A Qaseem Qureshi presenting Shield to Engr. Sohail Kibria for presenting his Paper on the topic of **"HISTORY OF TOLERABLE DEFORMATION OF FOUNDATIONS"**



(From Right) Engr. Muhammad Amin Vice President-PEC and Engr. M.A Qaseem Qureshi presenting Shield to Engr. Sohail Kibria for presenting his Paper on the topic of **"INTERPRETATION OF PROBLEMATIC SONOGRAPHS IN SONIC INTEGRITY TESTING OF PILES"**



(From Left) Engr. Iftikhar ul Haq Former Secretary/Member Executive Council and Engr. Dr. Mahmud Ahmad Visiting Researcher, Centre for Water Informatics & Technology LUMS Lahore presenting Shield to Engr. Ghulam Zakir Hassan Sial for presenting his Paper on the topic of **"SUSTAINABLE DEVELOPMENT AND MANAGEMENT OF GROUNDWATER- LAHORE CITY"**



(From Left) Engr. Iftikhar ul Haq Former Secretary/Member Executive Council and Engr. Dr. Mahmud Ahmad Visiting Researcher, Centre for Water Informatics & Technology LUMS Lahore presenting Shield to Engr. Dr. Muhammad Saeed for presenting his paper on the topic of **"COMPARISON OF TEMPORAL CHANGES IN GROUNDWATER DEPTH WITH RESPECT TO DROUGHT AND NORMAL YEARS IN IRRIGATED AREAS OF SINDH AND BALUCHISTAN"**



(From Left) Engr. Ch. Ghulam Hussain President-PEC presenting Shield to Engr. Husnain Ahmad Past President-PEC/Vice President-PEC for Chairing the Technical Session



(From Left) Engr. Ch. Ghulam Hussain President-PEC and Engr. Husnain Ahmad Past President-PEC presenting Shield to Engr. Muhammad Arif Vice President-PEC for Co-Chairing the Technical Session



(From Left) Engr. Ch. Ghulam Hussain President-PEC and Engr. R.K Anver Vice President-PEC Presenting Shield to Engr. Faqir Ahmad Paracha Former Vice President-PEC for Co-Chairing the Technical Session



(From Left) Engr. Ch. Ghulam Hussain President-PEC and Engr. Faqir Ahmad Paracha Former Vice President-PEC presenting Shield to Engr. R.K Anver Vice President-PEC for Chairing the Technical Session



(From Left) Engr. Faqir Ahmad Paracha and Engr. R.K Anver presenting Shield to Engr. S.M.A Zaidi Former Secretary/Member Executive Council for Co-Chairing the Technical Session



(From Right) Engr. Riaz Nazir Tarar and Engr. Muhammad Amin Vice President-PEC presenting Shield to Engr. M.A Qaseem Qureshi for Co-Chairing the Technical Session



(From Right) Engr. Riaz Nazir Tarar and Engr. M.A Qaseem Qureshi presenting Shield to Engr. Muhammad Amin Vice President-PEC for Chairing the Technical Session



(From Right) Engr. Ch. Ghulam Hussain President-PEC and Engr. Dr. Mahmud Ahmad Visiting Researcher, Centre for Water Informatics & Technology LUMS Lahore presenting Shield to Engr. Iftikhar ul Haq Former Secretary/Member Executive Council for Chairing the Technical Session

Questions/Answers Session



Engr. Tariq Rasheed Wattoo Vice President-PEC in discussion with the authors of Technical Papers



Engr. Ch. Ghulam Hussain President-PEC expressing views during Questions/Answers Session

Questions/Answers Session





(Above) Engr. Riaz Nazir Tararand Engr. Ghulam Zakir Hassan Sial (Below) discussing issues with the authors of Technical Papers

Questions/Answers Session





(Above) Engr. Muhammad Amin Vice President PEC (Below) Engr. Capt. (R) M. Qadir Khan Member Executive Council Participating in the discussion

Questions/Answers Session





(Above) Engr. M. Shabbir Hussain Kamboh and Engr. M. Suleman Khan Chairman Sindh-Tass Water Council in discussion with the authors of Technical Papers

Questions/Answers Session



Engr. Akhtar Abbas Khawaja Vice President-PEC in Conversation with the authors of Technical Papers

Glimpses of the Audience



(From Right) Engr. Ch. Ghulam Hussain President-PEC, Engr. Riaz Ahmad Khan Past President of the Congress, and Engr. Anwar Ahmad Member Executive Council

Glimpses of the Audience



(From Left) Engr. Riaz Nazir Tarar Water Resources Expert, Engr. Tariq Rasheed Wattoo Vice President-PEC, and Engr. M. Anwar Qaseem Qureshi Member Executive Council



(From Right) Engr. M. Anwar Qaseem Qureshi, Engr. Tariq Rasheed Wattoo Vice-President-PEC, Engr. Riaz Nazir Tarar, and Engr. Capt. (R) M. Qadir Khan Member Executive Council-PEC

Glimpses of the Audience



(From Left) Mr. Muhammad Imran, Mr. Faiz Raza Hasan, Mr. A.H. Siddiqui, and Mr. Zahid Hafeez



(From Right) Engr. Amjad Saeed Member Executive Council, and Engr. Muhammad Sajid Nazir an Author

Glimpses of the Audience



(From Left) Engr. Capt. (R) M. Qadir Khan, Engr. Husnain Ahmad, Engr. Usman Haider, Engr. Ch. Ghulam Hussain, Engr. Riaz Nazir Tarar, Engr. Tariq Rasheed Wattoo, and Engr. M. Anwar Qaseem Qureshi



(From Left) Engr. Capt. (R) M. Qadir Khan Member Executive Council, Engr. Husnain Ahmad Past President/Vice President-PEC, and Engr. Usman Haider Sheikh

Glimpses of the Audience



(From Left) Engr. Capt. (R) M. Qadir Khan, Engr. Husnain Ahmad Past President/Vice President-PEC, Engr. Usman Haider, Engr. Ch. Ghulam Hussain President-PEC, and Engr. Riaz Nazir Tarar Water Resources Expert



Welcome Address by

Engr. Ch. Ghulam Hussain

President Pakistan Engineering Congress

At the

Annual Symposium

On the topic of

"Impact of Infrastructure Development and Pakistan Economy"

Distinguished Engineers,

Members of Pakistan Engineering Congress,

Ladies & Gentlemen,

Asalaam-o-alaikum!

On behalf of Pakistan Engineering Congress, it is a great pleasure and honour for me to offer a warm welcome to this prestigious gathering of Engineers. Your presence here today bespeaks of the keen interest shown by you in the professional activities of Engineering Congress.

Pakistan Engineering Congress is a multi-disciplinary body of professional engineers that promotes science, profession and practice of engineering.

At the floor of this prestigious gathering, I feel immensely gratified to claim that most of the theories and formulae for the design of channels, barrages, regulating structures and cross drainage structures which altogether constitute the largest contiguous irrigation system of the world, were developed by the local irrigation engineers like M/s Kennedy, Lacey, Montague, Foy, Inglis, Kanwar Sain, Khawaja Ghafoor, S.I. Mehboob, Pir Ibrahim, Sh. Ahmad Hassan and Dr. S.S. Kirmani.

Since 1957, Pakistan Engineering Congress has been holding Annual Symposia regularly on different major problems, like Floods, Water salinity and other allied issues, Engineering Education, Planning and Execution of Engineering Projects and Researches in Pakistan, Problems and Solutions relating to Dams and Reservoirs, Energy Crisis, and Environmental Protection and its Conservation. So far 38-such symposiums have been organized on pertinent topics, printed in book form and distributed Complimentary to a wide segment of Engineers, Public/Private Sector, Departments and members of the Congress.

This year the significant topic of the Annual Symposium is **"Impact of Infrastructure Development and Pakistan Economy".**

Infrastructure Development is the backbone of Economic and Social advancement as without it, production of amenities (Goods/Services) that are required for Domestic Consumption in keeping with Global standards and above all for exports of Raw Material, Finished Goods to earn foreign exchange (to pay for

import of Machinery and equipment for modernization, production units etc.) is unimaginable;

Infrastructure is all encompassing term that includes inter-alia

- Dams (Big & Small)
- Hydro-Power stations/Thermal Stations/Solar/Wind Energy generation, equipment etc.
- Hospitals, Roads, High-ways
- Rail/Roads
- Air and Sea Terminals
- Factories, Computer, Machines

Moreover, these Tangible Assets alone do not represent Infrastructure; it also includes intangibles such as design, research, software and branding. So far Pakistan is concerned, it primarily composes of;

- Hydro-Power Projects, Mega Dams, Medium and Small Dams
- Rail, Road, Rehabilitation/Modernization for speedy Transport of Goods that needs Massive Capital investment
- Modernization of Road Transport
- Housing to meet needs of Rising Urbanization
- Emergence of Mega City Centers
- Colonies for Marginalized Segments of the Population

Railways:

Pakistan Railways used to be a profitable Organization upto 1971-1972. However in the ensuing period the budgetary allocation tilted towards "Road Transportation" so much so that in 8thfive year plan, the share of Roads was 57.2%. In the near past efforts have been made to inject heavy capital doses and coupled with the Road and Belt" CPEC, the capacity/performance of Pakistan Railway will be much better. The Railway network is also being extended under CPEC.

Roads:

Motorways started in nineties. Motorway M1 Peshawar to Islamabad, M2 Islamabad to Lahore is functioning. Motorway M3 Faisalabad to Multan is partly complete and the work continues. Most of the cities are being connected with motorways work on which is proceeding at high speed. Similarly the Metro buses are being extended to major cities.

Pakistan Engineering Congress organized a "Seminar" in December-2015 on "Means of Transportation-Present and Future" where amongst other proposals it was suggested that the truck ports may be established at;

- G.T. Road, Lahore
- Ring Road Crossing near Batapur
- Gujranwala Road – M2 crossing after Shahdara

- Near Sheikhupura-Faisalabad Road- M2 Crossing
- Near Multan Road-M2 Crossing

In order to run road, transport in an orderly/modern lines these proposals need implementation on fast track basis.

Under CPEC, Gwadar Port has been planned as a hub of economic and commercial activity and is being connected with a network of roads etc. it is being managed by China under CPEC and is now operational.

Thank you all for your patient hearing.

Pakistan Paindabad

KEY NOTE ADDRESS

By

Engr. Syed Mansoob Ali Zaidi[1]

INFRASTRUCTURE DEVELOPMENT AND ITS IMPACT ON ECONOMY

Honorable Chief Guest, Mr. President, delegates, members and professional colleagues!

Welcome to the to-days proceedings!

Today's symposium looks at the most important sector of infrastructure development in economic growth of the country.

Several global regions, particularly the developing countries face many challenges for the infrastructural development in the economic and social fields. Pakistan is going through the same set of problems as are being faced by others in this aspect. The problems are even worse in the case of Pakistan because of a faster rate of population growth and also migration to the cities. To ensure a proper access to the services the public infrastructural programmes are thus required to be implemented at a matching rate. However, in spite of serious efforts, there is still a backlog of infrastructural development virtually all over the country. In case the issues remain unattended or slow in implementation, the lack of infrastructural development is likely to result into a growing social and economic disorder in the near future. The unequal levels of development, present another dimension of a problem associated with the infrastructural development plans.

Broadly the infrastructural development could be divided into three main groups, i.e.:

1	Physical	Water Supply, Drainage, Roads, energy etc.
2	Social	Housing, Medical, Education, etc.
3	Economic	Business Districts, Industry, Transport, Communication, etc.

It is important to note that there is no use of spending on development projects, if we allow these to deteriorate or vandalized. All infrastructures have to be adequately protected, maintained and upgraded on a regular basis.

Provision of basic services (electricity, water, sanitation) to every citizen is the basic right. But this could be permitted with certain conditions, and a due level of moral diligence both from the receivers and the authorities.

Our population growth and changes in demography, such as people moving from rural to urban areas, demand that government should strive to provide the infrastructure for more and more people and should also take interest in developing the new areas with due consideration that our natural resource is not unlimited. Water is one such example being a dwindling resource. We must

[1] Convener Symposium Committee / Associate, National Development Consultants (Pvt) Ltd.

therefore provide and plan infrastructure development and look at alternatives in a manner that does not put our future generations on handicap.

All infrastructural programmes are important, but some are more urgent than others. For example, water and energy are the basic needs and more important for a community than road quality and some others.

Our economy is largely influenced by Agriculture, and Agriculture is dependent mainly on Irrigation and requirement of Irrigation water is supported by Multipurpose storage Dams which support both Irrigation network and production of Hydel Power.

The efficacy of Storage Dams is also acknowledged by the dam antagonistic report by the "World Commission on Dams." The following quote would clarify.

There can no longer be any justifiable doubt about that:

- Dams have made an important and significant contribution to human development, and the benefits derived from them have been considerable, and reflect a comprehensive approach to integrating social, environmental and economic dimensions of development;

There are no shortcuts to equitable and sustainable development between human needs and the requirements of a healthy environment.

Dams were built to provide water for irrigated agriculture, domestic or industrial use, to generate hydropower or help control floods. But dams also altered and diverted river flows, affecting existing rights and access to water, and resulting in significant impacts on livelihoods and the environment.

Dams are a means to an end, not an end in themselves.

The World Commission on Dams considers that the end of any dam project must be the sustainable improvement of human welfare. This means a significant advance of human development on the basis that is economically viable, socially equitable, and environmentally sustainable.

Normal development plans should effectively consider, water, electricity and other infrastructures. But we usually fail to realize that the poor communities which lack these services, feel deprived and became resentful.

Developing a vision based on strategic objectives and prioritized sector policies, would significantly be able to eliminate the deficits in infrastructural development.

Detailed analysis of the options for developments in energy, water and other sectors, based on a common vision, are likely to emanate from our consultative/validation sessions for a much-needed framework for engagement of development partners.

In today's session our professionals will be presenting the following seven papers, five relate to the most urgent, the energy sector and two to general fields.

1. "Impact of infrastructure development on Pakistan economic growth" by Engr. Riaz Rashid and Engr. Khurram Amin.

2. “Impact of energy development on economy of Pakistan challenges and constraints” by Engr. Hafiz Muhammad Mukhtar & Engr. Muhammad Rafique.
3. “Priority Construction of Cascade Hydropower Project on Indus Main” by Engr. Riaz Nazir Tarar & Muhammad Jabbar.
4. “Bunji Hydropower Project” by Engr. Abdul Khaliq Khan
5. “Optimization of Patan Hydropower Project on Indus River” by Engr. Dr. Izhar-ul-Haq and Engr. Muhammad Abid Sheikh.
6. “720 MW Karot Hydro Power Project in Pakistan” by Engr. Iftikhar ul Haq
7. “Assessing impact of infrastructure on Pakistan economy” by Mr. Muhammad Ali and Mr. Waheed Anjum.

The main features of these papers will be presented by the respective authors, and I will not venture upon them. However to give you the main thrust of each paper it can be said that:

1. Papers titled “Impact of infrastructure development on Pakistan economic growth” traces the policy and general infrastructural development and recommends more thrust in investment in infrastructure for water, energy and agriculture sectors.
2. The paper on “Impact of energy development on economy of Pakistan challenges and constraints” discusses the need for infrastructure development and its impact on economy and proposes more interest and efforts in hydropower development. The government should prefer the hydropower development as a long term solution for energy shortage management.
3. The paper entitled “Priority construction of cascade hydropower project on Indus main” explains the need for a cascade power project on the main stem of the Indus. The cascade could be long or short i.e. of 6 to 3 plants. I will leave further interaction to author’s presentation.
4. The paper on “Bunji Hydropower Project” authored by Engr. Abdul Khaliq Khan is quite interesting. The project is anticipated to add 7100 MW to the national grid with a gestation period of about 10 years. The paper also recommends a seminar on “Turbine Runners” which has become the call of the day in view of the sediment movement conditions in various resources and other relevant issues.
5. The paper on “Optimization of Patan Hydropower Project on Indus River” authored by Engr. Dr. Izhar-ul-Haq and Engr. Muhammad Abid Sheikh introduces various aspects of the project, which is estimated to add 2400 MW of power to the national grid with 12500 GWH generation.
6. The paper on “720 MW Karot Hydro Power Project in Pakistan” describes the project in detail. The project envisages power generation only. It is likely to add 720 MW of power to the national grid and a

mean annual generation of 3206 GWH. Trial run for the operation is planned at the end of the 5th year.

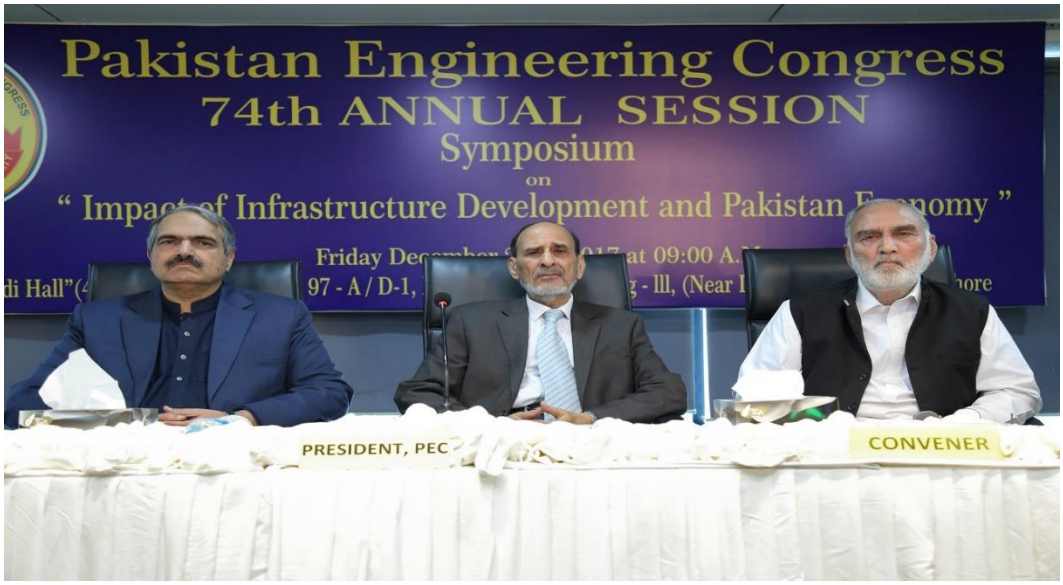
7. The paper titled “Assessing impact of infrastructure on Pakistan economy” basically presents the role of policy changes and infrastructure development. Preference of investment in power generation, water and agriculture sectors has been strongly advocated.

This symposium will thus deliberate on the importance of infrastructure; especially hydropower projects in the country. At the end of the symposium a panel discussion involving notable experts will be held and recommendations to the Government will be formulated for appropriate and expeditious actions.

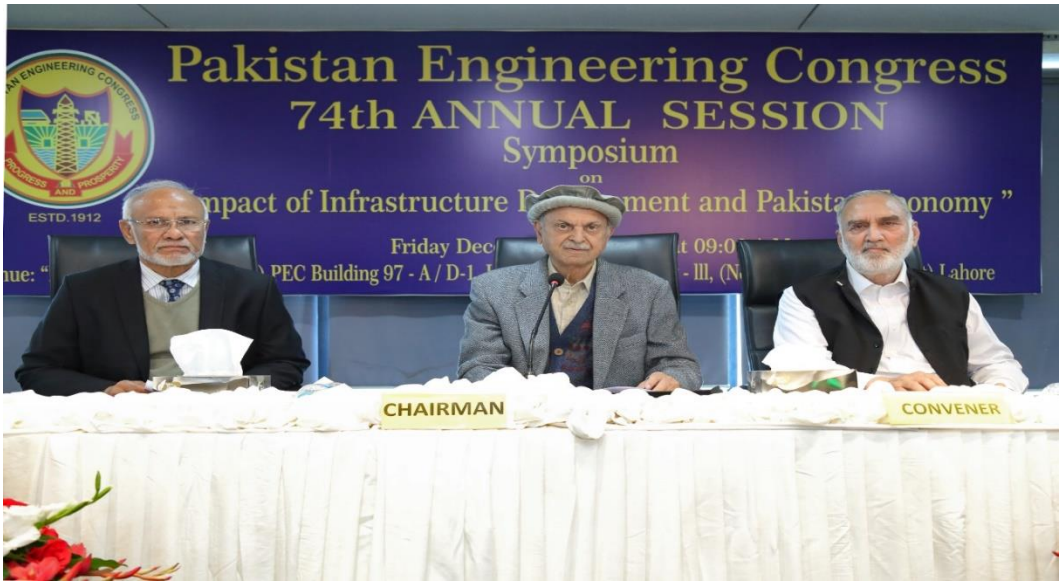
I have already encroached long enough upon your precious time and will no more stand between you and the speakers.

Thank you for your time!

74TH ANNUAL SESSION
OF
PAKISTAN ENGINEERING CONGRESS
Held on 27th December 2017 to 30th December 2017
Glimpses of 29th December 2017
Annual Symposium on the topic
of
"IMPACT OF INFRASTRUCTURE DEVELOPMENT AND PAKISTAN ECONOMY"



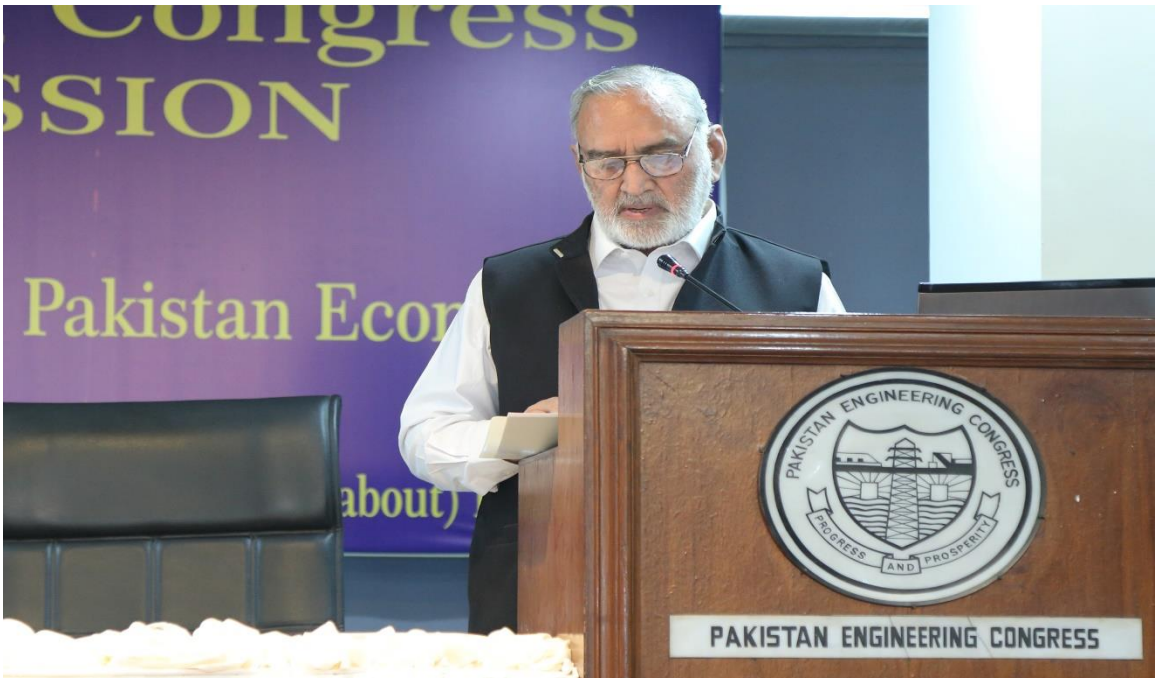
(From Left) Engr. Nayyar Saeed Secretary-PEC, Engr. Ch. Ghulam Hussain President-PEC, and Engr. S.M.A Zaidi Former Secretary-PEC



(From Left) Engr. Akhtar Abbas Khawaja Vice President-PEC, Engr. Riaz Nazir Tarar Water Resources Specialist and Engr. S.M.A Zaidi Former Secretary-PEC presiding over a Technical Session



Engr. Ch. Ghulam Hussain President-PEC presenting the Welcome Address



Engr. Syed Mansoob Ali Zaidi Former Secretary-Member Executive Council
presenting the Key Note Address on the theme of
"IMPACT OF INFRASTRUCTURE DEVELOPMENT AND PAKISTAN ECONOMY"



(From Left) Engr. Akhtar Abbas Khawaja Vice President-PEC and Engr. Riaz Nazir Tarar Presenting Shield to Engr. Khurram Amin for presenting Paper on the topic of "**IMPACT OF INFRASTRUCTURE DEVELOPMENT ON PAKISTAN"**



(From Left) Engr. Ch. Ghulam Hussain President-PEC Presenting Shield to Engr. Riaz Nazir Tarar for presenting Paper on the topic of "**PRIORITY CONSTRUCTION OF CASCADE HYDROPOWER PFOJECTS ON INDUS MAIN UNDER AMBIT OF CHINA-PAK ECONOMIC CORRIDOR (CPEC)"**



(From Right) Engr. Ch. Ghulam Hussain President-PEC and Engr. Nayyar Saeed Secretary-PEC Presenting shield to Engr. Abdul Khaliq Khan for presenting Paper on the topic of "**BUNJI HYDROPOWER PROJECT OPPORTUNITIES AND CHALLENGES"**



