PAKISTAN ENGINEERING CONGRESS
THE EXECUTIVE COUNCIL FOR THE 71TH SESSION

PRESIDENT

Engr. Husnain Ahmad

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1	Engr. R. K. Anver	8	Engr. Ch. Muhammad Rashid Khan
2	Engr. Dr. Bagh Ali Shahid	9	Engr. Pir Muhammad Jamil Shah
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7	Engr. Ch. Foad Hussain	24	Engr. Syed Saleem Akhtar
8	Engr. Ch. Iftikhar ul Haq	25	Engr. Tahir Anjum Qureshi
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10	Engr. Khalid Javed	27	Engr. Syed Abdul Qadir Shah
11	Engr. Liaqat Hussain	28	Engr. Shahid Ahmad
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13	Engr. Muhammad Saeed	30	Engr. Faisal Shehzad
14	Engr. Muhammad Sarfraz Butt	31	Engr. Iftikhar Ahmad
15	Engr. Najam Waheed	32	Engr. Malik Ata ur Rehman
16	Engr. Naveed Alam	33	Engr. Taufique Ahmad
17	Engr. Nayyar Saeed		

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COVER PHOTO

Sunset on the Indus

A View of Islam Barrage

A View of Shershah Barrage

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WELCOME TO NEW MEMBERS

The Executive Council of the Pakistan Engineering Congress approved Membership of the following new members into the Congress fold. The Engineering News congratulates all of them and welcomes them to Pakistan Engineering Congress

Members admitted on 13-02-2010

1 Engr. Muhammad Azher Hussain
2 Engr. Nosheen Zaib
3 Engr. Muhammad Ali Khan
4 Engr. Aurang Zaib Khalid
5 Engr. Usman Riaz
6 Engr. Umar Saleem
7 Engr. Muhammad Waqas Ejaz
8 Engr. Asma Maqbool
9 Engr. Ahsan Anwar
10 Engr. Adeel Akhtar
11 Engr. Imran Sarwar
12 Engr. Muhammad Irfan
13 Engr. Saqib Jahangir
14 Engr. Muhammad Ayub
15 Engr. Muhammad Qasim Khalid Dhariwal
16 Engr. Sajid Farooq
17 Engr. Ghulam Murtaza
18 Engr. Ansar Jawad Mirza
19 Engr. Usman Rafique
20 Engr. Asif Khalid
21 Engr. Umar Tauqeer
22 Engr. Khizar Hayat
23 Engr. Farhan Yousaf
24 Engr. Malik Asif Rehman
25 Engr. Muhammad Ayub Jan
26 Engr. Ahmad Umair
27 Engr. Khalid Munawar
28 Engr. Sajid Mehmood Iqbal
29 Engr. Wasim Iqbal
30 Engr. Irfan Ali Masood
31 Engr. Samar Rashid
32 Engr. Muhammad Rizwan
33 Engr. Kishaf Sarfraz
34 Engr. Saif Ullah Khalid
35 Engr. Lt Col Nisar Ali Khan
36 Engr. Muhammad Rafi
37 Engr. Agha Muhammad Shabbir Mahdi
38 Engr. Mustansar Ballah
39 Engr. Muhammad Aslam Qazi
40 Engr. Muhammad Naeem Ahmad
41 Engr. Muhammad Usman Zafar
42 Engr. Farrukh Navid Ul Hassan
43 Engr. Muhammad Arfan
44 Engr. Sana Ullah
45 Engr. Muhammad Burhan Iqbal
46 Engr. Mohsin Abbas
47 Engr. Muhammad Shazad
48 Engr. Farhan Ali
49 Engr. Muhammad Amar Khan
50 Engr. Irfan Ahmad
51 Engr. Jahan Zaib
52 Engr. Asif Zubair
53 Engr. Mian Gul Khan
54 Engr. Muhammad Luqman
55 Engr. Ch. Sarmad Akhtar Langrial
56 Engr. Khurram Arshad
57 Engr. Syed Tariq Hussain

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OBITUARIES

May their souls rest in Peace

1. Engr. Muhammad Saadat Ali Former Secretary I&P (Punjab), Member Punjab Public Service Commission & Former Chairman Indus River System Authority (IRSA), passed away on 16th November, 2009.