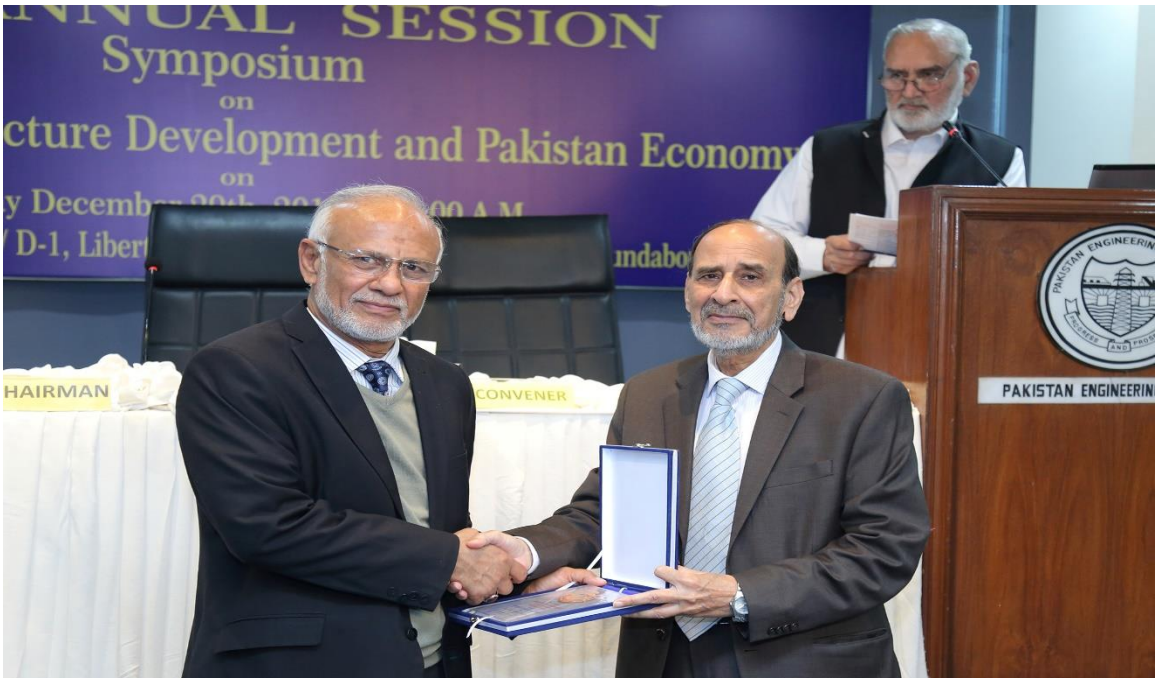
(From Left) Engr. Akhtar Abbas Khawaja Vice President-PEC and Engr. Riaz Nazir Tarar Presenting Shield to Engr. Muhammad Abid Sheikh for presenting Paper on the topic of "**OPTIMIZATION OF PATAN HYDROPOWER PROJECT ON RIVER INDUS"**



(From Left) Engr. Ch. Ghulam Hussain President-PEC and Engr. Nayyar Saeed Secretary-PEC Presenting Shield to Engr. Iftikhar ul Haq for presenting Paper on the topic of "**720-MW KAROT HYDROPOWER PROJECT"**



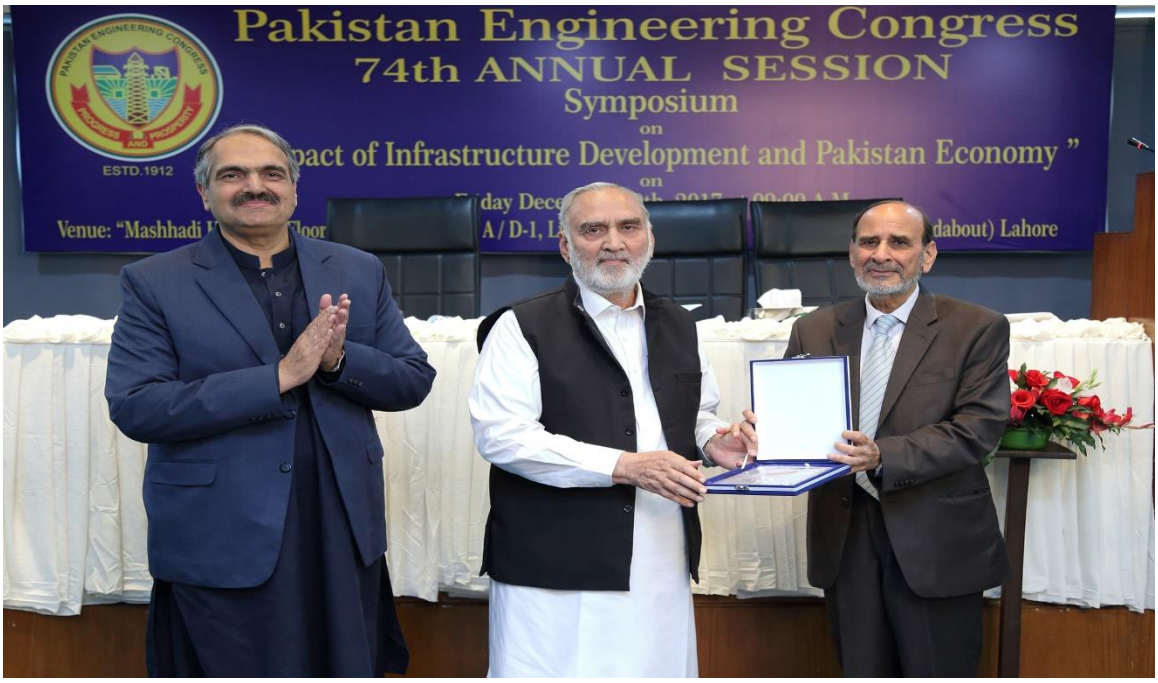
(From Left) Engr. Ch. Ghulam Hussain President-PEC and Engr. Nayyar Saeed Secretary-PEC Presenting Shield to Engr. Muhammad Ali for presenting Paper on the topic of "**ASSESSING IMPACT OF INFRASTRUCTURE ON PAKISTAN ECONOMY"**



(From Right) Engr. Ch. Ghulam Hussain President-PEC Awarding Shield to Engr. Akhtar Abbas Khawaja for Co-Chairing the Technical Session



(From Right) Engr. Ch. Ghulam Hussain President-PEC Awarding Shield to Engr. Riaz Nazir Tarar for Chairing the Technical Session



(From Left) Engr. Nayyar Saeed Secretary-PEC and Engr. Ch. Ghulam Husain President-PEC awarding Shield to Engr. S.M.A Zaidi former Secretary-PEC for Co-Chairing Technical Session

Questions/Answers Session



Engr. Riaz Nazir Tarar Water Resources Specialist answering questions of the audience in connection with his paper on the topic of **"PRIORITY CONSTRUCTION OF CASCADE HYDRO-POWER PROJECT ON INDUS MAIN UNDER AMBIT OF CHINA PAK ECONOMIC CORIDOR (CPEC)"**

Questions/Answers Session



Engr. M. Suleman Khan in Conversation with a Speaker



Engr. LT Col Abdul Razaque Bugti in conversation with the Authors of Technical Papers

Questions/Answers Session



Engr. Abdul Khaliq Khan responding to Questions in connection with his paper on the topic of “Bunji Hydro-Power Project”

Questions/Answers Session



Engr. M. Abid Sheikh responding to Questions in respect his presentation on the topic of "**OPTIMIZATION OF PATAN HYDROPOWER PROJECT ON RIVER INDUS"**



Engr. Subiyal Abbas in conversation with Authors of Symposium Papers

OBITUARIES

January – March 2018

Fateha for the Departed Souls

1. ***Haji Allah Bakhsh,*** Father of Engr. Anwar Ahmad, Member Executive Council passed away on 13.02.2018
2. ***Engr. Muhammad Akhtar Rana,*** Former Secretary, Ministry of Irrigation, Govt. of Punjab, passed away on 02.03.2018.
3. ***Mr. Muhammad Asif,*** Media Advisor of the Congress, passed away on 17.03.2018.
4. ***Mr. Muhammad Imran Hafeez,*** younger brother of Mr. Zahid Hafeez, Manager Computer College of Pakistan Engineering Congress passed away on April 13, 2018.

Glimpses of the Audience





“Protracted Economic Crisis”

By:

A. Shahbaz Rana

IMF could impose non-economic conditions on Pakistan this time'

Pasha warns lender could exploit situation by asking to cut back on CPEC size

Pakistan is in an incipient financial crisis which, unlike previous ones, may prolong and the International Monetary Fund (IMF) could exploit the situation by asking the country to cut back on the size of the China-Pakistan Economic Corridor (CPEC), former finance minister Hafeez Pasha cautioned on Monday.

"[And] When Pakistan knocks on the IMF's door, the United States being the largest shareholder could impose some "non-economic" conditions," Pasha warned while speaking at a seminar organised by the German institute Friedrich-Ebert-Stifting.

Pasha has in the past negotiated several bailout packages with the IMF and is critical of the fund's policies towards Pakistan.

By September next year, the government will run out of foreign currency reserves which will trigger a financial crisis, Pasha said.

By September next year, the government will run out of foreign currency reserves which will trigger a financial crisis

According to his forecast, Pakistan's external financing needs will be $32 billion for the next 16 to 18 months, of which only $8 billion will come through CPEC financing and foreign direct investment whereas the government will have to resort to borrowing to cover the rest.

Pakistan has been facing difficulties in managing its external account due to mounting foreign debt repayments and a widening current account deficit. The country raised $2.5 billion last month by floating bonds to take pressure off the falling foreign exchange reserves.

"Financial crises of 2008 and 2013 were the result of major price shocks, but this time the crisis will be the result of structural faults in the economy," Pasha warned.

"Instead of undertaking much-needed reforms, the government is conducting a 'holding operation' that is aimed at keeping foreign currency reserves at a level that will allow it to defer the crisis till June next year," Pasha said. "During this period, the economy will be allowed to bleed and no major reforms will be undertaken."

The former finance minister predicted that the real challenge would emerge after departure of the caretaker government. "By that time, cracks will widen and foreign currency reserves will fall below $3 billion," he said.

Pasha was of the view that the only way out would be another bailout from the IMF. "But this time, the IMF will not allow a joyride to Pakistan due to change in the US policy stance towards Pakistan."

"We may be told that CPEC's size needs to be cut down with the US asking for some non-economic conditions as well," he added. "This is a crunch time and the Pakistan Army is rightly worried as it is aware of the strong link between economic conditions and national security." He suggested that ***5%*** depreciation of the rupee earlier this month could be the result of an arrangement under which Pakistan would let the currency fall in return for a Letter of Support from the IMF to borrow from other international financial institutions.

He predicted that despite the holding operation, the gross foreign currency reserves would fall to $10 billion by June next year including the $6.5 billion that the central bank had borrowed from commercial banks under a swap arrangement.

Pasha said currency swap borrowings had stood at $5.8 billion by the end of August and they jumped to $6.5 billion by November-end.

"Unlike 1998, this time the central bank will have to return the currency swap loans and it should not fiddle with foreign currency accounts," Pasha emphasized.

In addition to problems on the external account, he said, the fiscal policy would also remain expansionary and the central government's borrowings from the State Bank for budget financing could exceed Rs. 1 trillion by the end of current fiscal year.

"Over the past four and a half years, the government has pursued a path of presenting unrealistic statistics. Indicators like debt-to-CDP-ratio, inflation and economic growth are manipulated. The problem is that the government has started believing in its own manufactured data," said Pasha.

(Report)

"Offshore, North-South Projects"

By

A. ZAFAR BHUTTA

Pakistan, Russia poised to sign $10b gas pipeline deals this week

Delegation will leave for Moscow on December 20 to pave way for closer ties

Pakistan and Russia are set to ink agreements this week on laying an offshore gas pipeline and the North-South liquefied natural gas (LNG) pipeline - the two projects in which Moscow will pour an investment of over $10 billion, indicating a major shift in foreign policy of Islamabad.

"A Pakistani delegation will leave for Russia on December 20 to sign these deals in order to execute the two gas pipeline projects," said a senior government official while talking to The Express ***Tribune.***

Inter State Gas Systems (ISCS) - a state-owned company established to handle gas import matters - is working on different gas pipeline projects and its managing director and the petroleum secretary will be part of the delegation.

ISGS is also working on the $10 billion Turkmenistan, Afghanistan, Pakistan and India (Tapi) gas pipeline to connect South and Central Asia and construction work on the scheme in Pakistan will start in March next year.

EXPORTS

1793b cubic metres of gas was exported by Russia in 2016

These projects are called a game changer for Pakistan as they will not only lead to regional connectivity, but will also meet energy needs of the country.

Amid a long-running tussle with Europe and the United States over the annexation of Ukrainian region of Crimea, Russia is looking for alternative markets and wants to capitalise on the growing demand in South Asia.

Russia, which controls and manages huge gas reserves in energy-rich Iran, plans to export gas by laying an offshore pipeline through Gwadar Port to Pakistan and India, which are seen as alternative markets because Moscow fears it may lose energy consumers in Europe over the Crimea stand-off.

Russia has been a big gas exporter to European Union (EU) countries and Turkey since long and despite US anger the European bloc has continued to make imports to meet its energy needs.

Moscow receives gas from Turkmenistan and then exports it to EU states. Later, it has got gas deposits in Iran as well and is looking to gain a foothold in the markets of Pakistan and India.

Earlier, Pakistan and Russia had reached an understanding on signing the offshore gas pipeline deal during Prime Minister Shahid Khaqan Abbasi's visit to Sochi, Russia. Now, during the upcoming trip, the two sides are poised to ink memoranda of understanding (MoUs) for the offshore pipeline and the North-South (Lahore-Karachi) LNG pipeline.

Pakistan has been experiencing gas shortages, particularly in winter, for the past many years as domestic production has stood static with new additions being offset by depleting old deposits.

In a bid to tackle the crisis, the present government kicked off LNG imports from Qatar under a 15-year agreement two and a half years ago and is bringing supplies through other sources as well.

"Such massive business deals will open a new avenue for closer diplomatic ties between Russia and Pakistan," the senior government official commented.

On the other hand, Pakistan and the US are going through a critical phase in their relations in the wake of President Donald Trump's new policy on Afghanistan, which proposes a vital role for India in this region. Pakistan has rejected the suggestion.

According to the government official, after signing of the MoU for the offshore pipeline, work on feasibility study will begin in an attempt to assess viability of the project. Russia is even ready to finance the study.

Russian gas exports touched an all-time high in 2017. According to its energy giant Gazprom, gas flows to Europe and Turkey, excluding ex-Soviet states, hit a new daily record at 621.8 million cubic metres.

Annual exports touched 179.3 billion cubic metres (bcm) in 2016, a significant jump from the previous high of 161.5 ban in 2013 and well above the 2015 total of 158.6 bcm.

(Report)

"Press Conference"

By

OUR CORRESPONDENT

Speakers stress need to impose 'population emergency' in Pakistan

Two-day moot titled Population Growth: Investing in Human Resource Development will begin tomorrow at GCU

After the Population Census 2017, it emerged that Pakistan's population was growing at a much higher rate than previously thought. Keeping this in view, there was a need for imposing a 'population emergency' in the country to check its growth and investment in human resource development.

This was stated by Punjab Higher Education Commission (PHEC) Chairperson Dr. Muhammad Nizamuddin.

He was addressing a press conference on Monday at the Government College University (GCU) Lahore to launch the 18th National Population Research Conference.

"The Population Census 2017 has brought critical issues to the forefront that has far-reaching implications for the development of Pakistan. Unprecedented growth rates, emerging urban poles, youth bulge and a growing elderly population are some of the many challenges that our country faces today", said Dr. Nizamuddin, who is also the President of Population Association of Pakistan (PAP).

"If the current pattern of fertility continues, then on the 100th birthday of Pakistan, the country's population is estimated to be around 390 million. Concerted efforts are required now on the federal and the provincial levels in order to address these issues in a timely manner," he said.

Dr. Nizamuddin revealed that the GCU, PHEC and PAP were holding the Population Research Conference from December 20, 2017 where all stakeholders would convene at a single platform to deliberate upon all issues related to population growth and human resource development. The PAP

president further said that the onus of population growth could not put on the government alone, rather it was shared. "I believe that universities and non-government organisations have a bigger role in creating awareness."

He proposed to establish the Population Welfare Studies Centre in all universities, saying that GCU must take lead in this regard.

The PHEC chairman also said that average population growth rate of Pakistan was 2.4 but it was less than 2 in cities which meant that NCOs or government's population control programme were not reaching the rural areas.

He said that at the current economic growth rate, providing employment to the youth of the country was not possible. He said that the increasing population would affect every sector of the country, including education, health, agriculture, housing etc. "Apart from youth, the increasing number of elderly people without any social protection is also a huge challenge which is needed to be overcome."

GCU Vice Chancellor Prof Dr. Hassan Amir Shah said that population growth should be handled proactively rather than reactively. "We know that our population is estimated to be around 400 million in the next 30 years, so we have to start taking concerted steps now on all levels instead of taking reactive measures later," he added. He also proposed that population studies should be part of curricula at all levels of education.

University of Education Vice Chancellor Prof. Rauf-e-Azam said that population control was a sensitive issue for which all stakeholders should be taken on-board to suggest pragmatic solutions. "This conference by PAP is a right step in the right direction and its proceedings will be sent to the government and policymakers for developing a future roadmap," he concluded.

J J The Population Welfare Studies Centre should be set up in all universities and GCU must take lead in this regard

PHEC Chairperson

Dr Muhammad Nizamuddin

Bargad Executive Director Sabiha Shaheen believed that population growth could not be controlled, rather initiatives must be taken to manage it now. "There is a huge youth bulge in the country which should be managed so that they could play an effective role for the development of the country instead of becoming a burden on the economy," she added. She also laid stress on cultivating an entrepreneurial mindset among youth,

CCU Political Science Department Chairman Dr. Khalid Manzoor Butt said that many models were available for population control such as Chinese and Malaysian models but there was a lack of political will in the country. He said that there were pressure groups that don't allow the government to

introduce radical reforms in this direction. Eminent historian Prof. Dr. Tahir Kamran also spoke at the press conference.

(Report)

"No Water Policy in Pakistan"

By:

Engr. Shams-ul-Mulk

Indus water commissioner asks India to implement treaty

Our correspondent

LAHORE: India has been asked to prove its sincerity by implementing the Indus Waters Treaty in letter and spirit.

"India says it honours the Indus Waters Treaty. We accept their stance on the face value but ask them to proceed further and prove their stance practically with the implementation of the treaty," said Pakistan Indus Waters Commissioner Mirza Asif Baig while talking to the media after the three-day 74th Annual Session of the Pakistan Engineering Congress held here on Wednesday.

To a question whether or not India is stealing Pakistan's water, the commissioner said Pakistan had a clash with India over water flows and both the countries were contesting this issue at international forums. "We call it only theft when we have 100 per cent proof. The real dispute with India is over infrastructure being built to control flow of water. Both the countries exchange data of flow of water. India is creating obstacles for implementing the treaty. It creates obstacles for the dispute resolution mechanism for the treaty."

He said Pakistan had raised objections to technical designs of Kishen-ganga and Ratle hydro power projects being built by India B one on the Chenab river and the other on the Jhelum river, arguing that the designs were not in line with the provisions of the Indus Waters Treaty.

"We can say that Pakistan won its case principally on Kishenganga because as a precedent, it has an impact on the future run of river projects, as Jon Briscoe of the World Bank said India won the battle but lost the war," he said.

Baig said: "We have asked the World Bank to constitute the Court of Arbitration and its response in this regard is still awaited. The World Bank is in process of mediation between the two countries on developing Consensus in the light of the Indus Waters Treaty." He said Pakistan could not get relief in the Baglihar Dam case. The decision of the neutral expert on the Baglihar Dam was not according to the provisions of the treaty as the neutral experts are bound to give decisions according to the provisions of the treaty.

Earlier, addressing the opening session of the Pakistan Engineering Congress, former Wapda Chairman Engr. Shams-ul-Mulk said Pakistan was losing huge money due to non-existence of the KBD which could produce power at Rs. 1.5 per unit. The Tarbela and Mangla Dams were generating electricity at Rsl.5 per unit even today. Enumerating the benefits of water reservoirs to cater to the country's needs, he stressed the need for initiating construction work on the Kalabagh Dam (KBD) without delay. In the absence of the KBD, do far the country had to bear an

accumulative loss of Rs 196 billion annually - Rs 100 billion Punjab, Rs 60 billion Sindh and Rs 36 billion KP. He accused India of this conspiracy, alleging that "water policy is formed *in* New Delhi and our people are on the payroll of India and delaying the KBD construction".

He said the water policy is simply non-existent in Pakistan. He said the authorities appeared to lack political will to tackle the problem. There were no proper water storage facilities in the country. Pakistan had not built new dams since 1960.

The biggest beneficiary of the KBD would be DI Khan where around 800,000 acres of arable land would be able to be cultivated. The area being 150 feet higher than the Indus River could only be cultivated economically with the construction of the KBD. The KBD would save DI Khafy Punjab and Sindh from floods. It would help reduce power shortage to a great extent by providing cheap and environment-friendly electricity.

In his welcome address, PEC President Engr Ghulam Hussain said the PEC recommends that the policy of hydel power generation should be adopted as a long-term policy. Construction of a cascade of mega storage and hydropower projects on the Indus River comprising Diamer Basha, Kalabagh Dam. Akhori Dam and Dasu, Pattan, Thakot and Bunji Hydropower Projects will provide a very strong base for agricultural and industrial development of the country.

He said: "Our population is growing rapidly and our needs for food and other agricultural products have greatly increased. God has blessed Pakistan with land, large rivers, excellent climate and hardworking people yet we continue to remain importers of edible oil, tea and other commodities. We have virtually clamped down on further development of major water storages for the last 40 years. The cumulative storage capacity of the major water reservoirs including Mangla and Tarbela has decreased by 25 percent because of sedimentation."

He said the Wapda through studies identified that Pakistan had potential of 60,000 MW hydel generation. Within another five to ten years, the shortage of canal irrigation water would become a serious issue, let alone the demand for water supplies by cities and industry, he added.

(Courtesy The News 28th December 2017)

“IWT: controversy persists over water flow in river system, says Baig”

By:

HASSAN ABBAS

LAHORE: The real controversy between Pakistan and India is not that of stealing water by the later but the issue of water flow in the river system spanning across the borders.

This was stated by Pakistan Indus Waters Commissioner Mirza Asif Baig while responding to a question to the media after the three-day 74th Annual Session of Pakistan Engineering Congress held here on Wednesday.

During this session, 18 technical papers were presented covering various important subjects. A symposium on the subject of Impact of Infrastructure Development and Pakistan Economy' was also held as part of this annual session.

Engr Ghulam Hussain, President Pakistan Engineering Congress, delivered a welcome address.

In reply to a question that whether or not India is stealing Pakistan's water, the Indus Water Commissioner stated that Pakistan has clashed with India on water flows and both the countries are fighting on this issue in the international court.

"We call it theft when we have 100 percent proves. Real dispute with India is over the control of flow of water. Both the countries exchange data of flow of water," he said.

Asif further said India honours the Indus Water Treaty. "We accept their stance on face value but ask India to proceed further and prove their stance practically."

"India is creating obstacles in implementing the treaty in letter and spirit. It creates obstacles in the dispute resolution mechanism of the treaty."

Mirza Asif Baig observed that Pakistan had raised objections on the technical designs of 300MW Kishenganga and 850MW Ratle hydro power projects being built by India-one on Chenab and another on Jehlum rivers-arguing that the designs are not in line with the provisions of the Indus Water Treaty and both the projects are disturbing water flows to Pakistan.

He also said that Pakistan cannot get expected relief in Baglihar Dam case as it was expected. The decision of the neutral experts in Baglihar Dam was not according to the provisions of the treaty as the neutral experts were bound to give decisions according to the provisions of treaty.

We have asked the World Bank to constitute the Court of Arbitration and its response in this regard is still awaited, he added. The World Bank is in process of mediation between the two countries on developing consensus in the light of Indus Waters Treaty to settle the issue of faulty designs of Indian power projects.

Earlier, addressing the opening session of Pakistan Engineering Congress former Wapda chairman Shamsul Mulk said that Pakistan is losing around Rs.196 almost every year due to non-existence of KBD which can produce power at Rs.1.5

per unit, as Terbela and Mangla dams are generating electricity at Rs.1.5 per unit even today.

Enumerating the benefits of water reservoirs to cater the country's water needs and hydro power generation, he stressed the need for initiating construction work on Kala Bagh Dam (KBD) without any further delay. So far the country had to bear an accumulative loss of Rsl96 billion annually -Rs.100 billion to Punjab, Rs60 billion to Sindh and Rs36 billion to KP - in the absence of KBD, he added. He accused India for this conspiracy, saying water policy is formed in New Delhi and our people are on pay role of India for delaying construction of KBD.

Shamsul Mulk said water policy is simply non-existent in Pakistan. He said that the authorities appear to lack the political will to tackle the problem. There are no proper water storage facilities in the country. Pakistan has not built new dams since the 1960.

Not only high cost of electricity has retarded Pakistan's Industrial development rather the gas required for Industries and domestic use is not available due to its excessive use in power generation. The additional availability of water due to KBD would increase the crops cultivable area in Pakistan thus helping poor farmers. The biggest beneficiary of KBD would be DI Khan area of KPK, where around 800,000 acres of arable land would be able to be cultivated. The area being 150 feet higher than Indus River can only be cultivated economically with the construction of KBD. The KBD would save DI Khan, Punjab and Sindh from floods. KBD would help reduce electricity shortage to a great extent by providing cheap and environment friendly electricity.

Unfortunately the time is running out fast, any further delay in the construction of KBD and other big dams, especially in the face of Indian water aggression, would be catastrophic for the country. The ultimate sufferers would be the farmers and poor people.

After completion of KBD, Bhasha Dam should be pursued, which would provide additional electricity and further reduce dependence on fuel generated electricity.

In his welcome address Engr Ghulam Hussain, President, Pakistan Engineering Congress, stated that PEC recommends that the policy of hydel power generation should be adopted as a long term policy. Construction of a Cascade of mega storage and hydropower projects on the Indus River comprising of Diamer Basha, Kalabagh Dam. Akhori Dam and Dasu, Pattan, Thakot and Bunji Hydropower Projects will provide a very strong base for agricultural and industrial development of the country.

He said electricity charges have registered unprecedented higher indices and are further spiraling. Consequently, higher power charges have adversely affected the industrial and agricultural sectors. There is thus dire need to revert to full exploitation of our Hydro Power potential of over 60,000 MW. The mining of coal reserves of Thar to provide affordable energy besides tapping the renewal energy resources such as Wino, Solar and Bio-mass should be given special attention by Federal and provincial governments.

He said that our population is growing rapidly and our needs for food and other agricultural products have greatly increased. "God has blessed Pakistan with

land, large rivers, excellent climate and hardworking people yet, we continue to remain importers of edible oils, tea and other commodities. We have virtually clamped down on further development of major water storages for the last 40 years. The cumulative storage capacity of the major water reservoirs including Mangla and Tarbela has decreased by 25 percent because of the natural phenomenon of sedimentation."

He said that 29 MAP of water flows downstream of Kotri Barrage every year on the average from 1976-2017. This necessitates increase in water storage capacity of Pakistan by constructing new dams. WAPDA through various studies has identified that Pakistan has potential of 60,000 MW hydel generation, which needs to be harnessed to its maximum for injecting low cost hydel electricity in the national grid to provide cheaper electricity to the masses and boost up the industrial and agricultural development in the country. Within another five to ten years, shortage of canal irrigation supplies would become serious issue besides competing demands for urban water supplies and industry, he added.

(Courtesy Business Recorder 28th December 2017)

"Pakistan lags behind in 'global infrastructure ranking'"

By:

SALMAN ABDUHU

Pakistan is among lowest ranked countries in 'global infrastructure ranking' though the country has invested heavily in public infrastructure development.

These views were expressed by the speakers at a symposium on the subject of 'Impact of Infrastructure development on Pakistan Economic Growth'.

The Symposium was organized by the Pakistan Engineering Congress here on Friday. PEC president Engineer Ghulam Hussain also addressed on the occasion.

The key speakers included Dr. Izhar ul Haq, Suleman Najib Khan, Iftikhar ul Haq, Engr Riaz Rashid, Engr Khurram Amin, Muhammad Ali and Waheed Anjum.

The speakers recommended the government to take aggressive steps to improve quality of infrastructure to fulfill the requirement of economic growth at high rate. Moreover, effective planning to ensure usefulness and fully utilization of infrastructure is essential to optimize the benefits in terms of GDP growth, they added.

The speakers said that Pakistan has highest rate of urbanization in South Asia which has put more pressure on already stressed infrastructure. The speakers quoted the World Bank as reporting that Pakistan's key infrastructure shortages lie in the water, irrigation, power and transport sectors. The country is amongst the most water-stressed in the world and rehabilitating current wear and tear in the water sector will require more than $7 billion in maintenance over the next 5 years. Pakistan had been facing severe power shortages, with per capita energy consumption among the lowest in the world, slowing industrial growth. The inefficiencies of the rail, road, port and aviation sectors are now costing the economy over 4 % of GDP. The productivity of agriculture sector is declining due to poor

condition of irrigation infrastructure. The access to irrigation infrastructure helps to keep the incidence of chronic poverty at lower levels.

The speakers said that improved infrastructure provide safety against natural disasters such as earthquakes, drought and floods which could result in negative economic impact on the country.

"Economic loss to Pakistan due to 2010 flood is estimated to be around Rs. *855* billion. Efficient infrastructure in transport, electricity and communication creates enabling environment for private sector to play their role for economic growth." The speakers said that infrastructure development is vital for economic growth of developing countries.

"The economic growth of Japan and Korea in 60s and 70s indicates vital role of infrastructure development and public investment in transport, communication and energy sector for economic growth of the country."

They said that lack of infrastructure in Pakistan in transport, energy and water sector proved to be major hindrance towards economic growth of the country. Lack of investment in water sector reduced country's agricultural output, increased unemployment in rural areas, decreased per capita income of more than 50% of population associated with agriculture, which in return put pressure on urban centers due to migration from rural areas, they added. High population growth of the country demand huge investment in water infrastructure to improve economic growth of country and rural population and to absorb massive rural population in agricultural sector. Indirect benefits must be accounted for while planning and deciding infrastructure development in the water sector. Comprehensive development framework which includes all major sectors is necessary and development should be coordinated in such a way that growth of one sector complement the growth of other sector. They said that sequencing and prioritizing of infrastructure is important keeping in view existing and future demand, employment and socio-economic condition of the people and long term and short-term impact of development. Infrastructure development is the only way for Pakistan to achieve its Millennium Development Goals (MDGs).

Governance and political stability are variables of political economy are significant elements that can affect the economic growth related with infrastructure development. Efficiency, accountability and reforms in public sectors are considered as vital element for effective monitoring and evaluation of projects funded by government.

Different type of infrastructure has different impact on GDP growth depending upon the situation of the country.

Energy sector has direct benefit in GDP development as it relates to development of many other sectors. Telecommunication has best documented impact on GDP growth and has highest and most impressive payoffs than any other sector. Impact of transportation infrastructure is consistently correlated with economic growth, with rate of return as high as 63%. China spends 1% of its Gross National Product (GNP) on trans-port infrastructure and its GDP growth is constantly in the range of 9%. Impact of transportation infrastructure is low in case of developed countries but for developing countries scenario is totally opposite and improvement of transport infrastructure hold positive impact on GDP growth. Water

and sanitation have no direct connection with GDP growth but it has indirect connection with other sub sectors.

(Courtesy The Nation 30th December 2017)

"Pakistan's rate of urbanization highest in South Asia"

LAHORE: Pakistan is among lowest ranked countries in 'global infrastructure ranking' though the country has invested heavily in public infrastructure development yet poor governance remains major plague to its assets.

These views were expressed by the speakers at a symposium on the subject of 'Impact of Infrastructure development on Pakistan Economic Growth'. The Symposium was organized by the Pakistan Engineering Congress here on Friday. PEC president Engineer Ghulam Hussain also addressed on the occasion.

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The speakers recommended the government to take aggressive steps to improve quality of infrastructure to fulfill the requirement of economic growth at high rate. Moreover, effective planning to ensure usefulness and fully utilization of infrastructure is essential to optimize the benefits in terms of GDP growth, they added.

The speakers said that Pakistan has highest rate of urbanization in South Asia which has put more pressure on already stressed infrastructure.

The speakers quoted the World Bank as reporting that Pakistan's key infrastructure shortages lie in the water, irrigation, power and transport sectors. The country is amongst the most water-stressed in the world and rehabilitating current wear and tear in the water sector will require more than $7 billion in maintenance over the next 5 years. Pakistan had been facing severe power shortages, with per capita energy consumption among the lowest in the world, slowing industrial growth.

The inefficiencies of the rail, road, port and aviation sectors are now costing the economy over 4% of GDP.

The productivity of agriculture sector is declining due to poor condition of irrigation infrastructure. The access to irrigation infrastructure helps to keep the incidence of chronic poverty at lower levels.

The speakers said that improved infrastructure provide safety against natural disasters such as earthquakes, drought and floods which could result in negative economic impact on the country. "Economic loss to Pakistan due to 2010 flood is estimated to be around Rs. 855 billion. Efficient infrastructure in transport, electricity and communication creates enabling environment for private sector to play their role for economic growth."

The speakers said that infrastructure development is vital for economic growth of developing countries. "The economic growth of Japan and Korea in 60s and 70s indicates vital role of infrastructure development and public investment in transport, communication and energy sector for economic growth of the country."

They said that lack of infrastructure in Pakistan in transport, energy and water sector proved to be major hindrance towards economic growth of the country.

Lack of investment in water sector reduced country's agricultural output, increased unemployment in rural areas, decreased per capita income of more than 50% of population associated with agriculture, which in return put pressure on urban centers due to migration from rural areas, they added.

High population growth of the country demand huge investment in water infrastructure to improve economic growth of country and rural population and to absorb massive rural population in agricultural sector. In direct benefits must be accounted for while planning and deciding infrastructure development in the water sector: Comprehensive development framework which includes all major sectors is necessary and development should be coordinated in such a way that growth of one sector complements the growth of other sector.

They said that sequencing and prioritizing of infrastructure is important keeping in view existing and future demand, employment and socio-economic condition of the people and long term and short-term impact of development. Infrastructure development is the only way for Pakistan to achieve its Millennium Development Goals (MDGs).

Governance and political stability are variables of political economy are significant elements that can affect the economic growth related with infrastructure development. Efficiency, accountability and reforms in public sectors are considered as vital element for effective monitoring and evaluation of projects funded by government.

Different type of infrastructure has different impact on GDP growth depending upon the situation of the country. Energy sector has direct benefit in GDP development as it relates to development of many other sectors. Telecommunication has best documented impact on GDP growth and has highest and most impressive payoffs than any other sector. Impact of transportation infrastructure is consistently correlated with economic growth, with rate of return as high as 63%. China spends 1% of its Gross National Product (GNP) on transport infrastructure and its GDP growth is constantly in the range of 9%. Impact of transportation infrastructure is low in case of developed countries but for developing countries scenario is totally opposite and improvement of transport infrastructure hold positive impact on GDP growth.

Water and sanitation have no direct connection with GDP growth but it has indirect connection with other sub sectors.

(Courtesy Business Recorder 30th December 2017)

“South Punjab witnesses over 550,000 road accidents in 13 years”

By:
OWAIS QARNI

Report reveals most accidents are caused by speeding and reckless behaviour of drivers [Road accidents (2004-2017)]

Road accidents were still on the rise in south Punjab despite risen voice of thousands of employees from federal and provincial government departments on road safety. Over 550,000 people met road accidents in this region in the last 13 years, many of whom had become physically handicapped as a result of these accidents. This was stated in the Rescue 1122 report.

According to the information available in the report, 560,392 road accidents had occurred from 2004-2017 in south Punjab. Moreover, the ratio of these accidents was increasing every passing year despite tall claims by the government of curtailment of road accidents.

Only few departments of the government work to stop these kinds of accidents which included National Highway and Motorway, Patrolling Police, Traffic Police and warden transport authority. These departments had always ensured people to reduce the rate of these accidents by training them on traffic laws. However, according to rescue 1122 report, most of the road accidents were caused by fast speeding vehicles and non-cautious behaviour of their drivers. Moreover, most of the accidents were motorcycle accidents.

According to the information provided in the report, from 2004 to 2017, 106,789 road accidents were occurred in Multan, 54,350 road accidents were occurred in Bahawalpur, 40,966 road accidents were occurred in DG Khan, 50,294 road accidents were occurred in Rahim Yar Khan, 37,078 road accidents were occurred in Khanewal, 15,567 road accidents were occurred in Rajanpur, 21,137 road accidents were occurred in Muzaffargarh, 20,032 road accidents were occurred in Bahawal Nagar, 19,215 road accidents were occurred in Vehari, 19,446 road accidents were occurred in Lodhran and 14,379 road accidents road accidents were occurred in Layyah.

Furthermore, number of road accidents in district Multan was 30,739 from 2015 to 2017 and the number of people who died in these accidents was 301. 36,258 people suffered injuries in these accidents including 28,701 males and 7,557 females. 28,000 people were on motorcycles, 3,979 were in cars, 1,126 in trucks, 5,328 in rikshaws and 1,121 people were in vans in these accidents.

In 8,298 of these accidents, people lost their legs. In 942 accidents, victims suffered from spinal injuries and 4,504 accidents caused injuries on head. 7,531 accidents were caused due to fast speeding, 12,562 accidents were caused due to unconscious driving, 5,231 accidents were caused due to wrong U-turns and three accidents were reported due to one-wheeling.

According to the report, most of the road accidents were caused by fast speeding and ignorance of traffic laws. However, the government had invested a big amount to train people about traffic rules.

(Courtesy Rescue 1122 report)

“WWF moves SC for demarcation of 250 protected areas”

By

Nasir Iqbal

ISLAMABAD: The Supreme Court was requested on Saturday to order demarcation of about 250 protected areas in the country, such as national parks, game reserves and wildlife sanctuaries, which might be threatened in the wake of extensive development work carried out under the China-Pakistan Economic Corridor (CPEC).

An application moved by Ahmer Bilal Soofi on behalf of the World Wide Fund (WWF) for Nature, Pakistan, argued that such a step would ensure that stakeholders align their development, investment and expansion plans in accordance with the restrictions placed under the law and would be useful for investors as well as the federal, provincial, district and foreign governments.

The application is expected to be taken up on Monday by a three-judge bench headed by Chief Justice Mian Saqib Nisar that is hearing a suomotu case relating to the cutting of trees in the Margalla Hills National Park and extensive quarrying work being carried out in Khyber Pakhtunkhwa.

Advocate Soofi, who also happens to be president of the WWF, told Dawn that around 11 per cent of its land or approximately 250 areas in Pakistan were protected or reserved sanctuaries where no development work should be undertaken, but lack of proper demarcation helped encroachers grab land illegally.

The application has requested the court to order the Surveyor General of Pakistan to undertake a survey by employing a Geographic Information System-based delineation of the notified protected areas of Pakistan. The funding and facilitation for the project could be provided by the federal government, the application said, while the climate change ministry and provincial wildlife, forestry and fisheries departments could assist the endeavour in public interest.

Such an exercise was urgently needed so that further damage to the protected areas as well as harm to the protected wildlife could be stopped, the application said.

A GIS-based delineation system would help inform the innocent buyers and unaware potential developers of the encumbrances on the properties falling within the protected areas because ambiguity about the status of a particular property could lead to fraudulent schemes and damage to the protected areas.

The information currently available about the boundaries of the protected areas existed only in the form of notifications and sketch maps. In some of these notifications localities, water channels or any other landmarks were considered references, the application argued, adding that such references were not reliable in the long run as conditions changed with the passage of time. For example a water channel could change its course.

Moreover, these references were often generalized in nature and could cause inaccuracies vis-à-vis positions as well as areas, the application contended. The GIS technology provided an opportunity to define the boundary of a region with accuracy. Hence, to avoid ambiguities and errors, GIS-based demarcation and notification was necessary.

According to the application, there are a number of notifications which have been issued by the relevant governments in relation to the protected areas throughout Pakistan. Such notifications have been issued under different federal and provincial enactments applicable to the four provinces, Gilgit Baltistan and Azad Jammu and Kashmir. However, despite these notifications, boundaries of these areas have not been accurately identified.

The application recalled that Pakistan had ratified the United Nations Framework Convention on Climate Change which came into force in 1994. Within the same framework, the Paris Climate Accord was signed in 2016 which dealt with greenhouse gas emission mitigation and came into force in Pakistan in December of 2016.

To meet Pakistan's obligations under the international conventions, the Pakistan Climate Change Act 2017 was enacted and pursuant to Section 12 of this act, the Pakistan Climate Change Fund was established that may be utilised to provide financial assistance to appropriate projects, according to the VWVF application.

"ABSTRACTS"

Proceeding Papers 74th Session

WATER ACCOUNTING AND AUDITING TO MANAGE WATER SCARCITY -- GLOBAL EXPERIENCE AND POSSIBLE GUIDELINES FOR PAKISTAN

By:

Dr. Mahmood Ahmad

ABSTRACT:

Pakistan boasts the largest contagious irrigation system in the world, which also poses large difficulties for its management. There is a need for proper accounting and auditing of water resources, taking stock beyond the simple accounting of volumes and flows, and a need to focus on issues relating to accessibility, uncertainty and governance of water. This paper introduces the concept of water auditing pertaining to institutional and governance issues related to water management. This paper looks at innovative work ranging from simple crop and water budgets to the use of remote sensing and in-situ sensing technologies (water informatics), that can allow real-time water accounting for over as small an area as a farm or as large an area as a river basin. Based on the results of Remote Sensing technology driven accounting exercises in Pakistan, we identify loss of storage, low beneficial depletion, and low land and water productivity as the main water resources management issues.

The Center for Water Informatics and Technology (WIT) at LUMS is expected to initiate policy work on water accounting which is critical in addressing the challenges of water scarcity. The scope of research work can include: first to rationalize water use in agriculture taking the case of rice and sugarcane and secondly to cross-pollinate water economics with water informatics technologies (e.g. remote sensing) for on-farm water management. We expect private sector, international donors and the Government to support this initiative at all levels.

A WAY FORWARD FOR FLOOD RISK MANAGEMENT IN PAKISTAN

By:

Dr. Qazi Tallat Mahmood Siddiqui

ABSTRACT:

Flood continues to play havoc in most parts of the planet. The frequency of occurrence of floods in the region in general and in Pakistan in particular has considerably increased since past several years, because of global warming and rapid climate change. Pakistan is a country with diverse type of land and fluctuating pattern of climate. Climate is usually considered hot and dry in Pakistan but it has shown significant obvious variations in last few years. Many districts and urban centers located along the river banks are ever on a great risk to confront with various types of floods i.e. riverine floods, flash floods, and urban floods particularly in Punjab & Sindh.

The floods in rivers are generally caused due to heavy concentrated rainfall in the river catchments during monsoon season, which is sometimes augmented by snow melt flows. Monsoon currents originating from Bay of Bengal and resultant depressions (weather system) often result in heavy downpour in the Himalayan foothills, which occasionally generate destructive floods in main rivers and their tributaries. Flooding of the Indus River and its tributaries represents the greatest hazard in Pakistan. Floods occur usually in summer season (July - October). Therefore, damages to agriculture sector are mainly to the standing Kharif crops. However, in some cases the inundated lands do not dry-up in time and ultimately affecting sowing Rabi crops.

Due to the large scale damages as a result of 2010 floods followed by 2011 & 2012-floods/rains, the need for investment in flood sector has gained importance. Federal Flood Commission initiated working on formulation of National Flood Protection Plan-IV (2016-25). The plan has been prepared in close consultation with all federal as well as provincial stakeholders. The planning strategy for development of National Flood Protection Plan-IV, in line with the current practices worldwide, is focused on integrated flood management planning laying more emphasis on the non-structural measures, such as Reservoir operations, Flood forecasting and early warning, Flood risk zoning, Watershed management, Flood proofing and insurance, Disaster management and other measures. However, considering the uniqueness of Indus Basin with its large integrated network of dams, barrages and canals, which form the lifeline of agriculture economy of the country, the protection of this infrastructure as well as the irrigated area that it feeds and which has been the focus of previous three Flood Protection Plans, the maintenance, up-gradation and in some cases new construction especially in light of 2010 floods, has not been ignored. The above guidelines have been adopted while formulating the Plan. The estimated cost of the Plan with category wise breakdown into structural and non-structural measures is Rs 177.61 Billion in the next five years. It is the need of the hour to implement flood mitigation measures under National Flood Protection Plan in all the provinces and federal line agencies.

PLANNING, DESIGN, CONSTRUCTION AND MONITORING OF FLOOD BUNDS

By:

Engr. Syed Mansoob Ali Zaidi

ABSTRACT

Flood protection Bunds have a long history dating back to the adoption by humans to living along the river streams to harvest the benefits of harnessing river flows, for irrigated agriculture and other miscellaneous uses. Initially the Bunds were in the form of micro earthen dividers between protected crops and river flow spills. With the civilization developing along the river streams, the Bunds sizes increased and the issues of design, construction, reinforcement and maintenance of Bunds were established which kept on improving all along. This paper presents the current methodology for planning, design, construction and monitoring of flood Bunds.

The design of Bunds provides the following geometrical parameters for construction:

a) The crest level;

b) The crest width;

c) Freeboard;

d) Side slopes;

e) Protective arrangements for flood levels water ways, velocity and scour

The crest level is established by taking into account, the flood levels, the rise in levels due to wave run-up, river set, wind setup and any emergency rise in flood levels. The crest width is mainly regulated by the requirement of crest width by transportation needs and space required for stocking of stone or other flood fighting materials. The side slopes are instrumental in providing the required seepage flow path for safety of the Bund. The design slopes are checked for stability against all loadings and seepage. Foundations soils if needed are strengthened by compaction, reworking, key trenches or seepage cut-offs. The shortcomings of original design are mitigated in the current design exercises.

TARBELA 4TH EXTENSION HYDROPOWER PROJECT

By:

Dr. Izhar ul Haq,

M. Mushtaq Ch.

ABSTRACT:

Tarbela the largest earthfill dam 475 ft. high was constructed on river Indus under Indus Basin Replacement Works in 1974. Its gross storage was 11.6 MAF. Four units of 175 MW and six units of 175 MW each were installed on Tunnels T_1 and T_2 in seventies and early eighties. In early nineties four units of 432 MW each were installed on T_3 third tunnel. T_4 and T_5 were used for irrigation releases. In order to meet the power shortages, three units of 470 MW each are being installed on Tunnel 4. The design was prepared by JVC lead by Mott MacDonald and the construction is being carried out by Sino Hydro. T_4 extension power house is located at the back of the existing powerhouse near the western hill.

The intakes of both Tunnel 3 and Tunnel 4 are being constructed at higher level in the right abutment and joined to the existing tunnels by a vertical shaft. This would reduce the silt entry to the turbines and avoid the risk of the tunnels being clogged by onslaught of the sediment delta which is already higher than the intake invert level of T_3 & T_4 (1160 ft.) Right hand Low level outlet of T_4 would also be retained to flush out the sediments and meet the irrigation indent if it is more than the outflow capacity of the power house. This paper describes the salient features of the T4 extension project and the problems faced during its construction.

CLIMATE CHANGE IMPACT ON WATER RESOURCES OF PAKISTAN

By:

Muhammad Munir Ch.

Maqsood Shafique Qureshi

Dr. Allah Bakhsh Sufi

ABSTRACT: (SUMMARY)

The water scarcity has reached a crucial stage in Pakistan, and it is considered as one of the most water-stressed countries in the World. It is apprehended that country has become water scarce due to high population, estimated over 200 million in 2017. The water storage capacity has been reducing due to continuous sedimentation of its existing reservoirs. It is apprehended that by the end of year 2017, storage capacity of reservoirs would be reduced by 27%. Under this scenario, construction of mega multi-purpose storage dams is assuming highest priority to sustain irrigated agriculture which is the backbone of Pakistan's economy and to meet the growing water needs of all water utilizing sectors. For meeting these requirements, a number of dams are planned on River Indus including under construction Dasu Hydropower Project. However, due to some controversial issues and non-availability of required funding, it has not been possible to undertake construction of any of storage dam, despite urgent national need for additional storage capacity, especially on river Indus. The construction of additional dams would not only augment irrigation supplies, but also mitigate floods, besides increase in power generation, employment opportunities and economic boost.

These dams would store billions m^3 of water that presently is going unutilized into the sea during floods in summer months. Confidence building measures among provinces, to address the related controversial issues and to develop consensus for building new dams, is a real national need. Additional water will be needed to meet requirements of irrigated agriculture and anticipated improvements in the standard of living through greater economic activity. Increase in industrial activity will also require additional water. Our underground water resources are already being over exploited. Increase in sustainable water resources in the country can be achieved through a combination of exploring valuable groundwater aquifers and constructing potential large, medium and small surface water storages and through water conservation strategies. This combination will be critical in meeting the water needs of the 21st century in the country.

The 4th Assessment Report (AR4) by the three working groups of the Intergovernmental Panel on Climate Change (IPCC) has projected that average global surface temperature will increase by approximately over 4°C during the 21st century. The recent annual average temperatures for Northern and Southern Pakistan are about 19°C and 24°C respectively. The glaciers constitute about 2,700 km3 of stored volume of ice (Roohi, 2005), equivalent to about 14 years of average Indus River System inflows. The thermal regime of HinduKush Himalayan (HKH) glaciating region has in general warmed up and the frequency of occurrence of moderate as well as severe heat waves have also increased significantly.

The climatic change in Pakistan has slowed down melting of glaciers and snow from mountains due to low temperatures in recent years in northern area, thus reducing flow of rivers resulting in severe water shortages during winter. However, temperature in the northern glaciating area is again rising since 2014-2015. Based on the studies available, it looks likely that the HKH glaciers are receding under the influence of global warming and their melting will increase with increase in summer temperatures. Recent simulation modeling conducted by Global Change Impact Studies Center (GCISC), Geneva, Switzerland, on Indus flows for a scenario where temperature will rise by 4°C and glaciers would shrink to half of their present size, indicates that overall annual river flows would reduce by about 15% and the monthly flow pattern would also change considerably, with more water coming in spring and early summer and less water in the later part of summer.

Due to anticipated major climate change related concerns, it is projected that it will increase variability of monsoon rains to enhance the frequency and severity of high floods as during 2010 and recent past droughts. Incorporating realistic scenarios of water resources availability is a fundamental element of sustainable development. Water resources and climate change not only affects agriculture, but these also affect urban centers, industry and human health. Management of water resources requires a balanced and careful review of current knowledge under a comprehensive framework for the national development purposes of all sectors of life including environmental requirements.