2. Engr. Ch. Muhammad Akhtar Project Director Punjab Barrages, passed away on 5th November, 2009.

3. Engr. Muhammad Younas Shami.

4. Engr. Inamdar Abdul Khalique Chief Engineer (R) Irrigation Punjab, passed away on 27th November, 2009.

5. Mrs. Khawaja Saleem ud Din S. E. Irrigation, (R) passed away on 29th August 2009.

From the Editor's Desk

At last we have succeeded in presenting to you another issue of your journal. Apparently it will look like the previous ones. While going through, you will feel a bit of difference. Unlike the previous issues which have always had in contents the papers pertaining to diversified fields of engineering, here you will find papers relating to environment alone. These papers are as matter of fact the ones presented on the World Environment Day Symposium that had been held on June, 2008 but we had not yet been able to publish as proceedings of the same. You will find the papers full of useful information & some of them quite thought provoking, calling upon us, the engineers to impress upon all in responsible positions not to ignore the all important issue of environment but rather pay attention to this hitherto badly neglected aspect.

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WELCOME TO NEW MEMBERS

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Members admitted on 03-10-2008

1 Engr. Tariq Mahmood
2 Engr. Muhammad Junaid Shafique
3 Engr. Rana Haider Faruq

Members admitted on 08-11-2008

1 Engr. Abdul Majid
2 Engr. Rana Aftab Ahmad
3 Engr. Syed Muzammil Abbas Shah
4 Engr. Muhammad Abid Aleem
5 Engr. Zila-Tahawar Shahbaz
6 Engr. Muhammad Shahbaz
7 Engr. Shahid Iqbal
8 Engr. Abdul Waheed Sattar Shami
9 Engr. Tahir Jabbar
10 Engr. Muhammad Tariq Nazir
11. Engr. Humayun Murtaza
12 Engr. Hannan Hafeez
13 Engr. Syed Moeen Khurshid
14 Engr. Muhammad Irfan Anwar
15 Engr. Ch. Muhammad Waseem

Members admitted on 03-01-2009

1 Engr. Farhad Akhtar Chaudhry
2 Engr. Zargham Abbas
3 Engr. Ahmad Buksh
4 Engr. Shahid Abbas
5 Engr. Bilal Javed Iqbql
6 Engr. Hassan Iqbal
7 Engr. Muhammad Faisal Naveed
8 Engr. Noman Ashraf
9 Engr. Muhammad Haseeb Khan
10 Engr. Abdul Basit
11. Engr. Numan Afzal
12 Engr. Ahmad Abdullah
13 Engr. Mubasher Hussain
14 Engr. Muhammad Nasir
15 Engr. Ali Raza
16 Engr. Fateh Sher
17 Engr. Muhammad Atif Mian

Members admitted on 24-01-2009

1 Engr. Muhammad Adnan
2 Engr. Yousif Aftab
3 Engr. Muhammad Asif Iqbal
4 Engr. Mian Yaser Qayyum
5 Engr. Akhtar Rasul
6 Engr. Muhammad Siddique

Members admitted on 21-03-2009

1 Engr. Tauqir Ahmad Qureshi
2 Engr. Muhammad Naeem Iqbal
3 Engr. Muhammad Adil Zafar
4 Engr. Lt. Col. Islam-ul-Haq (Retd.)
5 Engr. Muhammad Zahid Islam
6 Engr. Muhammad Qasim Nasir Butt
7 Engr. Dr. Arshad Ali Amjad
8 Engr. Muhammad Tariq
9 Engr. Aftab Ahmad Soomro
10 Engr. Imran Aslam
11. Engr. Raja Ahmad Hassan
12 Engr. Haseeb Iftekhar
13 Engr. Zahid Sattar
14 Engr. Muhammad Bilal Zafran Qazi
15 Engr. Usman Ghani Jamil Ahmad
16 Engr. Atta Muhammad
17 Engr. Muhammad Imran Shahzad
18 Engr. Noman Ali Mumtaz
19 Engr. Sardar Ali sheikh
20 Engr. Waqqas Asif
21 Engr. Sadiq Hussain
22 Engr. Imran Ali Ahmad Shah

Members admitted on 03-10-2008

1 Engr. Muhammad Muneeb Khan
2 Engr. Zeeshan Mustafa Maan

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OBITUARY

May their souls rest in Peace

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1. Mother of Engr. Muhammad Ibrahim Malik Member Executive Council passed away on 9th December 2008.