SUSTAINABLE DEVELOPMENT AND MANAGEMENT OF GROUNDWATER- LAHORE CITY

By:

Ghulam Zakir Hassan

Faiz Raza Hassan

ABSTRACT:

Groundwater consists of 96% of planet's unfrozen freshwater and globally 60% of it is used for agriculture, 20% for domestic and 20% for industry. Pakistan is 4th largest user of groundwater after India, USA and China where more than 90% drinking, almost 100% industrial and more than 40% irrigation water requirements are met from groundwater. Lahore is the 2nd largest city of the Pakistan and huge pumpage of groundwater is being carried out to meet the domestic and industrial demands of water supply. Lahore is the second largest populated city of Pakistan with estimated population of 10 million, with an area of 1014 km2. It is located on the alluvial plain of Indus Basin on an altitude ranging between 682 ft to 698 ft above mean sea level and is bounded by Ravi River in the North West and BRBD Canal on the east. Average annual rainfall recorded is about to 675 mm. Groundwater is the only source of domestic and industrial use in the city. The un-planned excessive pumpage of groundwater as 1645 cusec has threatened aquifer depletion along with other socio-economic issues. After creation of Pakistan, the groundwater level in Lahore city was as 15-16 feet which has now reached its depth 150 feet. With the increase in population and industry, extraction of groundwater is tremendously increasing and consequently groundwater reservoir is rapidly depleting. Ravi River,

the major source of recharge, remains almost dry throughout the year except few monsoon months. This situation has seriously created a fear that in near future Lahore city can face water crisis and its citizen will suffer badly. In this paper findings of different research studies have been outlined to identify the critical areas and to suggest some management options for the replenishment of this fast depleting natural resource in Lahore. It has been found that in Lahore City annual average depletion rate of water level is 2.5 ft. Potential sites for artificial recharge of aquifer have been identified and possibility of aquifer recharging through rain water has been explored. Results have revealed that quality of groundwater is deteriorating, moving downstream from Ravi Syphon to Lahore and then again improves towards Mohlanwal. It has been further found that pollution in River Ravi is contributing in deterioration groundwater quality.

COMPARISON OF TEMPORAL CHANGES IN GROUNDWATER DEPTH WITH RESPECT TO DROUGHT AND NORMAL YEARS IN IRRIGATED AREAS OF SINDH AND BALOCHISTAN

By:

Engr. Ijaz Javed,

Engr. Dr. Muhammad Saeed,

Engr. Muhammad Shoaib,

Dilbar Hassan

ABSTRACT:

In the past, it has been observed that with the time there have been fluctuations in watertable depth, especially in comparison of drought year (2000) to normal years afterwards (2010-14). This study relates to the comparison of temporal changes in groundwater depth with respect to drought and normal years in irrigated areas of Sindh and Balochistan.

In this study, the database of depth to watertable, was used as secondary data to assess spatial and temporal changes in groundwater depth conditions of pre-and post-monsoon for the period (2000, 2010-2014). Depth to watertable contour maps have also been used for identification of waterlogged (disaster) areas. Area under different depth to watertable classes, percentage area of Sindh and Balochistan derived from the contour maps that were processed through GIS software. A spreadsheet has been developed for conducting analysis of depth to watertable data derived via contour maps presented in the form of bar charts.

The result shows that during pre-monsoons the waterlogged areas i.e. (<1.50 m DTW) which was 11.13% in 2000 increased to 53.72% in 2011 after which it gradually decreased in the preceding years i.e., 2012, 2013 and 2014. Whereas during post-monsoon the waterlogged areas i.e. (<1.50 m DTW) which was 11.13% in 2000 increased to 69.88% in 2014. On an average (2010-2014) about 60% (9.03 million acre) of the IBIS (Indus Basin Irrigation System) was waterlogged (disaster area), which is 40% more than the pre-monsoon. Overall trend of disaster area for post-monsoon (2010-2014) indicates an alarming situation in Sindh Province.

PCRWR IRRIGATION ADVISORY SERVICES FOR DIFFERENT AGRO-CLIMATIC ZONES OF PAKISTAN – AN IMPACT ANALYSIS

By:

Ashfaq Ahmad Sheikh,

Ahmad Zeeshan Bhatti,

Adil Altaf

ABSTRACT:

In Pakistan, more than 80% water resources of the country are used by agriculture; nevertheless, it is the major limiting factor for agricultural sustainability and growth. Indus Basin Irrigation System (IBIS) is one of the largest in the world, but one of the least efficient. The overall IBIS losses are about 60 percent, which partially contribute to groundwater recharge. Groundwater is contributing more than 60% of the irrigation water requirements, but at a cost of huge chunk of energy. The present irrigation water deficit in the country is about 15%, which is predicted to be above 30% in 2025.

A major portion of irrigation water loss takes place in the fields (about 25%) where flood irrigation is practiced. Over irrigation is a common practice due to classical mindset that more water would produce more yields. Ultimately, irrigated agriculture is becoming less profitable business owing to high irrigation cost, particularly in groundwater-irrigated areas. Resultantly, food is becoming more expensive depriving a substantial portion of the society.

Quantification of crop water requirements is pre-requisite for optimizing water use efficiency. Water requirements depend mainly on the type and stage of crop growth and climatic conditions. A simplified approach to determine crop water requirements (ETc) is linking it with reference evapotranspiration (ETo) by a crop coefficient (Kc). Remote sensing techniques have made it possible to estimate the real time reference ET of the near past. The techniques are used worldwide to estimate crop water requirements of different crops and the irrigation advisories are broadcasted accordingly.

PCRWR cell broadcasts weekly irrigation requirements of different crops in 21-districts of Pakistan (10,000 farmers). The service is in collaboration with University of Washington, USA, which provides real time reference ET for entire Pakistan, whereas PCRWR has determined Kc values of all major crops through lysimeteric studies. The message updates the farmers that how much water its crop (in inch) has used during the last week excluding effective rainfall in order to replenish the same through irrigation. The rainfall forecast for the upcoming week is also included in the message. A survey reveals that farmers who were blindly applying irrigation saved at least 15-20% water due to this messaging service.

FARMER MANAGED IRRIGATION SYSTEM AND ITS IMPACT ON WATER SERVICE DELIEVERY: A CASE OF SINDH-PAKISTAN

By:

Nazir Ahmed Memon

Masroor Ahmed Shahwani

ABSTRACT:

Irrigation system of Pakistan is the largest integrated irrigation network in the world. The system is fed by the waters of Indus River and its tributaries. The Sindh province has 13 million acres of irrigated lands in its three barrage command areas, built between 1932 and 1962. In 1997 the Government of Sindh started the reform of the management of the entire irrigation system. The Sindh Assembly approved an Act, shifting the responsibilities for the management of the irrigation and drainage infrastructure from the centralised Provincial Irrigation Department (PID) to the farmer managed water institutions known as Sindh Irrigation and Drainage Authority (SIDA), Area Water Boards (AWB) and Farmers' Organisations (FOs). The institutional structure proposed under SIDA Act was restructured through Sindh Water Management Ordinance in 2002 with an objective to make the institutions more participatory and autonomous in its decision making and service delivery.

The key process of Institutional Reforms has been carried out by implementing Participatory Irrigation Management (PIM) which has evolved and become generally accepted as a necessary aspect of productive and sustainable irrigation. The concern of this paper is to review the reform process and assess its role, impact especially in improving water service delivery under command of farmer managed system. The paper will also focus on the current reform, reform process, working of SIDA, FOs and AWBs and their strategy to address the issues and problems of farmers with respect to water distribution and governance.

CROP WATER BUDGET ESTIMATION USING GIS

By:

Muhammad Awais

Muhammad Mohsin Munir

ABSTRACT:

Pakistan lies on the verge of world largest aquifer but on papers we are defined as water stressed country and crop stressed region. Institutional and individual attitude and practices in consuming water for domestic and agriculture needs can be blamed as reason behind this water stressed condition. To calculate this crop stressing, a sample area was selected in Sadiqia Canal, Hakra Branch for studying crop water requirement, its deficit and the actual water supplied by irrigation system and tube wells. It was calculated that the command area was crop stressed due to shortage of water and less tube wells were used to overcome the deficit. Based on preliminary study it is recommended that the distributary should be lined to decrease the losses hence decreasing water deficit. Further it is recommended that crop water reporting

must be done for the irrigation areas for calculation of actual crop water requirement for best efficiency of irrigation system.

ROOF TOP RAINWATER HARVESTING OPTIONS FOR WATER CONSERVATION – A CASE STUDY OF LAHORE

By:

Dr. Ghulam Nabi,

Muhammad Tarique

ABSTRACT:

This study aims to assess the rainwater harvesting options and issues, in big city of Pakistan. There is a huge potential; for this option. As an example high annual rainfall makes rainwater harvesting a logical solution to overcome water shortage in Lahore. The ground water resources are also depleting due to higher usage. As the growing population in the urban areas and higher demand of water for crops are putting increased load on underground aquifer, whereas in the last decade, the groundwater level in Lahore has decreased by more than 30 feet. The annual rain fall that the city receives may be the best management practice to recharge the aquifer. Rainwater harvesting during the rainy season can reduce the load on sewage and rainwater collection system which helps in ground water build up. Data from primary as well as secondary sources was used for this study, which aims to find out the potential of rainwater harvesting in Lahore and proposes various options after conducting analysis on; (i) land use and rainfall pattern of the study area of Lahore and their results, (ii) simulation of rainfall runoff and estimation of rainfall in the Central Drain Catchment using HEC-HMS, (iii) different design options of various rainwater harvesting systems consisting of groundwater recharge and rooftop rainwater harvesting structures, (iv) implementation of proposed options and estimation of subsequent impacts in the study area. The results showed that the rainfall pattern in the study area does not have a particular trend but there is significant potential for the implementation of rainwater harvesting systems in Lahore. Various beneficial design options are introduced as pilot study which demonstrates beneficial techniques.

AWARDING CONTRACT WITHOUT COMPETITIVE BIDDING: IMPLICATIONS

By:

Engr. M. Mazhar-ul Islam

ABSTRACT:

Development of a country is dependent on construction of infrastructure and buildings to establish better transportation means, generation of electricity, dams, reservoirs, airports, industries which contribute to the economy and standard of living of a developing Nation. For such construction, procurement of goods, works and services are realized through contract.

A contract is a set of conditions at a price agreed between the seller and the buyer following certain pre-determined rules, regulations and laws. Compliance of such regulations not only provide best value of money but also ensure transparency, quality of goods and services; and completion of a project within the stipulated time.

International best practices in modern contracting are the award of contract under competitive bidding. The same practices based on FIDIC are adopted, notified and followed in Pakistan as Country Regulations. Pakistan Country regulations envisage in certain cases, award of contract without competition on direct contracting for specialized product and services where no competition is required, for small procurements .However, manipulation and misinterpretation of this provision is made in many cases, generally by the project executing agencies.

Contrary to the above stated best practices, some disturbing trend of manipulative procurement has been witnessed recently in Pakistan in public sector procurement. Consequences of such practices of “awarding contract without competition” are many, eg. transparency is compromised, genuine bidders refrain from participations, delay in project execution and reduction in quality leading to loss in national exchequer. Additionally, as a result of awarding contract without competition; the rate of utility charges, toll taxes, per capita loan etc. increases which is ultimately borne by the public in general.

In the latest budget of 2017-18; PSDP allocation alone is Rs. 2.140 trillion coupled with announced $ 46 billion China-Pakistan Economic Corridor (CPEC) funding; and significant provincial allocations, the total construction sector volume is one of the highest in the history of Pakistan. To spend such huge amount through the process of procurement; the relevant regulations should be transparent, equitable to contracting parties and in conformance with International best practices. However, as discussed here below in detail, the Punjab PPRA Rules after several amendments have become inconsistence with similar federal regulations; and also misinterpreted and manipulated. Further in many cases, Foreign Direct Investment (FDI) is attracted by awarding a contract at the terms and conditions of the investors which are not in the interest of Pakistan. FDI will automatically flow in to Pakistan if law and order condition is normalized resulting into lower risk factors; and malpractices are eliminated and governance is improved.

Recent trend of the governments; Federal as well as the Provincial to manipulate the regulatory provisions viz-a-viz PPRA (Punjab Procurement Regulatory Authority), PEC (Pakistan Engineering Council) & CCP (Competitive Commission of Pakistan) has destroyed the spirit of competitive bidding and violated the country regulations. Examples of such violations and implication thereof in competitive bidding are discussed in detail hereunder.

IMPACT OF SOIL CHARACTERISTICS ON FAILURE OF FLOOD BUNDS- CASE STUDY FROM PUNJAB PAKISTAN

By:

Ghulam Zakir Hassan,

Ghulam Shabir,

Adnan Hassan

M. Shahzad Abdul Rahim

ABSTRACT:

Flood bunds are earthen embankments constructed along rivers to control the floods. Pakistan which lies in the Indus Basin has been facing severe threats and losses from the floods since histories. About 6807km length of flood embankment has been constructed to safeguard against the floods in the country. Punjab Province has been severely hit by heavy floods causing severe loss to human lives, infrastructure, crops and livestock etc. A study was carried out to evaluate the "health" of flood bunds by investigating their geotechnical, geometrical, geochemical and hydraulic properties to ascertain strength against breaching during floods. A length of about 731 km of Chenab River was selected and investigations were carried out on 78 sites of 38 flood bunds which were found critical during flood 2014.

Different field activities including density test, measurement of geometrical parameters, collection of undisturbed/disturbed soil samples, physical inspections and collection of ground water samples from bore holes were performed. Laboratory tests including soil texture, Atterberg's limits, compaction, unconfined compressive strength, permeability, Direct Shear etc. were performed in laboratories of Irrigation Research Institute (Irrigation Department Lahore, Punjab, Pakistan).

A River Embankment Breaching Vulnerability Index (REBVI) was derived to delineate the risk of vulnerability of the embankment. Cluster analysis was performed based on vulnerability index for each indicator.

On the basis of REBVI and Cluster analysis it was concluded that 11 out of 78 sites are representing high potential to prevent embankment breaching while 35 sites low potential to prevent embankment breaching point indicating that the consistence of the embankment is very high and high in 11 and 35 flood bund sites respectively. The consistence of the embankment are medium, low and very low at remaining 16, 12 and 4 flood bund sites due to moderate vulnerability, High probability of embankment breaching and very high vulnerability respectively.

HISTORY OF TOLERABLE DEFORMATION OF FOUNDATIONS

By:

Sohail Kibria

Sajid Iqbal

ABSTRACT:

The issue of prediction of deformation of foundations has been attracting the attention of geotechnical as well as structural engineers for ensuring sound performance of structures. Quite often, a realistic prediction of actual deformation is quite difficult because structures are too complicated to be modeled, actual material properties are not well known, as-built is not the same as designed, rate and stages of construction and post-construction change in geo-environmental factors are not readily known etc.

The deformation based limit states viz. architectural and serviceability limits states, are directly related to the deformations and need to be established separately. In practice, some settlements do take place safely before finishes are placed and therefore may not cause any distress to the final product.

The prediction of deformation at different stages of construction and their threshold values for distress-free performance of structures have been handled by various researchers including Terzaghi and Peck (1948), Skempton and MacDonald (1956), Meyerhof (1956), Polshin and Toker (1957), Sowers (1962), Bjerrum (1963), Burland and Wroth (1974), Grant et al. (1974), Wahls (1981) and Moulton et al. (1985), etc. Whereas various standard field and laboratory testing and analysis techniques are in vogue for prediction of deformations, empirical and observational procedures have been adopted by various researchers as well as by building codes, for defining safe threshold of foundation deformation.

Current study investigates the credible work done in this regard since 1930s to date. Engineers should recognize potential problems associated with structures on variable ground conditions individually. The intention of this paper is to provide awareness to engineering community on need to consider allowable movement of structures with regard to the type of structure and foundation and underlying subsurface soil conditions.

FINANCIAL AND ECONOMIC ANALYSIS OF PROJECT OF UP-GRADATION / REHABILITATION OF MAIN LINE-2 of PAKISTAN RAILWAYS

By:

Abdul Rehman Chaudhry

Muhammad Inam

ABSTRACT:

Main Line-2 (ML-2) route of Pakistan Railway's network comprises its following five existing sections:

1. Kotri – Dadu – Habib Kot = 346 km

2.	Habib Kot – Jacobabad – Kashmor	= 177 km
3.	Kashmor – D.G. Khan – Kot Adu	= 306 km
4.	Kot Adu – Bhakkar – Kundian	= 231 km
5.	Kundian – Basal – Attock City	= 194 km
	Total:	**= 1,254 km**

The above mentioned ML-2 route joins main line ML-1 route (Karachi-Lahore-Rawalpindi-Peshawar) at Kotri in the south and at Attock City in the north.

The existing infrastructure on the above mentioned sections has mostly been completed its useful life and is in depleted condition. The up-gradation/rehabilitation of the infrastructure on these sections is essentially required to meet not only the anticipated traffic after establishment of China-Pakistan Economic Corridor (CPEC), but also to meet with the additional transportation demands of imported coal for coal fired power plants to be built in Sindh & Punjab provinces.

The importance of ML-2 route will increase manifold after the proposed construction of new railway line between Gwadar and Jacobabad as it will provide an additional route for the transportation of freight traffic to up country and Afghanistan, not only from Gwadar Port but also from Karachi/Bin Qasim Ports.

The proposed up-gradation/rehabilitation of ML-2 route shall also be part of CPEC in addition to the up-gradation of ML-1 (Karachi-Lahore-Peshawar) route of Pakistan Railways. The construction of the new rail link from Gwadar to Jacobabad (located on ML-2), is planned for construction under CPEC by 2030.

Pakistan Railways accordingly decided to carry out feasibility study of existing Main Line-2 (ML-2) from Kotri to Attock City stations with a view to ascertain the existing condition of its infrastructure and the improvements required to achieve the speeds up to 160 Km/h for passenger trains and up to 120 km/h for freight traffic.

The Contract for carrying out the above referred feasibility study was awarded in February, 2016 to the JV comprising ILF Consulting Engineers ZT GmbH, Rum/Innsbruck, Austria, and ILF Pakistan (Pvt) Limited, Lahore.

The feasibility study has been completed and draft feasibility study report has been submitted to the Client. The salient features of the financial and economic analysis of project included in the feasibility study report, have been described in this paper.

INTERPRETATION OF PROBLEMATIC SONOGRAPHS IN SONIC INTEGRITY TESTING OF PILES

By:

Sohail Kibria

Asim Masud

M. Tayyab Javed

ABSTRACT:

Low strain impact integrity testing / Sonic Integrity Testing (S.I.T.) is finding its increasing use for the integrity evaluation of cast-in-place concrete piles in Pakistan.

S.I.T. is considered very useful in assessing the quality/integrity of bored piles. State-of-the-art S.I.T. equipment with latest software provisions is being used for evaluating the integrity of piles in Pakistan.

Occasionally, the sonographs resulting from S.I.T. in the field and after adjustment by signal processing techniques are not easily comprehensible to delineate soundness/unsoundness of the tested piles. Our experience of testing more than 10,000 piles of various projects in Pakistan over a span of about five years, by team of experienced engineers, has indicated some serious difficulties/limitations in proper interpretation of some of the sonographs. Attempts have been made to correlate the signal of such sonographs with the type of possible defects, L/D ratios, pile head preparation, soil type, method of construction etc., keeping in view the pile construction records.

This paper describes ten (10) cases of selected sonographs, where serious difficulties were encountered in interpretation and were subsequently resolved based on our vast experience and using various techniques. The discussion in this paper and its findings are considered to provide useful guidelines for interpretation of S.I.T. signals, in similar testing and ground conditions.

BARRAGES PROJECTS- FLOOD MANAGEMENT

By:

Amjad Saeed

Muhammad Sajid Nazir

ABSTRACT:

Punjab province of Pakistan is holding the largest area measuring about 8.4 million hectares being fed through the largest contiguous irrigation system. Barrages are the kingpin structures across rivers in Punjab and designed mainly for guaranteeing (i) safe and sustained diversion of requisite flows into canals emanating from the barrages and (ii) safe passage of all range of flood flows through the barrages avoiding any colossal damages to the barrage and its adjoining areas. These barrages have served their intended function in general during the design life by feeding the canals and passing the floods safely. Life span of barrages located in Punjab is from 45 years to 125 years and most of them have outlived their useful life. Flood discharging capacities have considerably reduced due to undesirable deposition immediately upstream of these barrages. Some of these barrages are found under designed for passing the 100-years return period discharges.

Punjab government being cognizant of safety of these barrages launched a phased program in year 2004 for rehabilitation, up-gradation and modernization of barrages to ensure their serviceability for another life span of fifty years. Different alternatives were studied during feasibility and detailed design stages to rehabilitate and upgrade the existing barrages or go for construction of new barrage. Depending upon the existing condition and capacity of the barrages, decisions were made to rehabilitate and upgrade Taunsa , Jinnah, Balloki, Suleimanki, Islam, Trimmu and Panjnad barrages, whereas, replacement of Khanki headworks with a new barrage was recommended. In the context of Flood Management, besides construction of New Khanki Barrage, major interventions are introduced / being introduced at Balloki,

Trimmu, Panjnad and Suleimanki Barrages to accommodate 100-year return period discharge. Out dated and cumbersome manual gate operation system is being replaced with automatic gate operation system. All these barrage projects are being implemented with the financial assistance of Asian Development Bank valuing about Rs. 45 Billion. With the completion of these mega projects, barrages will become strong enough for safe handling of floods and sustained diversion of supplies into canals. Since the barrages are very sensitive and strategic structures, therefore extreme care would be required in managing their maintenance and operation and evaluation of safety should be conducted periodically with the help of latest techniques. Pond area of barrages, where perennial flows are not available should be kept free of undesirable depositions either by regulation or dredging to ensure availability of adequate water way to safely pass design floods.

KEY RECOMMENDATIONS

By

PAKISTAN ENGINEERING CONGRESS

ON

Annual Symposium Held on 29th December, 2017

Pakistan Engineering Congress Organized Annual Symposium on the theme of **"*Impact of Infrastructure Development and Pakistan Economy*"** on 29thDecember 2017 held at Mashhadi Hall of Congress Headquarter. Welcome Address was presented by Engr. Ch. Ghulam Hussain, President Pakistan Engineering Congress. Seven (7) papers were presented. It was a very well attended event and was widely covered by News & Electronic Media. The Papers are being printed in a book form for complimentary distribution to the Members of the Congress and concerned public/private organizations.

Given below are the recommendations made by the Speakers:-

Paper: IMPACT OF INFRASTRUCTURE DEVELOPMENT ON PAKISTAN

Author: Engr. Riaz Rashid, Engr. Khurram Amin

Recommendations:

Under the current economic scenario infrastructure development is vital for socio-economic growth of Pakistan. Infrastructure development will improve the conditions for foreign investment in trade, industry and development sector. It will create more jobs and improve local skill to match with international standards. It will improve the demand for raw materials and enhance the local business. Major hydraulic structures like construction of dams, irrigation network and barrages can attract foreign investment and proved to provide economic benefits for longer period at low maintenance cost. Energy, Transportation, agricultural and water are main sectors requiring huge and constant public investment to improve per capita income and ensure constant economic growth. Based on the above discussion the following recommendations are made for sustainable economic growth of Pakistan.

- Planning of infrastructure development must be coordinated with economic growth to meet with its requirements. During planning infrastructure development large portion of population associated with agriculture must be taken into consideration.
- While investing in water infrastructure the indirect benefits must be considered before making decision.
- Comprehensive integrated water management approach must be adopted to reap the benefits of every drop of water with modernized irrigation system and irrigation techniques to meet with the future challenges of over population and climate change.

- Comprehensive development framework, which includes all major sectors should be adopted and development should be coordinated in such a way that growth of one sector complements the growth of other sector.
- Sequencing and prioritizing of infrastructure is important keeping in view existing and future demand, employment and socio-economic conditions of the people and long term and short-term impact of development.
- System of accountability, consistency of policies at national level, capacity building, skill development, monitoring & Evaluation and involving all stakeholders in decision making should be the main priority for sustainable development of infrastructure.

Paper: IMPACT OF ENERGY DEVELOPMENT ON ECONOMY OF PAKISTAN-CHALLENGES AND CONSTRAINTS

Author: Engr. Muhammad Rafiq

Recommendations:

To meet the objectives of development, a tentative accelerated implementation programme for the reservoir/ run-of-river hydropower projects is the essential requirement of the day. Rigorous efforts need to be made to arrange the financing from the foreign donor agencies and the project features and its economic viability may be made attractive for the potential investors. Strong and consistent efforts are required to improve the pace of hydropower development. Government should prefer the hydropower development as a long term solution.

Paper: PRIORITY CONSTRUCTION OF CASCADE HYDROPOWER PFOJECTS ON INDUS MAIN UNDER AMBIT OF CHINA-PAK ECONOMIC CORRIDOR (CPEC)

Author: Engr. Riaz Nazir Tarar, Engr. Muhammad Jabbar

Recommendations:

Now, when Diamer Basha Dam and Dasu Hydropower Projects are being taken up through staged development, it is recommended that to meet the medium term electricity demand through 2030, maximum effort be made to significantly enhance hydropower portfolio of CPEC. This should at least include: -

i. Second stage developments of both Diamer Basha Dam and Dasu Hydropower Projects
ii. Downstream cascade Pattan and Thakot Hydropower Projects.

Paper: BUNJI HYDROPOWER PROJECT OPPORTUNITIES AND CHALLENGES

Author: Engr. Abdul Khaliq Khan

Recommendations

- A number of bore holes at Bunji dam site and powerhouse area were proposed but could not be drilled before finalization of Bunji Design Report. These holes should be drilled so that the new information could be used for refinement of design.
- The geological conditions and rock strength parameters are not fully known for the rocks to be traversed by HRT and most importantly for MMT/RSFZ area. An exploratory adit from the Burchi village towards HRT was proposed but could not be implemented during the currency of Bunji Consultants. Excavation of this exploratory adit and the insitu geotechnical testing inside the adit should be carried out preferably before the tendering process of main project.
- Bunji access tunnel (BAT) along with four access adits to provide work faces are a prerequisite before the start of excavation for headrace tunnels. Since BAT will also be used for investigations of geological conditions, construction problems and insitu rock testing, it should be constructed in advance of the main contract.
- The seismo-tectonic report of the Bunji project should be got reviewed by some internationally known expert.
- The construction of Bunji dam would require provision of large quantity of pozolanic material which is not locally available. Alternate arrangements should be thoroughly studied and proposal for procurement of suitable material should be planned well in time.
- In the next about two decades more than 50 turbine runners will be installed for Dasu, Basha, Bunji and Pattan hydropower projects on river Indus.
- Bunji Consultants have recommended that a manufacturing factory for repair and refurbishment of runner units should be established at site.
- Other locations and modes could also be considered. It is recommended that a seminar on manufacturing of turbine runners in Pakistan should be arranged to study the possibilities and challenges.

Paper: OPTIMIZATION OF PATAN HYDROPOWER PROJECT ON RIVER INDUS

Author: Engr. Dr. Izhar-ul-Haq, Engr. Muhammad Abid Sheikh

Recommendations

The optimized project would produce more energy at less cost per unit. It would have the following generating characteristics:

- Annual Energy = 12,500 GWh,
- Installed capacity = 2,400 MW
- Plant Factor = 59.5%
- Unit cost = Cents 4.9

Paper: 720 MW KAROT HYDROPOWER PROJECT

Author: Engr. Iftikhar-ul-Haq

Recommendations

- 720-MW Karot HPP is “Run of the River” hydropower project under construction on Jhelum River, being developed in the Private sector under the Power Policy 2002 on a Build-Own-Operate Transfer (BOOT) basis with an expected concession period of approximately 35 years, which includes the construction period of 5 years and the operation period of 30 years, after which the ownership of the project will be transferred over to the Government of Punjab, Pakistan.
- Karot HPP is the first investment by China Three Gorges Corporation in Pakistan in renewable sector and the first hydropower funded and built by a Chinese company in Pakistan.
- The dam site controls the drainage area of 26,700km^2; having long term average runoff of 819m^3/s and long-term average annual runoff of 25.83 billion m^3. The project is a single power generation task hydropower complex, with reservoir’s Full Water Level (FWL) of 461m, reservoir storage at FWL of 152 million m3.
- In order to ensure the necessary reservoir balancing storage and safeguard the normal water intake to generate electricity, the sediment flushing outlets are arranged in the spillway near the power intake.
- Asphalt Concrete Core Rockfill Dam (ACCRD) has been proposed, which is more adaptable to the geological conditions, anti-seismic feature is better, the excavated materials can be used as dam construction material and the quantity demand for concrete aggregate is less.
- The ground powerhouse will avoid large cavern, geological risk is smaller, and the investment can be better controlled.
- The total duration of constructing of Karot HPP is 5 years (60 months). The period from the commencement of the project to the time when the installation and trial operation of the first unit is completed is 53 months. Defects Liability Period is 36 months.
- Critical paths would be the construction of ground powerhouse and unit installation during construction of the main project.
- Principal Features of the project include;
    - 95.5m high asphaltic core rockfill dam
    - Gated chute spillway on right abutment
    - Sediment flushing outlet incorporated within the spillway structure
    - 720MW power station
    - 4 hydropower tunnels and associated intake structure
    - 3 diversion tunnels

Paper: **ASSESSING IMPACT OF INFRASTRUCTURE ON PAKISTAN ECONOMY**

Author: **Mr. Muhammad Ali, Mr. Waheed Anjum**

Recommendations:

Physical infrastructure plays a vital role in economy of Pakistan. In this study, we have estimated to check the impact of physical infrastructure stock (electricity generation, telecommunications, water availability and road access) on real percapita GDP. The study shows that investment in power generation, telecommunications and availability of water for agriculture has significant role in economic growth of Pakistan. On the other hand, roads and highways have no significant impact on its economy although there is increase in its investment in PSDP over-time.

There is need of priority change diverting investment from other sectors toward power and agriculture water availability to increase economic growth of the country. There may be some impact in investing in railways and expansion of road network than development on motorways and expressways.

Further, we can infer from our estimation that infrastructure stock accumulation has positive impact on economic growth. A large investment is needed in electricity, telecommunication, transport and water supply to boost Pakistan economy. Demand for infrastructure will increase as due to increase in urbanization and CEPEC projects under consideration. Government has to take steps in priority sectors to be investing under PSDP. The major portion of investment is needed to be invested in power generation sector.

ROLE OF SEDIMENT FOR HILL TORRENTS MANAGEMENT IN D.G. KHAN AREA OF PUNJAB PAKISTAN

By:

Ghulam Zakir Hassan[1], Ghulam Shabir[2], Adnan Hassan[3], M. Shahzad Abdul Rahim[3] and Sumayya Noshin[3]

ABSTRACT

Sediment is a naturally occurring material that is broken down by processes of weathering and erosion, and is subsequently transported by the action of wind, water, or ice, and/or by the force of gravity acting on the particles. Hill torrent is a flash hill stream with steep slopes, prone to sudden surges of high volumes of water after rain in catchment area carrying high sediment loads. There are about 200 hill torrents- minor, medium & major, of which 13 are major, originate from Suleman Range and flow through D.G Khan and Rajanpur districts towards the River Indus. The catchment area of theses hill torrents is 11881 square miles. Velocity of hill torrent flood water varies from 6-8 ft/sec and discharge of more than 15000 cusecs. Four hill torrents viz Vidore, Mithawan, Kaha and Chachar in the Irrigation Zone have been selected for carrying out Sediment investigation required for feasibility of some storage structure to manage and use efficiently the water of hill torrents. Monsoon period from the start of August to mid of October field sampling have been carried out. The results indicate that more sediment/concentration was found at the center of hill torrents as compared to top and tail sites. It has also been found that sediment load increases with the increase in discharge/flow. Bed material is mostly found poorly graded sand with fines. The results have also revealed that average sediment loads of four hill torrents are 10.2, 24, 3.7, 9.8 at dam site and 34.8, 51.8, 5.8, 27.4 (Acre-Feet per square mile per annum) at Vidore, Mithawan, Kaha and Chacher respectively.

Key works: Sediments, Hill Torrents, Punjab, Pakistan

1. INTRODUCTION

Sediment is a naturally occurring material that is broken down by processes of weathering and erosion, and is subsequently transported by the action of wind, water, or ice, and/or by the force of gravity acting on the particles. The term torrent is utilized for water carrier channels carrying flash water flows; the term is mostly utilized for steep mountainous rivers generating rapid runoff. Locally these types of channels are termed as “Rodh Kohi”. The torrential area of Dera Ghazi (D.G.) Khan and Rajanpur Districts of Punjab province is situated between the Indus River and the Suleman range surrounded by province of Sindh, Baluchistan in the west and Khyber Pakhtunkhwa (KPK) in the North. About forty five percent of the total catchment areas lie in the two districts and the remaining 55% in the province of Baluchistan. The area in the west (on the right side of the Indus River) which is unirrigated by local canal Irrigation network is piedmont area locally known as "Pachad" area and is fertile due to unexploited sediment deposits of the mountains brought down with flood water. Pachad area is considered to be an area between

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darrah (the point after which torrent enters the plains) and the right bank of Indus River. The torrential area of the two districts consists of thirteen (13) major Hill torrents extending from Kaura and ending at Sori Janubi [7]. Hill torrent is a flash hill stream with steep slopes, prone to sudden surges of high volumes of water after rain in catchment area carrying high sediment loads. There are 200 hill torrents- minor, medium & major, of which 13 are major, originate from Suleman Range and flow through D.G Khan and Rajanpur districts towards the River Indus. Some features and details of hill torrents have been provided in Table 1.

Velocity of hill torrent flood water varies from 6-8 ft/sec. Hill Torrents having up to 5000 cusecs discharge are classified as minor, 5000 to 15000 cusecs as medium while over 15000 cusecs are major hill torrents. In DG Khan Zone, 13 are classified as major hill torrents having discharge over 15000 cusecs out of which seven major hill torrents are in DG Khan District and six in Rajanpur districts. Out of these thirteen, 4 hill torrents (Vidore, Mithawan, Kaha and Chachar) have been chosen where plan for the construction of Dam for capturing flood water is under process. The flood water brings high silt content in the plain areas and thus precluded flood management by dams or detention reservoirs. The silting and scouring phenomena are largely responsible for frequent changes in flow regime and shifting of flow paths of hill torrents.



Figure 1: Views of Kaha and Vidore Hill Torrents

2. MATERIALS AND METHODS

2.1 Study Area

The catchment area of the study hill torrents is about 2915 square miles. The area extends over a length of 360 Km (200 miles) from Ramak to Kashmore, while in width it varies from 25 Km to 40 Km. The area between the foot hills of the Suleman range from Ramak to Kashmore and Chashma Right bank Canal System and D.G Khan Canal System is locally known as Piedmont area. The hill torrents bring flashy floods of shorter duration and higher magnitude. Flood water from the hill torrents is used for irrigation with the piedmont area, through a network of diversion and dispersion structures. Geographically Suleman range lies between longitude 69^{o} 10' E to 70^{o} 49' E and serves as a divide line between KPK, Baluchistan and Punjab province. Climate of the area is arid. Rainfall varies between 125 mm to 375 mm (5-15 inches) and its distribution is uneven, erratic and patchy. Concentration of rain fall / precipitation is mostly in the month of July and August (monsoon period).

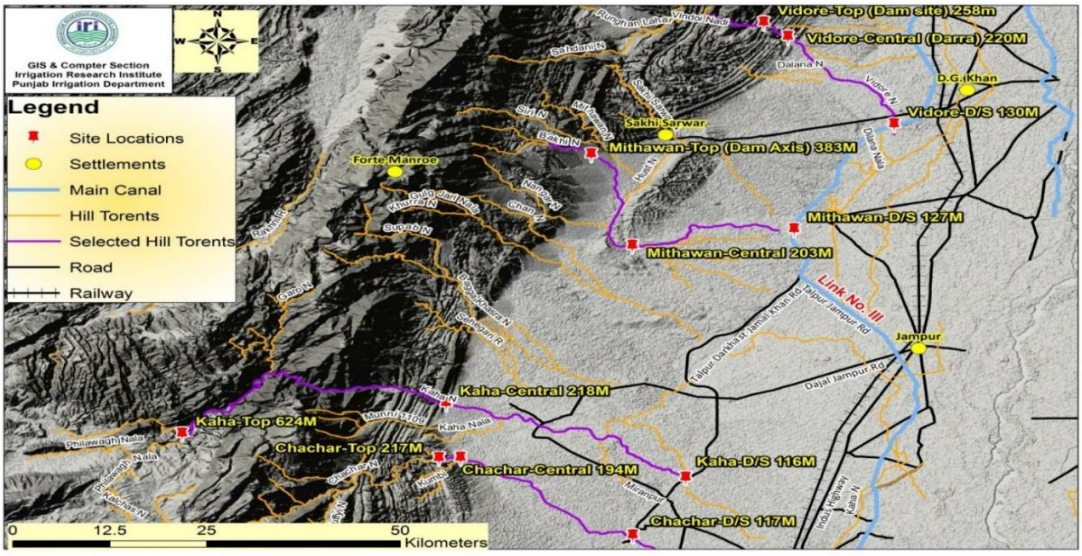


Figure 2: Location of sites of Hill Torrents of DG Khan Irrigation Zone

Table 1: Salient features of study Hill Torrents

Sr. No.	Name of Hill Torrent.	25/40 years return period discharge (Cfs)	Peak discharge (Cfs) (yr)	Catchment area. (Sq. Miles)	Cultivable area. (Acres)
1	Vidore	97000 (40)	14,5101 (2012)	292	32983
2	Mithawan	87000 (25)	61,905 (2010)	298	38000
3	Kaha	118,500 (25)	96,000 (2013)	2029	89581
4	Chachar	85,500 (25)	65000 (2013)	296	42253

Source: D.G. Khan Irrigation Zone

2.2 Field Survey and Investigations

Field surveys were carried out for observing the physical condition of the selected sites by IRI and ISRIP jointly. Two types of samples were collected from field and methodology adopted in field for sampling is described below.



Fig 3: Site Survey by IRI Teams

2.2.1 Suspended Sediment Sampling

Suspended sediment samples have been collected in sampling bottles from top and center of the hill torrents. Generally water does not reach at the tail sites. These collected samples then shifted to lab for sediment analysis.

2.2.2 Bed Material Sampling

Bed material samples have been collected randomly from different locations to determine the soil strata of the bed of the Hill Torrents, which were then packed in sampling bags and shifted to laboratory for Grain Size Distribution.

2.2.3 Ground water level Observation

Ground water levels have been measured at different locations from all Hill Torrents.

2.2.4 Ground water Sampling

Ground water samples have been collected from different water sources (hand pumps, lalpumps and turbines) in sampling bottles for checking the ground water quality.



Fig 4: Sampling of Suspended Sediment

2.3 Laboratory Investigations

The sediment samples were collected from Hill Torrents of DG Khan Irrigation Zone and analyzed in the laboratories of Physics Directorate of IRI Lahore.

2.3.1 Suspended Sediment Analysis (Sieve-Pipette Analysis)

The pipette method of determining particle size gradation for sizes finer than 0.062 mm is one of the most widely accepted techniques utilizing the Oden theory and the dispersed system of sedimentation. The upper size limit of sediment particles which settle in water according to Stokes law and the lower limit which can be determined readily by sieves is about 1/16 of 0.062 mm. This size is the division between sand and silt and is an important division in many phases of sediment transport phenomena.

The fundamental principle of the pipette method is to determine the concentration of a suspension at a predetermined depth as a function of settling time. Particles having a settling velocity greater than the size at which separation is desired will settle below the point of withdrawal after elapse of a certain time. The time and depth of withdrawal are predetermined on the basis of Stokes Law. There are Standard times and depths of withdrawal to determine the concentrations finer than each of six size increments from 0.002 mm to 0.062 mm at a particular temperature. Values are given for the standard depths of withdrawal of 10 cm for the 0.062 to 0.008 mm sizes, 5 cm for the 0.004 mm size, and 3cm for the 0.002 mm size.

Table 2: Time of Pipette withdrawal for given temperature, depth of withdrawal and diameter of particles.

Diameter of particle (mm)		0.031	0.016	0.008	0.004	0.002
Depth of withdrawal(cm)		10	10	10	5	3
Time of withdrawal		(Min.sec)	(Min.sec)	(Min.sec)	(Min.sec)	(Hr. Min)
Sr. No.	Temperature (ºC)					
1.	20	1.55	7.40	30.40	61.19	2.27
2.	21	1.52	7.29	29.50	59.50	2.24
3.	22	1.50	7.18	29.13	58.22	2.20
4.	23	1.47	7.08	28.34	57.05	2.17
5.	24	1.45	6.58	27.52	55.41	2.14
6.	25	1.42	6.48	27.14	54.25	2.11
7.	26	1.40	6.39	26.38	53.12	2.08
8.	27	1.38	6.31	26.02	52.02	2.05
9.	28	1.35	6.22	25.28	50.52	2.02
10.	29	1.33	6.13	24.53	49.42	1.59
11.	30	1.31	6.06	24.22	48.42	1.57

2.3.2 Grain Size Distribution

Purpose of this test is to determine the Grain Size of bed material of Hill Torrents. This test has been performed using **ASTM D 421- 58(1965) & 422- 63 (1963)** standard. Unified Soil Classification System is for the description of classification of the bed material.

3. RESULTS AND DISCUSSION

The results of Suspended samples analysis indicate that sediment load is minimum at Kaha Hill Torrent, while maximum is found at Mithawan Hill Torrent. The results also indicate that more sediment/concentration was found at the center of hill torrents as compared to Top sites.

3.1 Suspended Sample Analysis.

Table. 3: Summary of Results of Suspended Sediment Samples

Sr. No.	Name of Hill Torrent	Location	No. of Samples collected	Catchment Area (Sq. Mile)	Average Discharge	Average Concentration of sediment (ppm)	Average Sedimentation Load (tons/day)	Average Sediment load (Acre. Ft per square mile per annum)
1.	Vidore	Dam Axis/Top	4	282	1021	42164	108794	10.2
		Hill Torrents/Centre	18	292	5006	25137	381280	34.8
2.	Mithawan	Dam Axis/Top	10	40	924.5	14922	36001	24
		Hill Torrents/Centre	12	248	3551	39997	241677	51.8
3.	Kaha	Dam Axis/Top	25	1968	2994	15806	701702	3.7
		Hill Torrents/Centre	31	2029	4496	16835	482504	5.8
4.	Chachar	Dam Axis/Top	2	296	3000	13387	108435	9.8
		Hill Torrents/Centre	15	296	3455	32428	303950	27.4

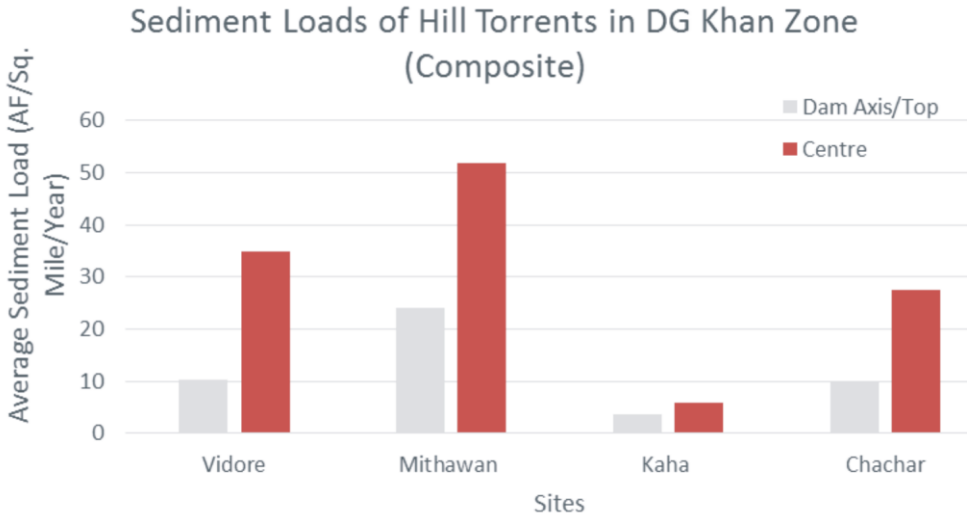


Figure 5. Average sediment load at different sites.

3.2 Bed Material Analysis

Bed material samples collected randomly from different areas of four hill torrents are analyzed and their results are described in Table 4 and sample gradation curves have been shown in Figure 6.

Table 4. Results of bed material analysis.

Sr. No.	Name of Hill Torrent	%age Gravel	%age Sand	%age Silt	%age Clay	Description of Type of sample (USCS)
1.	Vidore (Top)	-	93.6	6.4	-	(SP-SM) Poorly-graded sand with silt, fine with medium
2.	Vidore (Centre)	0.2	80.6	19.2	-	(SM) Silty sand, fine
3.	Vidore (Tail)	-	95.2	4.8	-	(SP) Poorly-graded sand, fine
4.	Mithawan (Top)	15.6	84.0	0.4	-	(SP) Poorly-graded sand with gravel
5.	Mithawan (Centre)	9.6	85.4	5.0	-	(SP-SM) Poorly-graded sand with silt, fine to medium
6.	Mithawan (Tail)	4.4	80.4	15.2	-	(SM) Silty sand, fine to medium
7.	Kaha (Top)	2.8	95.4	1.8	-	(SP) Poorly-graded sand, fine to medium
8.	Chachar (Top)	0.4	99.0	0.6	-	(SP) Poorly-graded sand, fine to medium

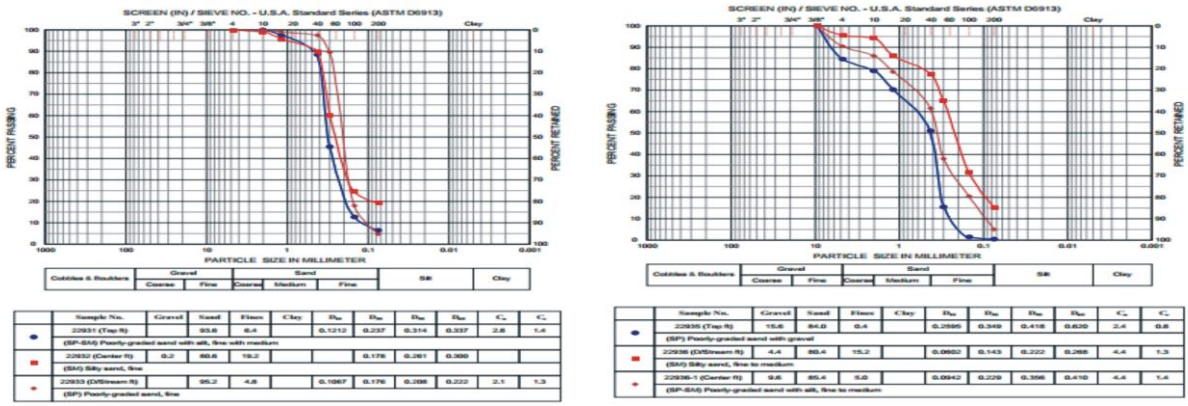


Figure 6. Gradation curves of bed material collected from Vidore and Mithawan Hill Torrents

3.3 Ground Water levels

Ground water levels were observed at different points in the study area. Contour of Groundwater Level in Hill Torrents of DG Khan are shown in Fig. 7.

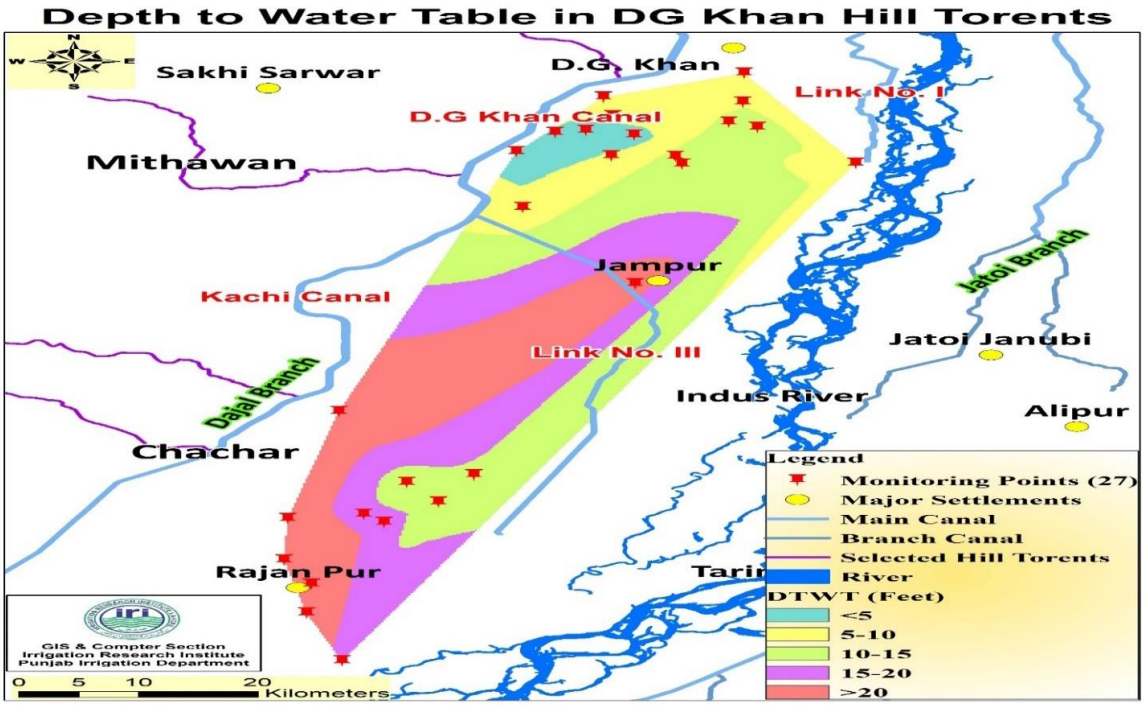


Fig 7: Contours of depth to ground water table

Ground water levels were observed at 27 locations in the study area. The results of depth to water table in these 27 points are shown in Table 5.

Table 5: Ground Water Levels

Sr. No.	GWL RANGE (FT)	No. of Points	Percentage %
1	0-5	4	15
2	5-10	7	26
3	10-15	7	26
4	15-20	3	11
5	20-30	6	22

3.4 Groundwater quality in Hill Torrents of DG Khan

Total 62 ground water samples were collected from different sources and were analyzed to check the ground water quality, out of which 13 points are found to be fit for irrigation purpose, 7 are found to be marginally fit, whereas 42 points are found unfit for irrigation purpose. Locations and results of groundwater quality have been depicted in Figure 8. While standard values and results have been tabulated in Tables 6 and 7 respectively. Standard values and Ec results are given in Tables 6 and 7.

Table. 6: Standard values of Irrigation Parameters and Limits of Water

Sr. No.	Parameter	Limits Range	Remarks
1.	pH	6.0-8.5	Fit
2.	E.C	0-1000	Fit
		1000-1250	Marginal Fit
		>1250	Unfit
3.	Chloride	4.5 me/l	Fit
4.	Residual Sodium Carbonate (RSC)	<1.25	Fit
		1.25-2.50	Marginal Fit
		>2.50	Unfit

Ref: Agricultural Hand Book 60

Table 7: Ground Water Quality

Parameter	Status	No. of Points	Percentage (%)
EC	Fit	13	21
EC	Marginal Fit	7	11
EC	Unfit	42	68

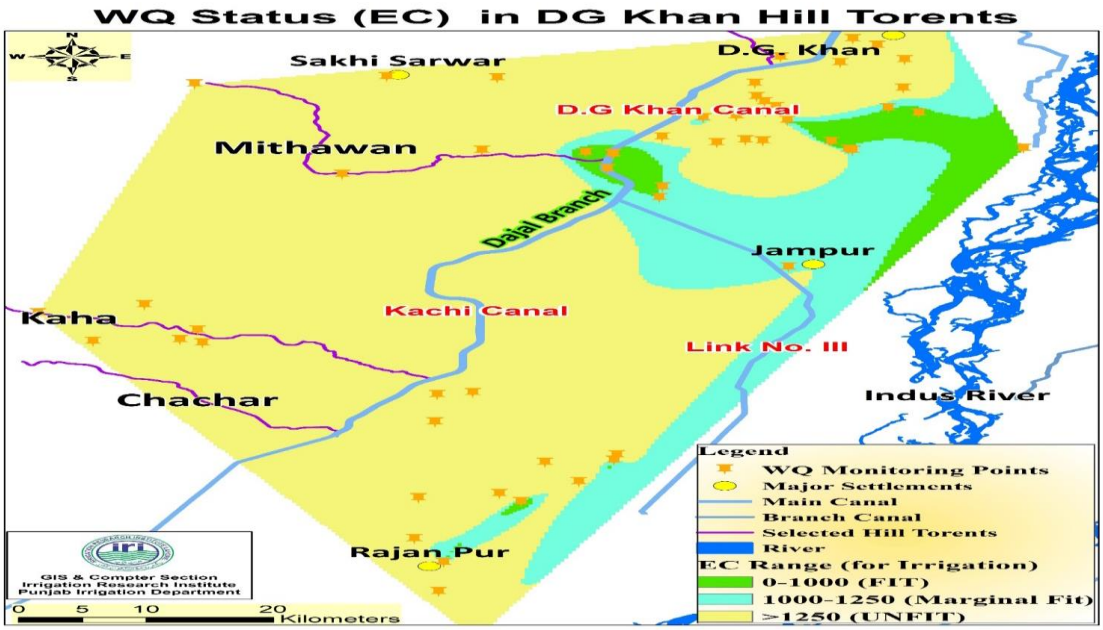


Figure 8: Contours of Ground water Quality (EC) in Hill Torrents of DG Khan

4. CONCLUSIONS AND RECOMMENDATIONS

4.1 Conclusions:

Overall results reveals that sediment load at dam axis is less as compared with central point which means as the water flows out of dam axis it carries more sediment from the flow path. Average sediment loads of four hill torrents are 10.2, 24, 3.7, 9.8 at dam site and 34.8, 51.8, 5.8, 27.4 (Acre-feet per square mile per

annum) at Vidore, Mithawan, Kaha and Chacher respectively. Maximum sediment load has been found at Mithawan Hill Torrent (center), while minimum is observed at Kaha Hill Torrent (Dam Axis) among all twelve sites. It has also been found that sediment load increases with the increase in discharge/flow. Bed material is mostly found poorly graded sand with fines.

Ground water level is generally found in the range of 5 to 25 ft. Groundwater quality in the study area is generally brackish. Surface flowing water has been randomly checked and found mostly fit for irrigation purpose.

5. Recommendations

It is proposed that detailed investigation of catchment areas of all four hill torrents may be got carried out with respect to hydrology, geology, vegetated cover, geophysical and geochemical investigations. Sediment and other studies may be got carried out over the whole period for 2 to 3 rainy seasons. As per visual observations and analysis of sediment samples, Kaha Hill Torrents seems better option as compared with other sites under investigations. However other parameters and further detailed investigations from different angles need to be carried out for feasibility of a water storage structure. Water shed management can be adopted as an intervention for construction of storage structure for management of Hill Torrents.

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TRACKING GROUNDWATER FROM SPACE: AN APPROACH TO EXPLOIT SATELLITE REMOTE SENSING TECHNOLOGY FOR GROUNDWATER MONITORING IN PAKISTAN

By:

Naveed Iqbal, Ashfaq A. Sheikh, Muhammad Ashraf & Faizan ul Hasan

Abstract

The proper management of groundwater aquifers is important for agricultural sustainability in the exploited basins such as the Indus basin of Pakistan. The frequent and accurate information related to spatial changes in groundwater storage and its long-term system behavior provides the basis for effective management of this vital resource. The NASA's Gravity Recovery and Climate Experiment (GRACE) and Variable Infiltration Capacity (VIC) simulated soil moisture and surface water fluxes from 2003-2010 have been used to extract monthly groundwater storage (GWS) anomalies. The satellite based monthly GWS anomalies are found in good agreement with piezometric observed data in terms of levels as well as groundwater trends. This methodology provides the spatial quantification (10 km x 10 km) of groundwater abstraction patterns and identification of groundwater vulnerable areas at monthly scales which can be used for groundwater management. With the added advantage of free and frequent availability of satellite information, this methodology augments the existing groundwater monitoring mechanism in Pakistan.

Keywords; GRACE, Remote Sensing, Pakistan, Bari Doab, Groundwater

1. Introduction

The groundwater aquifers are the sources of regular groundwater supply to maintain agricultural productivity in the developing countries where, surface water resources are insufficient to meet the annual demands. Apart from other reasons, the leverage to pump groundwater of any desirable quantity is the major reason for the farmers to prefer groundwater pumping in Indus Basin of Pakistan. With more than 60% contribution, the dependency of agricultural productivity has shifted from surface water to groundwater resources. The unregulated and indiscriminate groundwater pumping through ever increasing number of private tubewells reaching to over 1.2 million (Punjab Development Statistics, 2012), is a major concern for policy makers towards the sustainability of groundwater dependable agriculture in Pakistan. The over drafting of groundwater has not only made the groundwater pumping uneconomical but causing severe groundwater depletion in many areas of Punjab Province. In addition to groundwater depletion, the groundwater quality is another area of immediate consideration in Indus Basin (Qureshi et al, 2010). The groundwater quality is quite variable both in time and space (Bashart and Tariq, 2013). Due to marine geology, the groundwater in Indus Plain is natively saline (Ashraf et al, 2011). Over the time, a fresh layer of groundwater has developed as a result of recharge from irrigation system and rainfall.

Under such scenario, the assessment of available fresh groundwater resource and its proper monitoring is critically important for sustainable groundwater management. The efforts of both quantitative and qualitative assessment of available groundwater resource were started back in 1980s. The United States Geological Survey (USGS)

and Water and Power Development Authority (WAPDA), Pakistan conducted groundwater investigations and completed the groundwater mapping work by preparing depth to water tables and salinity maps. They also performed pumping tests and delineated aquifer properties. Later, Scarp Monitoring Organization (SMO), WAPDA was setup for the proper monitoring of groundwater in Punjab Province through. SMO has installed a piezometric network in all canal command areas. The depth to water table data and water quality samples were collected during pre-monsoon and post-monsoon period manually. Since long, these biannual readings have been used for the analysis of groundwater trends. The groundwater modeling is another tool used for groundwater system analysis and prediction of future scenarios. This tool is quite useful for accurate assessment of groundwater system and devising appropriate management strategies. However, the extensive input data requirements limited its applicability for doab or basin scales implementations. In past, many researchers applied various groundwater models (Ashraf and Ahmed, 2008; Khan et al, 2010; Basharat and Tariq, 2013; Awan et al, 2014) but the work is in bits and pieces and doesn't provide a holistic picture. PCRWR conducted a complete doab scale assessment of groundwater resources by adopting and integrated methodology consisting of geophysical, groundwater modeling and isotopic techniques (Khan et al, 2016). However, such type of integrated methodology is not economically effective for continuous monitoring due to the involvement of extensive field surveys and ancillary data collection. Therefore, there is a need to explore some other viable and economically suitable techniques and methodologies. The satellite remote sensing has emerged as new scientific tool for water resource assessment and planning. Many studies have demonstrated the potential of GRACE satellite based groundwater monitoring (Rodell et al, 2009; Famiglietti et al, 2011; Scanlon et al, 2012; Chen et al, 2014; Long et al, 2015). The effective monitoring is critically important for proper management of groundwater resources. The implementation of any well documented regulatory framework is not successful until and unless a sound measurement or monitoring mechanisms are not in practice.

2. Groundwater Regulation in Pakistan

The sustainable groundwater management requires twofold strategy which includes; implementation of groundwater regulation and effective monitoring mechanism. The Punjab Irrigation Department (PID) is mandated for surface water and groundwater resource management in Punjab Province. With realization of this critical situation, PID has recently drafted a groundwater act which covers; protection, regulation and development aspects of groundwater management. It is a timely taken good initiative but, just a first step. However, the effective groundwater regulation requires proper assessment of available resource and establishment of strong groundwater monitoring systems in practice. Instantly, the biannual groundwater monitoring through piezometric network is ineffective to determine the groundwater system behavior and designing of subsequent management approaches. The manual recording of biannual water table fluctuations is insufficient and not a reliable information for long-term basin level policy formation (Iqbal et al, 2017). Under such scenario, a very robust and accurate system of groundwater monitoring is essential.

3. Role of PCRWR

Pakistan Council of Research in Water Resources (PCRWR) is an apex national water resources research organization working under Ministry of Science and

Technology (MoST). PCRWR is mandated to conduct, organize, coordinate and promote research on all aspects of water resources including surface and groundwater management. Being a premier S&T organization of MoST, the focus of PCRWR is first piloting of new innovative tools and technologies and then its transfer to relevant stakeholders at national and provincial level. PCRWR believes that the capacity building of provincial relevant departments such as irrigation and agriculture is the real game changing step. If the provincial partners are well equipped with updated knowledge, it impacts to change the situation on ground easily. PCRWR envisages that the solution of complex challenges need long term stakeholder engagement rather than traditional approach. It is an innovative approach which helps to create a friendly and trust building environment where technology transfer becomes more effective. PCRWR values its provincial partners and maintains a close liaison with them. Infact, PCRWR is bridging the capacity gaps by linking the provincial partners with internationally conducted research for sustainable water resource management in the country. PCRWR is piloting a number of water conservation tools and technologies through its active collaboration with multi-dimensional internationally reputed partners. The satellite based groundwater monitoring and irrigation advisory service are the two recent initiatives of PCRWR.

4. Groundwater monitoring through Space

Being a national water resources research organization, PCRWR has recently developed an algorithm for satellite based groundwater monitoring in Pakistan. It is a joint initiative of PCRWR and University of Washington (UW), USA where the organizational capacity has been developed under a National Aeronautics and Space Administration (NASA) funded project in 2015. Over the time, the technological development in the field of satellite remote sensing has become possible to track groundwater storage changes from space. Gravity Recovery and Climate Experiment (GRACE) satellite was jointly launched by German Space Agency and NASA in 2002. GRACE is basically a gravity satellite which is capable to sense gravitational anomalies globally at 10 daily to monthly scale. The gravity is a product of mass distribution. Hence, variations in densities over the earth surface result changes in gravity. These precisely measurements of gravity changes (anomalies) are then further processed to infer total water storage (TWS) anomalies at 1˚ x 1˚ grids. These changes in TWS are extracted from gravity data by subtracting the average gravity of earth and are termed as “anomalies”. The TWS anomaly is the function of changes in water cycle. The changes in any component of water cycle covering from glaciers to groundwater storage, impact the variations in TWS anomaly over any area. To infer groundwater storage (GWS) anomalies, the information pertaining to other components of water cycle such as soil moisture and surface water fluxes is required (Iqbal et al, 2016). This information is either gathered from hydrological models or field observations. For this purpose, Variable Infiltration Capacity (VIC) model developed by University of Washington, USA has been applied for the simulation of daily soil moisture and surface runoff fluxes in Indus Basin. By using numerical downscaling technique, the resultant GWS anomalies are achieved at 0.1˚x 0.1˚scale which showed a good agreement (93% correlation) with piezometric point measurements in Bari doab (Fig.1).

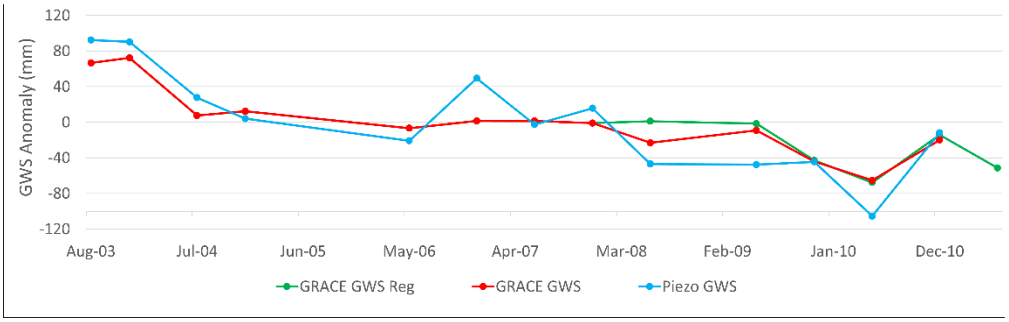


Figure 1: Comparison of GRACE based GWS with piezometric GWS in Bari doab (Iqbal et al, 2017)

The advantage of this downscaling is to empower the doab scale operational groundwater monitoring in Pakistan. The four doabs (Thal, Chaj, Rechna and Bari) are the effective groundwater management units in Punjab Province. As compared to existing manually piezometric monitoring of groundwater, this new satellite based methodology is very cost effective, reliable and robust. The big advantage of this methodology is that GRACE satellite data is totally freely available on monthly scale. The only requirement is capacity building for data processing and interpretation. By using this technique, monthly scale monitoring of groundwater is easily passible with limited investment of resources. Another added advantage of this technique is the provision of output as a spatial map which helps in pinpointing the critical areas as well as decision making to devise appropriate management strategies. The Fig. 2 shows the monthly picture of groundwater storage anomaly for the month of April, 2017 where most of the areas of Upper Indus Plain are under negative anomalies due to excessive pumping for agricultural requirements. It is basically a post monsoon period where pumping exceeds the recharge. The areas of lower Thal, Chaj and Rechna and whole Bari doab are under moderate to severe groundwater depletion. Therefore, there is need to control pumping with enhancement of groundwater recharge.

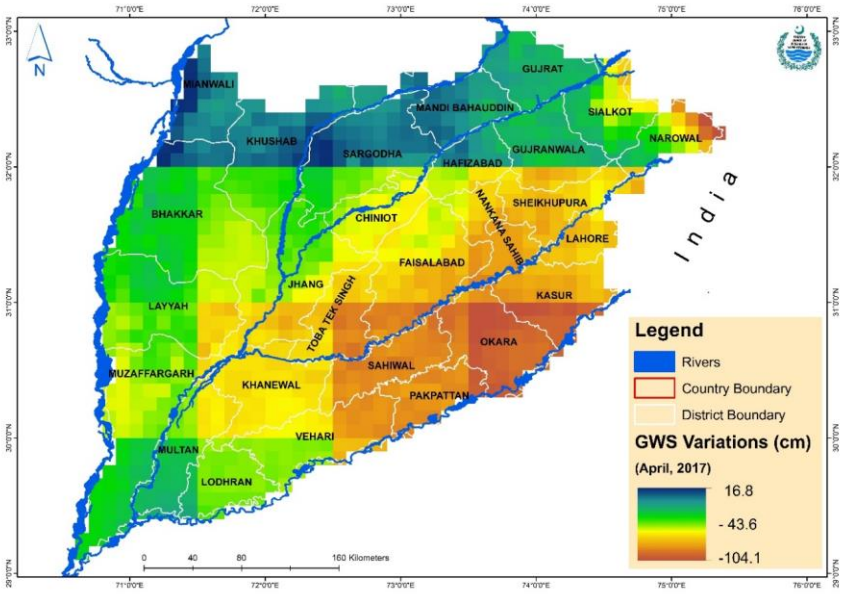


Figure 2: Groundwater storage variations in Upper Indus Plain during April, 2017.

5. Organizational Capacity Building

For sustainable water resource management, the capacity building of line departments is critically important. As per its mandate, the promotion of latest scientific tools and related updated knowledge is the primary focus of PCRWR. Presently, PCRWR is actively involved in capacity building efforts and conducted a number of programs for various national and international departments. Recently, PCRWR has established a National Capacity Building Institute (NCBI) funded by KOICA-Korea. PCRWR intends to launch a nation-wide capacity building programs for water professionals and NCBI will act a pivotal role for the promotion of new cost effective technologies in future.

It is fact that the adoption of any new technology is a time taking process. Therefore, a step approach is required to be followed for the successful adoption of satellite based groundwater monitoring. This approach consists of; awareness, trust building and practical adoption. Since 2015, PCRWR is working parallel on first two stages where the awareness and demonstration efforts are being initiated through presentations at various provincial and national forums. After drafting of Groundwater ACT, PID is found very keen in the adoption of satellite based groundwater monitoring in Punjab.

6. Conclusion and Recommendations

The satellite based groundwater monitoring is an effective tool for basin wide assessment of groundwater system behavior and its dynamics. At present, it is quite suitable for Bari doab where it has shown a good agreement (93% correlation) with piezometric data. It is envisaged that GRACE based methodology will further strengthen the groundwater monitoring which is essentially required for the successful implementation of groundwater regulatory framework in Punjab Province.

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QUALITATIVE ASSESSMENT OF INDUSTRIAL AND MUNICIPAL POLLUTANTS OF RACHNA DRAINAGE SYSTEM, SHEIKHUPURA

By:

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ABSTRACT: *The Punjab Irrigation System is unique in the world which consists of rivers, Head-Works, Link Canals, Canals, Distributaries and Minors meant for irrigating the farmer's fields which is interalia linked with a subsequent network of a parallel Drainage System originally constructed to meet agricultural drainage, counter the problem of water-logging and to drain off surplus irrigation as well as flood water. Unfortunately, due to various factors, this drainage water carries an additional load of untreated effluents having Industrial and Municipal origin. Rachna Drainage Division, Sheikhupura was selected as a Study Area for monitoring and accessing its environmental implications. A total of 105 samples were collected from various industrial, municipal and ground-water sources which were analyzed as per Irrigation and Environmental Parameters. The present paper gives an analysis of 28 number samples collected from the outlets having industrial and municipal origin discharging their effluents into the Sheikhupura Drain. The analytical data reveals that they are unfit as per Punjab Irrigation Parameters as well as FAO (Food and Agriculture Organization) and WHO (World Health Organization) Guidelines.*

Key Words*:* Contamination, Drains, Irrigation Parameters, Minors, Rachna Doab, Rachna Drainage System, Sheikhupura Drain.

INTRODUCTION

Irrigation Network of Punjab is one of the largest interlinked system in the world comprising an adjacent and extensive drainage network designed for draining/disposing of surplus water emanating from agricultural run-off, water-logging, vertical drainage, seepage and storm water etc. Due to unplanned urbanization, rise in population, increase in industrialization and lack of proper planning, these drains also carry an additional load of industrial as well as municipal effluents. The seepage and seepage-cum-storm-water drains are undergoing a process of decline and degradation in Pakistan primarily due to untreated industrial and sewage waste. It is worth mentioning that more than 85% of samples were found to exceed permissible limits from municipal and industrial origin alongwith agricultural runoff which can also be a major source of biological contamination (WHO, 1993, Afzal, 2000 and Kahlown, 2006).

A contaminant has been defined by the Safe Drinking Water Act, 1974 of the United States of America as any physical, chemical, biological, or radiological substance in water, Freeze and Cherry (1979) define it any solute introduced into the hydrological environment because of human activities whereas the Punjab Irrigation Department (SEMU, 2007) outline it as any compound polluting the surface as well as

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groundwater. These contaminants reach below the root-zone through macro-pores of soil in a few minutes when water is applied to the surface of the soil which after degrading the sub-surface soil contaminate the groundwater as well (Afzal, et al. 1998a). World Health Organization (2008) has also warned against the risks of mixing of drain-water with fresh groundwater where pipes carrying drinking-water pass through these drains.

Sheikhupura District in Punjab, Pakistan was selected for carrying out sampling of industrial effluents being discharged into the Rachna Drainage System, Sheikhupura. The present Study relates specifically to Sheikhupura Drain which travels all along the Sheikhupura-Faisalabad Road. The total length of Sheikhupura Drain is 35.1 Km having a maximum discharge of 11.4 m^3 (400 Cusecs). Its maximum F.C.D (Full Capacity Discharge) is 0.15 m^3 (5.4 Cusecs) with a catchment area of 259 Km^2. Sheikhupura Drains outfalls into the left bank of Mangoki Drain at RD: 1300. The present study was initiated in order to assess the quality of effluents falling in the Sheikhupura Drain from industrial and municipal sources, the impact created by these discharges on the characteristics of water of Sheikhupura Drain, its effluents impact on the aquifer and soil strata and monitoring the environmental hazards in the adjoining area of the Sheikhupura Drain.

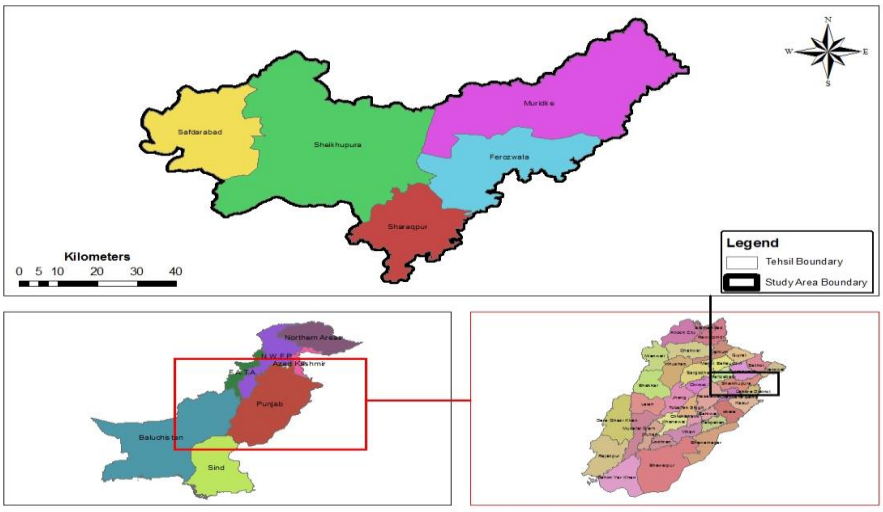


Figure 1: Location Map of Rachna Doab, District Sheikhupura

The present Study relates specifically to Sheikhupura Drain which travels all along the Sheikhupura-Faisalabad Road. The total length of Sheikhupura Drain is 35.1 Km having a maximum discharge of 11.4 m^3 (400 Cusecs). Its maximum F.C.D (Full Capacity Discharge) is 0.15 m^3 (5.4 Cusecs) with a catchment area of 259 Km^2. Sheikhupura Drains outfalls into the left bank of Mangoki Drain at RD: 1300. The present study was initiated in order to assess the quality of effluents falling in the Sheikhupura Drain from industrial and municipal sources, the impact created by these discharges on the characteristics of water of Sheikhupura Drain, its effluents impact on the aquifer and soil strata and monitoring the environmental hazards in the adjoining area of the Sheikhupura Drain.

MATERIALS AND METHODS

Total 42 sites were visited from where 28 Samples were taken - 2 Samples were of Ground Water, 2 having Municipal background whereas 24 Samples were taken

from different industrial outlets, majority of which were Textile Industries and Paper and Board Mills. The samples of 14 No. industries could not be taken because many of them were closed, under-construction, outlets not available while some were using their effluents for irrigating crops planted within their premises. Samples were collected by using 1.5 liter capacity Polystyrene bottles and Geo-spatial coordinates were also recorded at every sampling site (Fig 2).

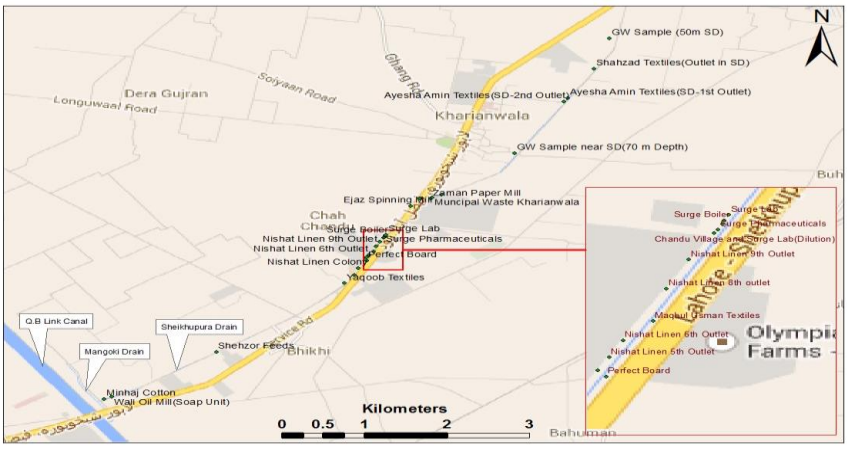


Figure 2: Location of Sampling Sites in the Study Area

RESULTS AND DISCUSSION

Many of our environmental problems are primarily problems of human behavior (Larry and Lee, 1972). Due to the presence of untreated industrial and sewage waste in seepage and seepage-cum-storm-water drains in Pakistan plus adding the fact that good quality water is scarce, water of marginal quality of drains has to be considered for use in agriculture (Haq et al., 1997). As the year 2000 has been taken to indicate water scarcity, it will not be out of place here to state that the under discussion Sheikhupura Drain, polluted with industrial and municipal waste, is not only infecting the ground-water, spoiling adjacent soils, endangering the ecological balance but its water as utilized by farmers in order to boost their agriculture produce has long-term effects. Major cations like Na, K, Ca and Mg and anions like CO_3, HCO_3, Cl and SO_4 and even the toxic materials present in a waste-water drain might be gainful in promoting micro- or macro- organisms of malicious possibilities (Pescod, 1992). Moreover, these pollutants cause numerous health problems ranging from physiological diseases to neurological disorders (Punjab Irrigation & Power Department, 2009).

The samples were analyzed with respect to Irrigation Parameters and other physico-chemical indicators as per criteria mentioned in (IPD, 2009; PCRWR, 2006; Tripathy and Govil, 2001; USDA,1954; USEPA, 1987 and WHO, 1993;) (Fig 3):

i. Nascent Hydrogen or pH

The general range of pH lies in between 5.74 to 9.51 which belong to Nishat Textile Mills (9^{th} Outlet) and Wali Oil Mills respectively whereas rest of the samples fall within safe limits as far as pH is concerned.

ii. Electrical Conductivity (EC)

14 samples fall beyond the limit of 1.5 dS/m whereas the rest were within limits.

iii. Total Cations /Anions

Maximum value of Total Cations/ Anions was present in Ground Water Sample near Sheikhupura Drain (70 Feet Depth) amounting to 43.7 meq/l whereas the minimum value was of Ayesha Amin Textiles 1st Outlet amounting to 6.4 meq/l.

iv. Sodium Adsorption Ratio (SAR)

It is calculated as per the following formulae:

$$SAR = \frac{Na}{\sqrt{\left(\frac{(Ca + Mg)}{2}\right)}}$$

The minimum value of SAR was 1.48 whereas the maximum was 17.54 belonging Municipal Waste Sample, Kharianwala and Ground Water Sample near Sheikhupura Drain(70 Feet Depth) respectively. 4 Samples were found unfit whereas 24 fit as per Irrigation Criteria.

v. Residual Sodium Carbonate (RSC)

It is a criterion used for measuring the fitness of a sample with respect to Irrigation purpose as per the following formula:

$$RSC = (CO_3 + HCO_3) - (Ca + Mg)$$

The values of RSC varies from 0 (Zero) to 23.4. Total 6 Samples were found fit while 22 determined unfit on the basis of Irrigation Standards.

vi. Total Dissolved Solids (TDS)

Maximum value of TDS is of Ground Water Sample near Sheikhupura Drain (70 feet depth) whereas the minimum value of TDS is of Ayesha Amin Textiles 1st Outlet amounting to 2624 mg/l and 422 mg/l respectively.

vii. Total Suspended Solid (TSS)

General range of TSS values lies between 0-13mg/l.

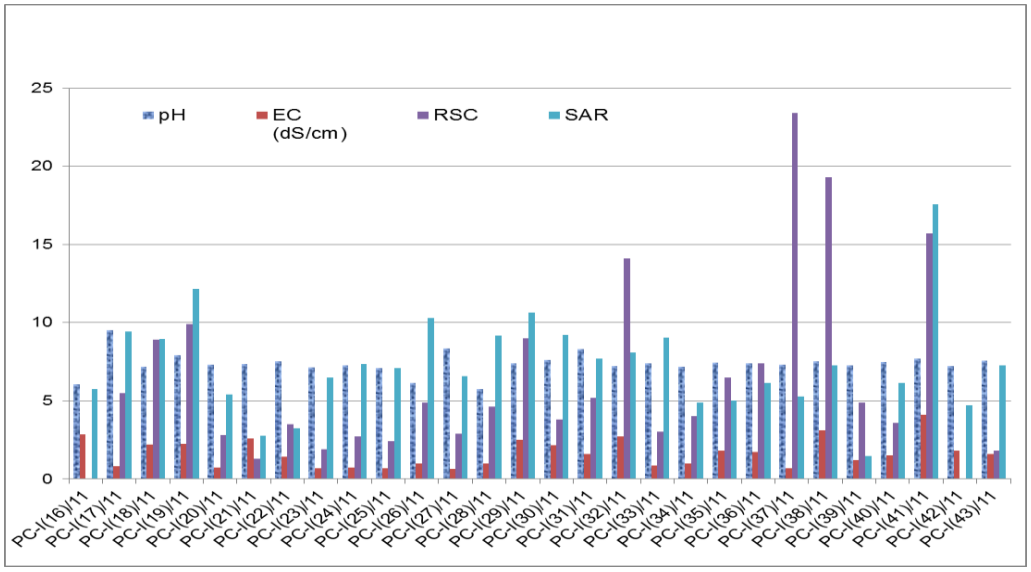


Figure 3: Composite Graph of Irrigation Parameters

Each in-question sampling site was physically checked for its outlet size and number of outlets whereas their quality was analyzed in the Chemical Section Laboratory of Directorate of Land Reclamation, Punjab as per Table-1.

Table-1 Qualitative Assessment of Industrial and Municipal Pollutants of Rachna Drainage System, Sheikhupura with Special Emphasis on Irrigation Parameters (Analysis with respect to Irrigation Parameters)

Sr. No.	Name of Unit	Outlet / Pipe Size	Lab No.	pH	EC (dS/cm)	Ca+ Mg	Na	K	CO 3	HCO3	Cl	SO_4	RSC	SAR	TDS	Total Cations	TSS mg/l
1	Minhaj Cotton	1.5'	PC-I(16)/11	6.04	2.83	9.9	12.8	0.7	0	2.9	20.5	6.1	0	5.75	1811	30	Negligible
2	Wali Oil Mill Soap Unit	1.0'	PC-I(17)/11	9.51	0.81	1.1	7	0.2	1.2	5.4	1.3	1.6	5.5	9.44	518	8.3	Negligible
3	Shehzoor Feeds	1.5'	PC-I(18)/11	7.18	2.2	6.3	15.9	0.6	0	15.2	3.7	4.9	8.9	8.96	1405	23.8	Negligible
4	Yaqoob Textiles	1.5'	PC-I(19)/11	7.92	2.25	5	19.2	0.8	0	14.9	5.1	4	9.9	12.14	1440	24	Negligible
5	DS Textile / Power	1.5'	PC-I(20)/11	7.32	0.73	1.3	5.8	0.1	0	4.1	1.5	1.7	2.8	5.41	473	7.3	12
6	Perfect Board	1.5'	PC-I(21)/11	7.33	2.6	9.8	13.5	0.4	0	11.1	12.9	3.4	1.3	2.75	1600	27.5	**13**
7	Maqbool Usman Textile (Old Name Crescent)	1.5'	PC-I(22)/11	7.54	1.4	4.9	9.5	0.2	0	8.4	2.5	3.7	3.5	3.22	896	14.6	8
8	Nishat Linen (Colony)	9"	PC-I(23)/11	7.11	0.7	1.5	5.6	0.1	0	3.4	1.3	2.5	1.9	6.47	448	7.2	Negligible
9	Nishat Colony(4th Outlet)	3'x2'	PC-I(24)/11	7.27	0.72	1.2	5.7	0.2	0	3.9	1.4	1.8	2.7	7.36	461	7.1	Negligible
10	Nishat Linen(5th Outlet)	2"x1"	PC-I(25)/11	7.1	0.7	1.3	5.7	0.1	0	3.7	1.2	2.2	2.4	7.07	448	7.1	Negligible
11	Nishat Linen(6th Outlet)	6"	PC-I(26)/11	6.13	1	1.3	8.3	0.3	0	6.2	1.9	1.8	4.9	10.29	640	9.9	Negligible
12	Nishat Linen(8th Outlet)	6" Culvert	PC-I(27)/11	8.32	0.65	1.2	5.1	0.03	0	4.1	1.5	0.9	2.9	6.58	416	6.5	2
13	Nishat Linen(9th Outlet)	4"x4" Culvert	PC-I(28)/11	5.74	1	1.6	8.2	0.4	0	6.5	2.1	1.6	4.6	9.17	640	10.2	Negligible
14	Chandu Village and Surge Lab(Dilution)	1'x2'	PC-I(29)/11	7.37	2.5	5.9	18.3	0.6	0	14.9	8.9	2.7	9	10.65	1600	26.5	Negligible
15	Surge Pharmaceutical (1st Outlet)	1'	PC-I(30)/11	7.6	2.14	6.2	16.2	0.2	0	10	5.9	6.7	3.8	9.2	1370	22.6	2.3
16	Surge Pharmaceutical (2nd Outlet)	4"x4"(2nd Outlet)	PC-I(31)/11	8.3	1.6	5.1	12.3	0.2	0	10.3	3.9	3.4	5.2	7.7	1024	17.6	1
17	Surge(Boiler)	6"	PC-I(32)/11	7.2	2.72	6.6	14.7	0.9	0	20.7	7.3	1.5	14.1	8.09	1747	29.5	Negligible
18	Surge(Lab)	6"	PC-I(33)/11	7.39	0.85	1.3	7.3	0.2	0	4.1	1.5	3.2	3	9.05	544	8.8	2
19	Ejaz Spinning Mills	6"	PC-I(34)/11	7.17	0.99	3.1	6.1	0.2	0	7.1	2.3	0.5	4	4.9	634	9.9	Negligible
20	Chenab Fabrics + Municipal Waste	1'x2'	PC-I(42)/11	7.21	1.82	8.8	9.9	0.6	0	8.3	3.7	7.3	0	4.72	1165	19.3	Negligible
21	Zaman Paper Mill	3'	PC-I(35)/11	7.44	1.8	5.2	8.1	0.6	0	11.7	7.6	0.2	6.5	5.02	1152	19.5	Negligible
22	Municipal Waste Kharianwala	2x4'	PC-I(39)/11	7.27	1.2	4.4	5.3	0.4	0	9.3	2.4	0.5	4.9	1.48	768	12.2	Negligible
23	Flying Craft Paper Mill	1.5'	PC-I(36)/11	7.37	1.7	4.6	9.3	0.6	0	12	3.6	2.2	7.4	6.13	1088	17.8	Negligible
24	GW Sample near SD(70'Depth)	Hand Pump	PC-I(41)/11	7.69	4.1	7.6	34.2	1.9	0	23.3	4.3	16.1	15.7	17.54	2624	**43.7**	**Nil**
25	Ayesha Amin Textile(2nd Outlet)	1'	PC-I(38)/11	7.52	3.1	6.3	22.8	1.4	0	23.6	8.7	2.7	19.3	7.24	984	35	Negligible
26	Ayesha Amin Textile (1st Outlet)	1'	PC-I(37)/11	7.29	0.64	1.6	4.7	0.1	0	25	2.2	1.7	23.4	5.25	422	**6.4**	3
27	Shehzad Textiles	1.5'	PC-I(40)/11	7.46	1.5	6.2	10.8	0.2	0	9.8	3.6	3.8	3.6	6.13	960	17.2	Traces
28	Groundwater Sample(50 m SD)	Hand Pump	PC-I(43)/11	7.55	1.6	5.2	11.7	0.3	0	7	3.9	6.3	1.8	7.26	1024	17.2	1

CONCLUSIONS

In view of the discussion above, it has been concluded that water quality of all the industrial effluents is unfit as far as Irrigation Parameters i.e. pH, EC, SAR and RSC are concerned. The frequent use of drain water for irrigation is deteriorating the soil fertility of the area. Aquatic life has been depleted from these Irrigation Channels (Drains) due to these unfit Industrial effluents. The Groundwater quality has also been deteriorated due to infiltration /seepage of untreated industrial wastewater into this Drain. The effluents having a lot of suspended solids in them are creating a lot of maintenance problems for the Drain. Apparently, the gravity of pollution does not seem significant due to the Dilution phenomenon but has long term effects as effluents having such high values of pH (5.74-9.51) and RSC (0-23.4) are constantly

being added into the Irrigation Drainage System which is ultimately seeped into the sub-surface strata.

Thus it can be concluded that untreated sewerage (industrial and municipal) being instilled into the irrigation channels is a bane for the crops, soil, groundwater as well as our health and hence this practice should be stopped forthwith.

RECOMMENDATIONS

Following recommendations are detailed for improving the quality of industrial effluents as well as municipal sewage being discharged into the drains so that minimum amount of hazard is done to the adjoining soil, sub-soil strata, groundwater, crops as well as to the our health:

The use of Drainage water for cropping by the farmer community without prior analysis should be strictly discouraged.

It must be made mandatory for the Industrial units discharging their wastes into the Irrigation Channels to install Primary and Secondary Treatment Plants into them.

The Factory owners should be asked to take necessary steps for improvement of general environment in and around their premises.

The Industrial and Municipal stake-holders may be asked to use Recycling Techniques before discharging their effluents into the Irrigation Drainage System.

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WATER AND ENERGY RESOURCES OF PAKISTAN

By:

Muhammad Suleman Khan (Chairman),
Shah Muhammad Mehdi Ata Ghazali Advocate (Sec. General)
SIND TAS WATER COUNCIL PAKISTAN[1]

ABSTRACT

There is little chance to give boost to the economic growth even with independent foreign policy when we are spoiling a huge quantity of water by falling it in the sea of the value of $ 70 billion every year. Each country has its own model of economic development & on that very basis the Building of Development plan is constructed. Singapore had the best geographical position in the middle of Pacific, Atlantic & Indian Ocean, utilized its geographical position, focused on shipping and today Singapore is a big mart of free trade in the world. State of Dubai had also centralized his geographical position in the middle of Asia, Africa and Europe, used its wealth of Oil to make infrastructure for a Trade City in the world, with much more budget than Pakistan.

Economy of Pakistan is Agro-based. More than 80% industries are based on Agro. Water procurement is not only necessary for agriculture, very important needs of raw material for industries as well as cheap electricity to be driven by the natural flow of the rivers. We have the hydro-electricity potential of one lac Mega Watt (MW) whereas WAPDA has made the feasibility for 60 thousands MW. But we are generating only 7,000 MW from hydel resources. It is also due to the differences within the provinces and due to which construction of Kalabagh Dam has been put in cold storage.

Outline

- Objectives
- Situational analysis
- Institutional priorities
- Action plan
- Way Forward

OBJECTIVES

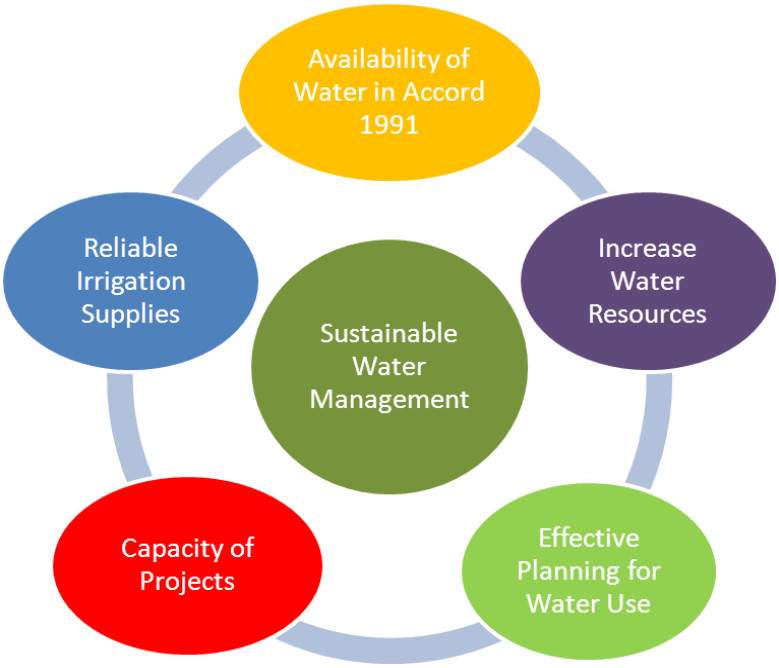
- UNITY FAITH & DISCIPLINE Only for the Nation
- Every drop of Water should be used
- Every inch of the land should be irrigated.
- Max generation of electricity through indigenous Resources.
- Vast network of value added industries
- Agriculture hub for QUALITY EXPORTS
- to ensure the development of all the PROVINCES

Vision: SUSTAINABLE WATER MANAGEMENT

- Availability of water in Accord
- Adequate, equitable, reliable irrigation supplies

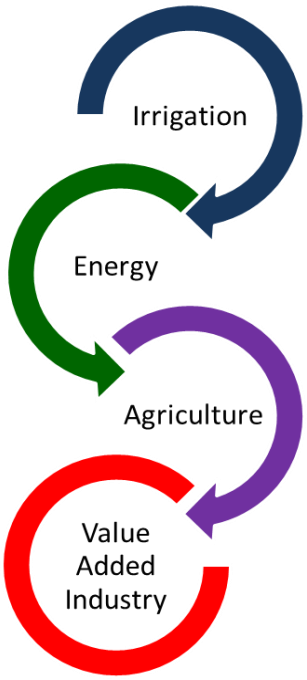
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- Capacity of Projects to Achieve productivity
- Increase in Water Resources

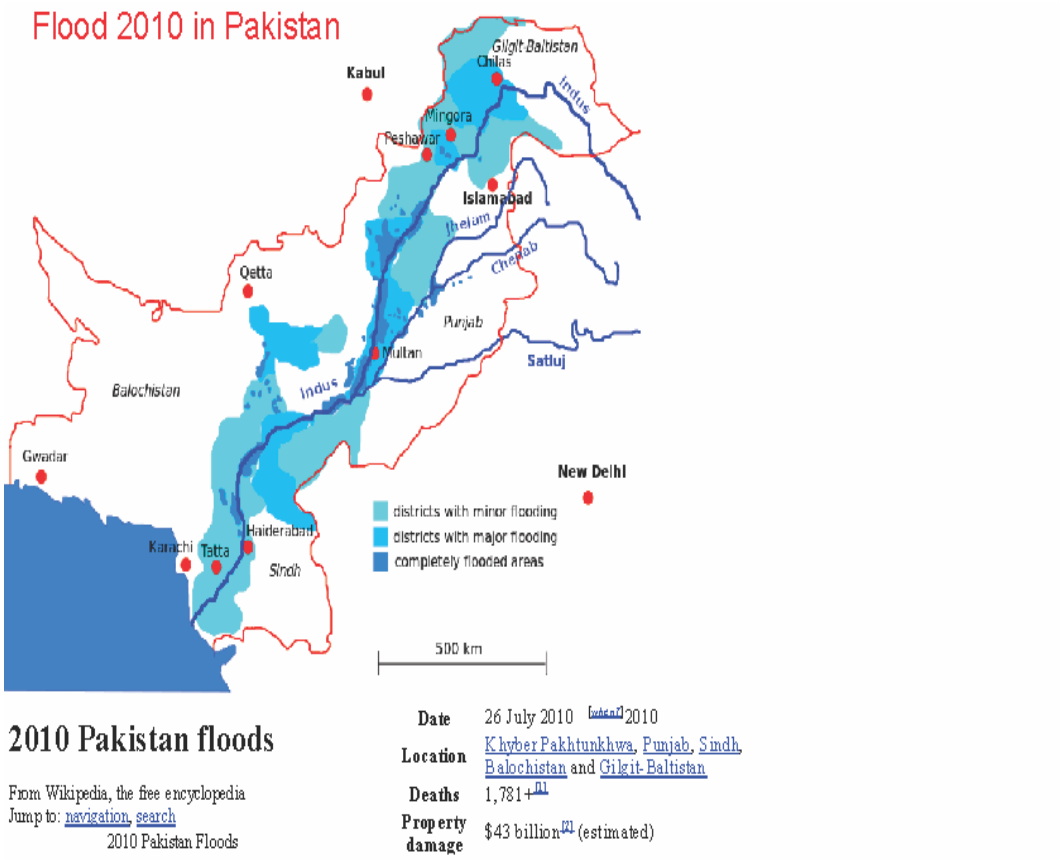


Role

- Indus System water shares
- Construction, maintenance and operation of irrigation infrastructure
- Basic and applied research in hydraulics, groundwater and land reclamation
- Storage of water, construction of reservoirs
- Electric Power Generation



EXAMINE THE LOSSES IN FLOOD 2010 DUE TO MISMANAGEMENT OF FLOOD CONTROL



Water Availability

After/Before Water Apportionment Accord 1991

PROVINCE	KHARIF (MAF)	RABI (MAF)	TOTAL (MAF)	TOTAL (MAF)
PUNJAB	37.07	18.87	55.94	54.49
SINDH	33.94	14.82	48.76	43.04
KHYBER PK	3.48	2.30	5.78	3.09
Civil Canals KPK	1.80	1.20	3.00	
BALUCHISTAN	2.85	1.02	3.87	2.11
TOTAL	77.34	37.01	114.35	102.73
Civil Canals KPK	1.80	1.20	3.00	

Water Availability from Kalabagh Dam (MAF)

Water Storage Capacity of Kalabagh dam	6.1	
Water Availability from Kalabagh dam	11.62	100%
Sindh Share	5.72	49.22%
Khyber Pk Share	2.69	23.15%
Baluchistan Share	1.76	15.15%
Punjab Share	1.45	12.48%

It is point to note, that as per Water Apportionment Accord 1991, surplus water should be shared between four provinces Punjab & Sindh 37% (each), Khyber Pk 14% and 12% Baluchistan but Punjab sacrifices its share.

Indus System Water Shares and irrigated Land

Let us see and examine the shares of water and its use within the provinces

Million Hectare (MH)

Province	Agriculture Land (MH)	Cultivated Area (MH)	Net Area Sown (MH)	Area Sown More than once (MH)	Total Cropped Area (MH)	Water Availability (MAF)
Punjab	14.57	12.50	11.00	6.13	17.13	54/49
Sindh	7.32	4.37	2.81	1.01	3.82	43.04
Khyber Pk	4.43	1.86	1.30	0.56	1.86	3.09
Baluchistan	7.34	2.05	1.13	0.07	1.20	2.11
Total	33.66	21.28	16.24	7.77	24.01	102.73

Source: Statistics Division, Federal Bureau of Statistics, Government of Pakistan, Islamabad

Availability of Water to Provinces before Water Apportionment Accord	102.73 MAF
Availability of Water to Provinces after Water Apportionment Accord	114.35 MAF
Increase in USEABLE WATER	11.62 MAF
Average Water Availability	140 MAF
Surplus Water	35 MAF
Punjab Average Share in Surplus Water	10.7 MAF

Situational Analysis

- High risk water environment
- System size
- Gross system constraints
- Supply constraints
- Organizational structure
- Financing & Planning

High risk water environment

- Pakistan lies in semi-arid zone, average annual rainfall is 240 mm
- Irrigation depends predominantly on single river system
- Per capita per annum water availability reduced from 5500m^3 in 1947 to <1000m^3 in 2013
- 67% rainfall occurs between July to September, correspondingly 70% of river discharge is received during this period
- Seasonal swells can lead to floods and accompanying losses
- Low water storage capacity, available canal water less than the share
- Unregulated pumping of groundwater to compensate shortage leading to aquifer degradation

System size

- World's largest contiguous gravity flow network
- 13 headworks, 55 small dams
- 23712 miles canal infrastructure
- 58000 outlets irrigating 20.78 million acres
- 2083 mile flood embankments, 640 river training works
- 4800 mile surface drains
- 19.32 million acre deserted land, 3.43 million acre in Punjab
- High rate of energy in the absence of hydel electricity (22%)

Gross System Constraints

- System designed for cropping intensity of 67%, present cropping intensity is 120-150%
- Supply driven system
- Emphasis on equitable distribution on basis of land holding rather than catering to demand for water
- Limitations imposed by Water Apportionment Accord

- Low storage capacity (30 days average flow), further reduced due to sedimentation
- Wastage of monsoon supplies (average 35 MAF per annum)
- Ignoring the construction of dams/reservoirs for water and cheapest electricity.

Important Note

Valley of the five rivers (Punjab) was known as the golden sparrow in the world due to its green economy. To make it a barren land, conspiracy started before the creation of Pakistan. To make differences between the provinces, the most important Kalabagh dam project is ignored. As the result of Indus Water Treaty 1960, the additional water drawn by the construction of Mangla and Terbela dam (about 6 MAF reservoir capacity) was given to other provinces and Punjab was totally ignored. Due to the extra ordinary use of water for agriculture in Sindh province. The below given table gives the use of water and irrigated land of the 4 provinces.

Indus System Water Shares and irrigated Land

in Million Hectare (MH)

Province	Agriculture Land (MH)	Cultivated Area (MH)	Net Area Sown (MH)	Area Sown More than once (MH)	Total Cropped Area (MH)	Water Availability (MAF)
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Organizational needs

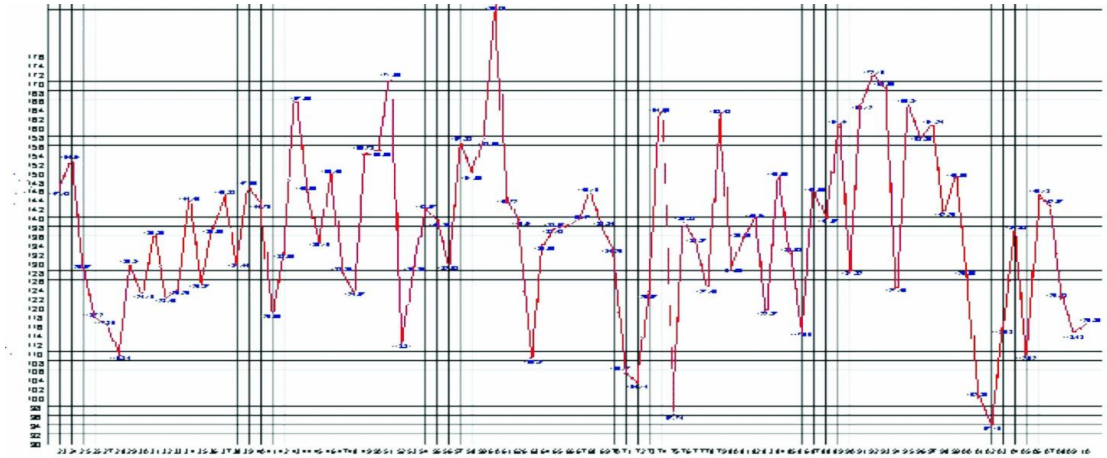
Availability of ‘water at

Bhasha 50 MAF

Terbela 60 MAF

Kalabagh 90 MAF

Water Availability from 3 Western rivers



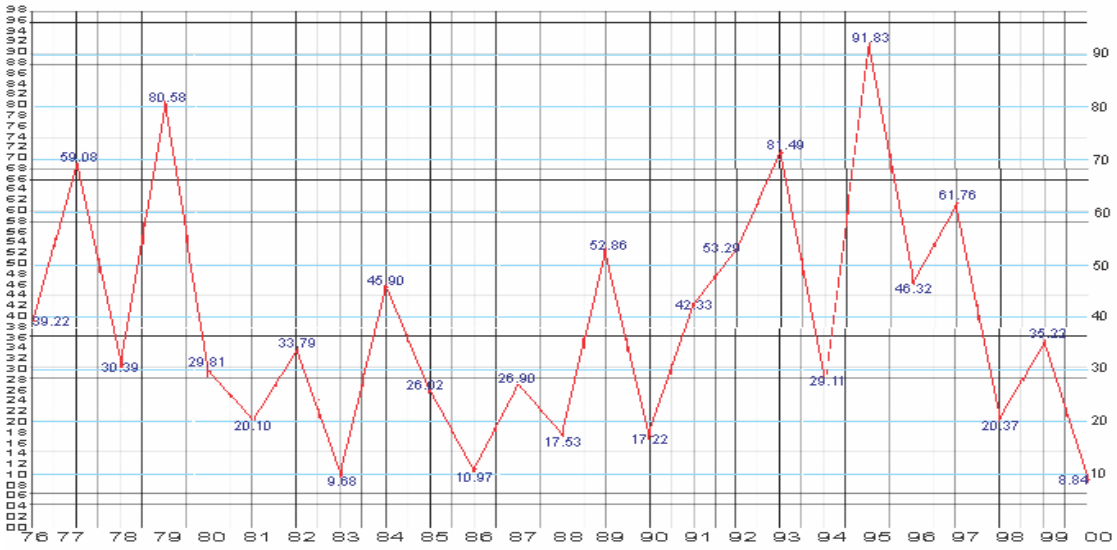
Annual flow of

Indus, Jhelum & Chenab

1922 to 2010

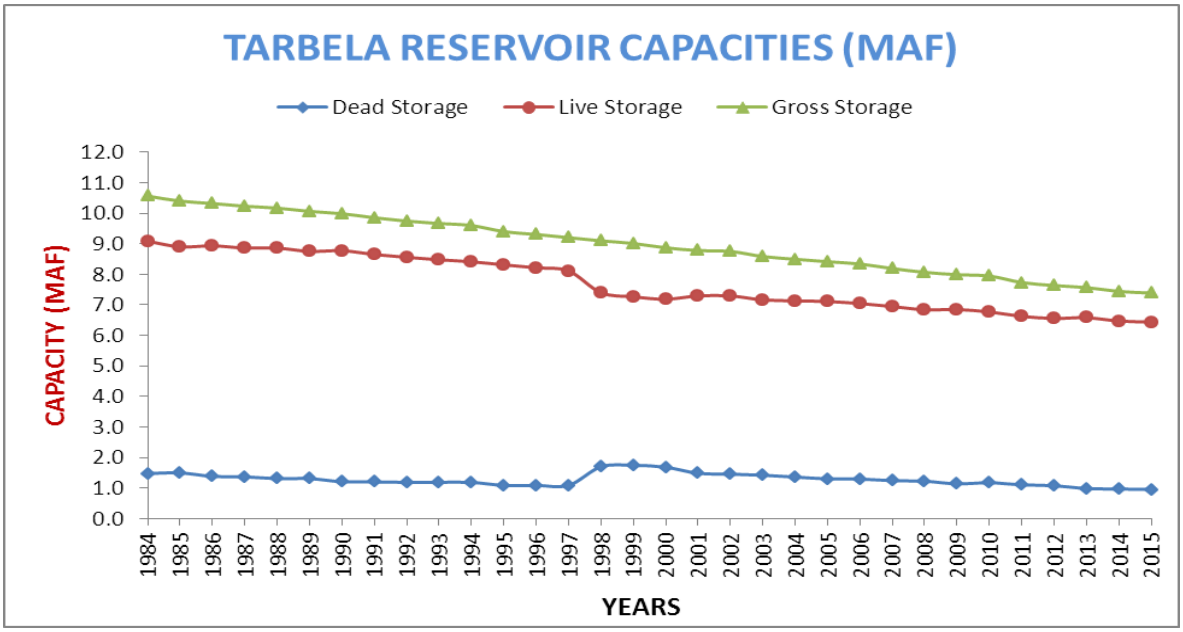
ESCAPAGES BELOW KOTRI

Post Terbela Period



Escapage from 1975-76 to 1999-2000

Average 39.22 MAF
say 40 MAF



Maximum Level	1550 SPD
Original Dead Level	1300 SPD,
Current Dead Level	1380 SPD
Gross Storage	7.388 MAF,
Dead Storage	0.954 MAF
Live Storage	6.434 MAF

Situational Analysis

Water Apportionment Accord 1991 between the four provinces of Pakistan, a legal document passed by the Council of Common Interest. Accord allows all provinces to make projects to use their water share. Clause 6 and 8 clearly shows that the provinces have no restriction for the said projects.

(6) The need for storage, wherever feasible on the Indus and other rivers was admitted and recognized by the participants for planned future agriculture development.

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

It is very important to note that we are wasting 35 MAF (average) water to the sea. In this water Punjab share is 10.7 MAF. The point to note is that this water fluctuates between 2 MAF to 9 MAF. Fortunately, Punjab has all the feasible reservoirs sites to use 90% of this water. Other provinces have no site to deliver flood water for their requirements.

It is necessary to make a “MASTER PLAN” for 100% use of our water share.

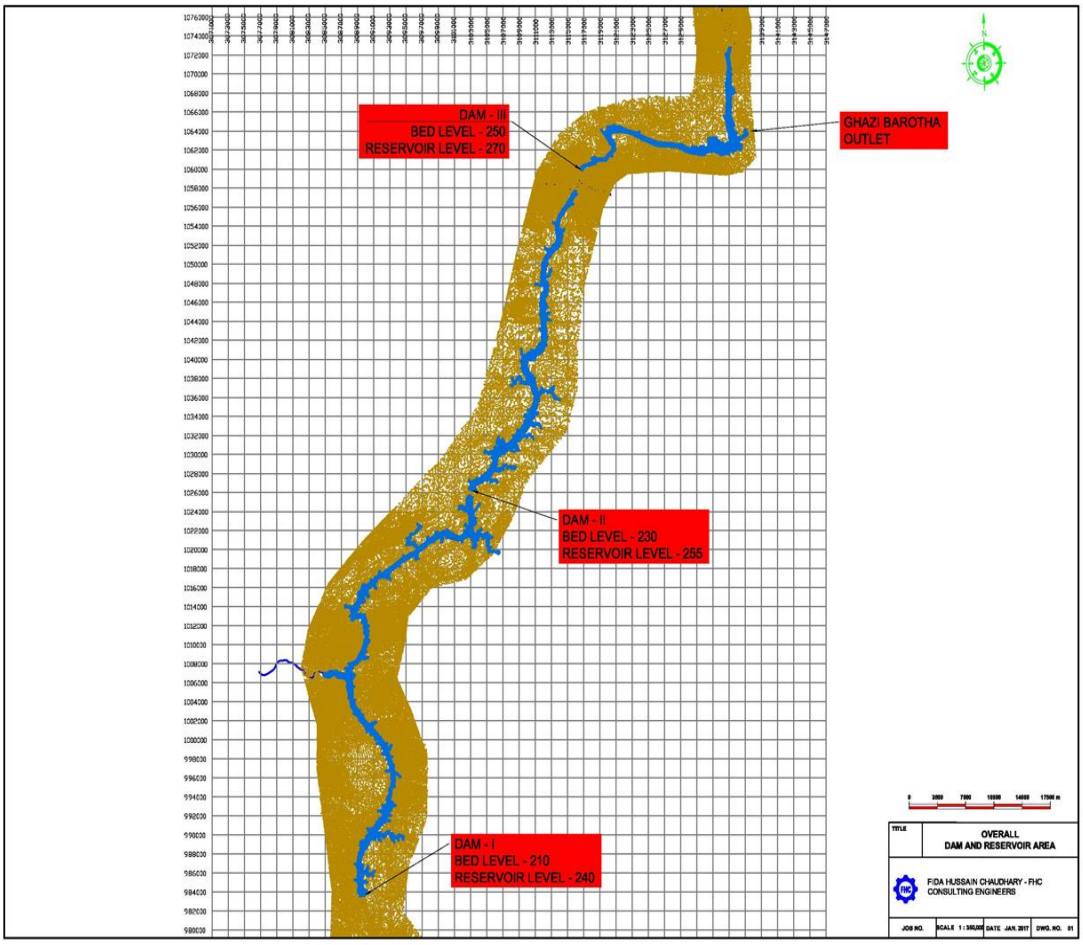
The dispute in respect of Non-Constitutional Kalabagh Dam is very interesting. It is situated in Punjab. Other provinces are opposing this project. The Government of Punjab should take a step to construct a reservoir at this place for its requirements. The height of the dam can be reduced to get its own flood share and also make a series of Hydro power projects on the river Indus within Punjab territory which can

provide us 3600 MW. But for the future planning of Water resources development, we can generate more than 1500 MW from different sites on upstream Kalagagh.

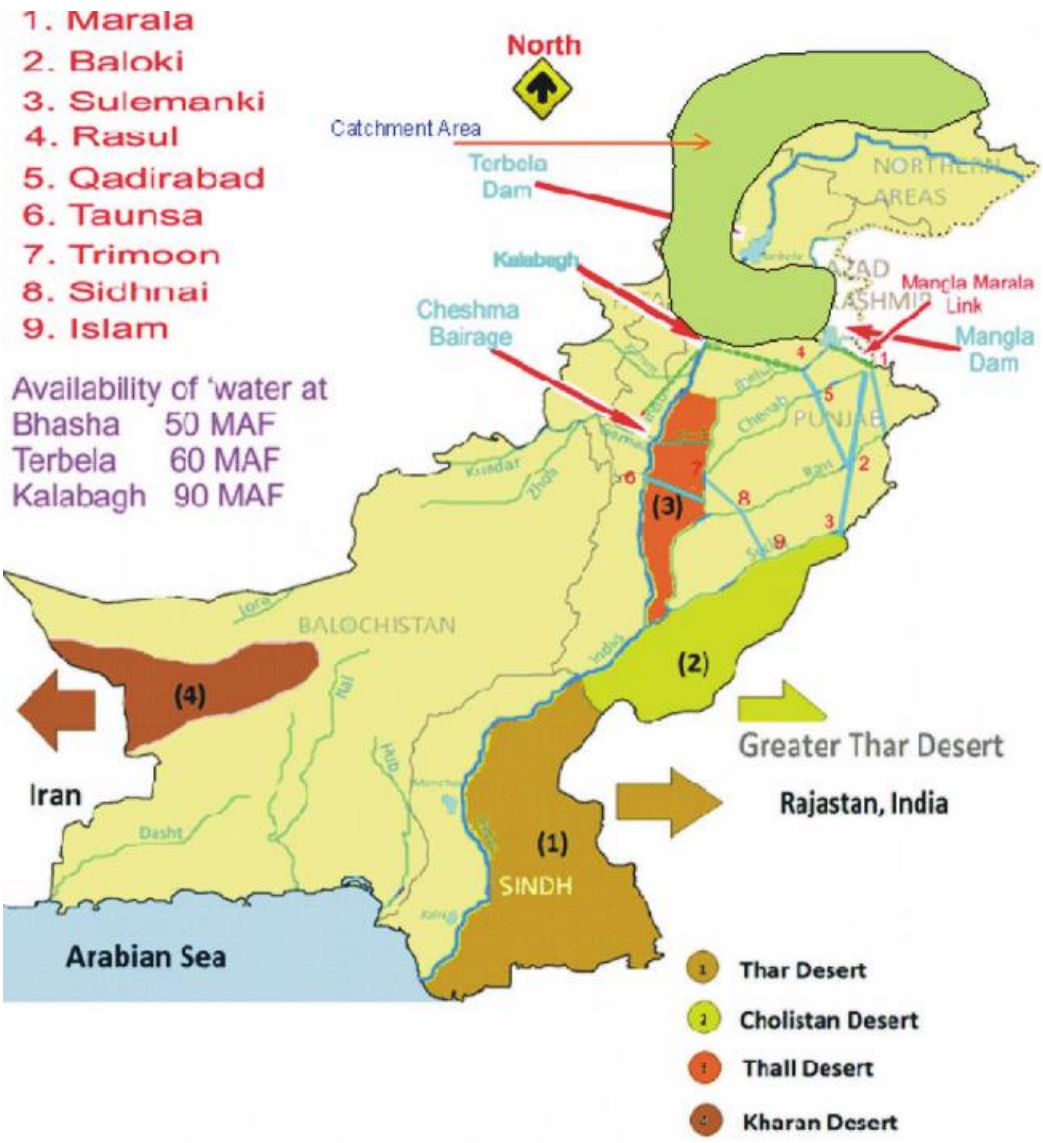
New canal projects to use flood supplies are also very necessary. This share can be diverted to desert areas in Punjab and Cholistan in Bahawalpur. Through these flood canals, we can also recharge the valley of rivers Ravi and Sutlej.

On river Jhelum in Punjab, we can generate more than two thousand Mega Watts from upstream Mangla. From Karot Hydropower 740 MW and from Mahal and Azad Patan 650 MW each.

Kalabagh Hydro-power unit (Run of the river)



According to the 18th amendment of the Constitution of Pakistan, Punjab Province can construct 4 hydropower units run of the river at the site of Kalabagh, that will generate 3,600 MW. But it will create an horrible effect to control the remaining flood supplies in future.



Indus Water Development Fund Agreement for the Projects in Pakistan

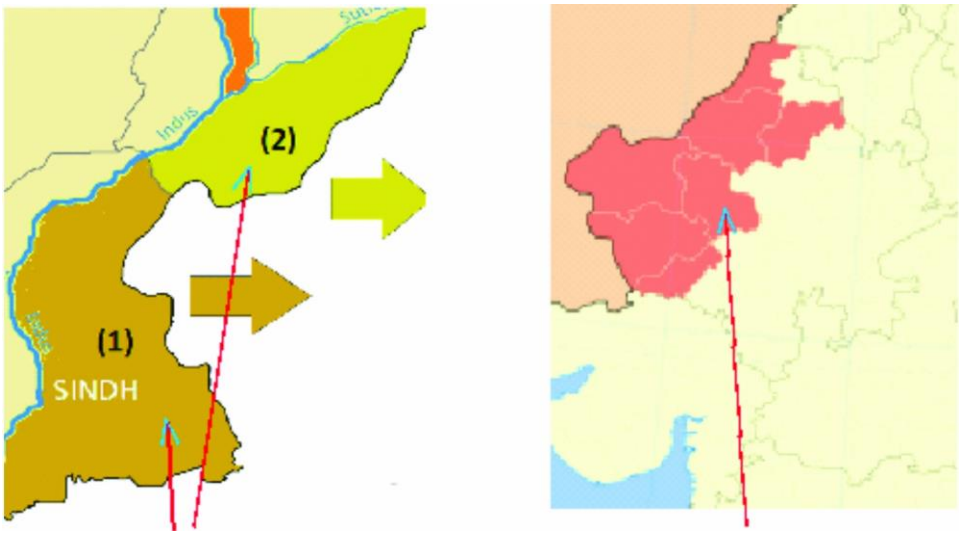
Pakistani and Indian Thar

Both the areas of Pakistani and Indian known as Thar desert have quite same features like soil, fertility, climate. Rajasthan, India's popular tourist state, is famous for its sprawling palaces, historic forts, vast tracts of desert and celebrity weddings. Now, olives has been added in the list. The state is growing the fruit on a large scale in India for the first time, in its deserts and semi-arid areas, and there are signs of success.

Not only would olive cultivation induces struggling farmers in the state's ailing and neglected agricultural sector to a lucrative cash crop and boost the local economy. It would also satisfy the growing domestic demand for healthy olive oil in the country, which has one of the highest rates of heart disease in the world.

The difference between both Thar (India and Pakistan) is “WATER”. India constructed Indra canal from river Setluj to Thar desert. But Pakistan is continuously

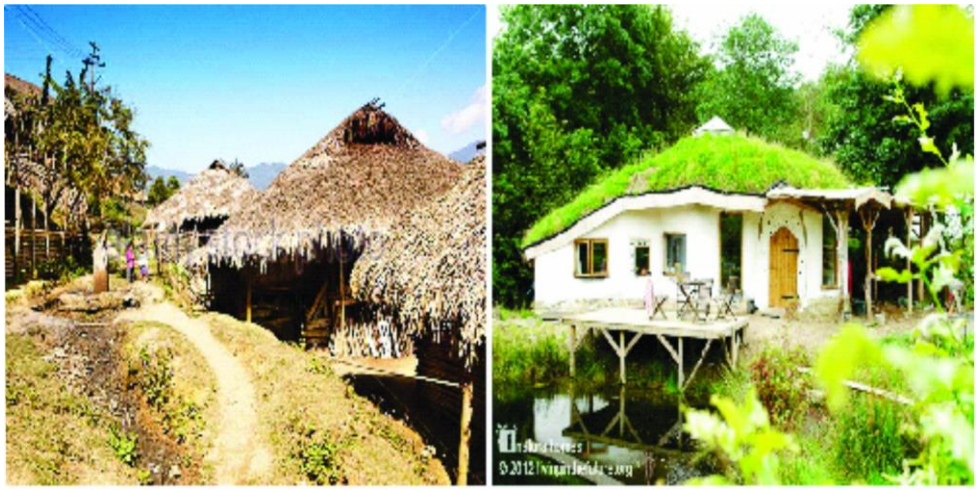
ignoring its own Thar. The different agriculture and standard of living between the both Thar(s) is shown as under:



PAKISTANI THAR INDIAN THAR



PAKISTANI THAR INDIAN THAR



PAKISTANI THAR INDIAN THAR

Appendix-I

INDUS RIVER SYSTEM AUTHORITY
Government of Pakistan
35-Mauve Area, G-10/4
Islamabad

Tel : 051-9108013-4
Fax : 051-9108007

No: IRSA/PS/79/4210-11
Date: February 25, 2015
Through Fax

The Secretary
Ministry of Water & Power
Government of Pakistan
Islamabad
(Attn: Mr. Shakeel Ahmed SO. DW.MoW&P)

Subject: WATER AVAILABILITY

Ref'nce MoW&P letter No: DW-1(1)/2012 dated 16.02.15

1. The contents of the letter referred above were considered in IRSA meeting held on February 24, 2015. The views / comments and way forward proposed by the Authority are as under:-

"IRSA fully endorses the viewpoint of the Hon'able Federal Minister for Water & Power regarding construction of new storages. It may be pertinent to mention here that the para 6 of Water Apportionment Accord 1991 signed by the Provinces, on March 16, 1991, in the rare show of consensus and afterwards ratified by the Council of Common Interests (CCI) on March 21, 1991, clearly envisages need of new storages and validates Minister's viewpoint. The para is reproduced below:-

> The need for storages, wherever feasible on the Indus and other rivers was admitted and recognized by the participants for planned future agriculture development.

2. The main features of the Accord were to open an era of expansion of water resources as out of 14 paras 6 are about development but, unfortunately, due to indifferent approach towards the precious resources, the availability of water at canal heads has reduced to 97

maf (which was 105 maf in 1991) against allocations of 117 maf. The gap will further widen and aggravate drastically, as the existing reservoirs capacities are diminishing with passage of time, due to sedimentation and other factors.

3. Presently, an average of 30 million acre feet (maf) fresh water is being released downstream of Kotri Barrage to sea against the basic requirement of 8.6 maf determined by the International Penal of Experts (IPOE) in 2005 to check sea intrusion as well as protection against environmental hazards. Thus almost 22 maf fresh water is escaped below Kotri to sea unutilized.

4. It may also be pointed out that the total water availability of the country is 145 maf (average) while the existing live storage capacity is only 14.10 maf i.e., 9.7%. By comparison the world average is 40%, which requires achievement expeditiously.

5. Keeping the above in view, IRSA strongly recommends construction of new water storage of at least 22 maf capacity on all the feasible sites on war footing basis as agriculture is the backbone of the county's economy. The new storages will help to improve the diminishing per capita water availability, increase in GDP, control of floods etc., besides availability of cheap environment friendly Hydel Power to overcome the Power crisis being faced by the country which is giving the serious setback to the economy.

6. To achieve the above objective and to put an end to the miseries faced by the country the PSDP for all sectors be frozen for at least 5 years and funds may be diverted for the construction of mega storages on priority basis in the best interest of public."

7. This issues with the approval of IRSA.

(Engr. Raqib Khan)
Chairman/Member IRSA KPK

CC

All IRSA Members, Islamabad.

Situational Analysis (Energy)

Energy crisis is the major issue of the province. Without cheap electricity, our value added industries cannot give better results. The situation of the energy production and using capacity is as under.

Generation Capacity 2014-15							
		Punjab	**Khyber Pk**	**Sindh**	**Balochistan**	**AJ&K**	**Total**
Hydel		1794	4208	0	0	1114	7116
NTDC Thermal		2301	0	3426	35	0	5762
IPPs		5926	0	402	2399	0	8727
Nuclear		650		137	0	0	787
Wind		0	0	106	0	0	106
KEL		0	0	2326	0	0	2326
Total		10671	4208	6397	2434	1114	24824
New Projects installed in 2015-16							
Solar		400					400
Wind				300			300
Chashma iii		340					340
		740	4208	6697	2434	1114	95864
Total		**11411**	**4208**	**6697**	**2434**	**1114**	**25864**

Peak Demand		**DISCO**	**Demand (MW)**	*Demand Province wise*
		PESCO	2798	
Khyber Pakhtunkhwa		TESCO	560	**3358**
		IESCO	2347	
		GEPCO	2386	
		LESCO	5021	
		FESCO	3091	
Punjab including AJ&K		MEPCO	2892	**15737**
		HESCO	1167	
		SEPCO	1357	
Sindh		Karachi electric	3056	***5580***
Balochistan		QESCO	1762	***1762***

Studies have shown that only those areas progress, which depend on indigenous resources of energy. Import bill of energy is the main cause of failure the economic.

ACTION PLAN

Punjab either has to rely upon the imported electrical energy or purchase it from the neighbor federating units. Sindh province has the potential of oil and gas resources, Baluchistan can survive with the resources of wind mill in vast coastal belt. Khyber Pk has the great opportunity of hydro power projects. With respect to neighbor federating units, Punjab has no potential of cheap energy generation.

This is an important challenge for the Punjab, to take an urgent step for the cheap energy generation. Punjab has opportunity of hydro power projects of 4,000 MW on rivers. Kalabagh is another best site 3600 MW for cheapest hydro power generation. In the light of Water Accord 1991, all provinces have to take steps for her water share as well as the opportunity of cheapest hydro electricity generation.

Provinces can focus on the concept of distributed generation: Power generation at the point of consumption rather than centrally. This will eliminate the cost and inefficiencies associated with transmission and distribution. For this, provinces have to utilize the reliable and indigenous resources being wasted at moment such as agriculture waste and municipal waste. Further more, small Hydel and Solar projects should also be used to connect currently off-grid villages.

As a model project, Punjab has planned to provide electricity to two villages during the current Fiscal Year, through local resources. This is a commendable move which may step Punjab towards energy security and energy surety.

Punjab has 25,000 villages, and if at least a 300kVA Powerhouse is installed in each village running entirely on the local resource can add 7,500 MW to the power sector. Similarly Punjab May opt for installation of 2-4 MW Power Plants at its Municipal Town level using waste of the city as fuel. She has 134 Towns. This move can add further 500 MW in the system. The generation keeping in view the reduction in the amount of transmission losses in Punjab will impact the reduction of 10000 MW demand of National Grid. This will also impact the energy import bill of the national level.

Punjab may opt to develop hydel power 10,000 MW hydel in Khyber Pk a 8,000 MW in AJ&K and in Northern areas by paying Water-Use charges. In Thar (Sindh), Punjab can opt for investing in one of the six blocks of the Coal offered by Coal Development Authority (CDA) of SINDH for private investors.

Punjab government has started 2 projects of bio-gas 300 KVA power house in the villages of Chak 563/EB in Vehari and Chak 443/GB in Tandlianwala (Faisalabad).

WAY FORWARD:

- Government of Punjab initiates projects, keeping in mind the possibilities, a cheap and uninterrupted supply of power can be provided to this province for prosperous future.
- Concept of hydro power generation at all sites specially at Kalabagh may be started as pilot project.

- Re-examine water allowance for better results for agriculture and climate change.
- Water harvesting is being done by a number of cities at buildings, mosques, universities and gardens and need to be adopted.
- Solar projects on government offices may also be started as pilot projects.
- Value added industries on CPEC root is very important to boost the economy of the province.
- Improving the capacity building of Engineering Departments.
- It is very important for our National Economic Growth, there should be Joint Venture of Foreign Investing companies with the Pakistani companies especially in hydel and energy projects.