2. Engr. Izhar-ul-Hassan Siddiqui Chairman Engineering Associates Karachi passed away on 25th November 2008.

3. Engr. Abdul Hamid Arif Chief Engineer Irrigation Department Government of Punjab.

4. Engr. Nisar Ahmad Malik S.E. Upper Chenab Circle I & P Department Punjab died in a sad accident.

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WELCOME TO NEW MEMBERS

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Members admitted on 03-07-2008

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2 Engr. Moeed Qadir
3 Engr. Muhammad Aslam Khokhar
4 Engr. Bilal Ahmad
5 Engr. Imran Shahid
6 Engr. Muhammad Imtiaz-ul-Haq
7 Engr Major Iftikhar Bin Niaz
8 Engr. Muhammad Zubair Asifi
9 Engr. Lt. Col. Anwar-ul-Haq
10 Engr. Maj. Khurshid Hussain
11 Engr. Anwar-ul-Haq Bloch

Members admitted on 26-08-2008

1 Engr. Aftab Ahmad
2 Engr. Asim Nasim
3 Engr. Khurram Aftab
4 Engr. Saad Nazir
5 Engr. Sehar Shahzad
6 Engr. Imran Tahir
7 Muddassar Mahmood
8 Engr. Awais Safder

Members admitted on 26-09-2008

1 Engr. Muhammad Khalid Shad
2 Engr. Muhammad Aurangzeb
3 Engr. Hesham Arshad Baig
4 Engr. Aamir Iqbal Khan
5 Engr. Usman Sajjad
6 Engr. Muhammad Adil Masroor
7 Engr Islam Mustafa

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5 Engr. Sehar Shahzad
6 Engr. Imran Tahir
7 Muddassar Mahmood
8 Engr. Awais Safder

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7 Engr Islam Mustafa

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11 Engr. Hamayoun Murtaza
12 Engr. Hannan Hafeez
13 Engr. Syed Moeen Khurshid
14 Engr. Irfan Anwar
15 Engr. Ch. Muhammad Waseem

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OBITUARY

May his soul rest in Peace

Mother of Engr. Muhammad Ibrahim Malik, Member of Executive Council passes away on December 9, 2008.

Engr. Azhar-ul-Hassan Siddiqui, Chairman Engineering Associates, Karachi passed away on 25th November, 2008.

Editorially Speaking !

Awareness about environmental degradation is of course need of the hour & we also seem to have realized that to some extent. Establishment of Environment Protection Departments & Authorities, introduction of courses or degree programs in the universities & holding of seminars on the subject does indicate that we are seized of the issue. Industrial & non industrial projects in both public as well as private sectors are now analyzed by these agencies & their likely impact on environment assessed before they are launched. But many a time one is forced to think that perhaps we are going too far & in the process leaving behind some very basic issues related to environment at our own level. Like elsewhere in the world, use of heavy weight terms like global warming, ecological cycle, green house, ozone layer, biodiversity & many more of the type is quite common with our environment experts also & their repeated mention has almost become a fashion. No doubt the problems related to these aspects are enormous & could prove to be disastrous in the long run. But while thinking of future long term damages to the environment we seem to be neglecting our present day to day environment related problems that are every moment harming all of us. As an example, in view of being a potential hazard to environment objections are quite often raised on some big industry proposed to be set up somewhere or even construction of an otherwise much needed dam. This might be done of course in right earnest, but what about so many mini industries that are flourishing in the thickly populated areas, manufacturing various items & materials. These so called factories give out pungent odor & produce noise of many decibels making the life of the neighbors miserable. Filth containers full of rotten waste of all kinds with the contents spilling over on the streets are a common sight in our towns. Particles of this waste get mixed up with the air that we are forced to inhale. Storm Water channels have been transformed into sewage drains, oozing out nauseating smell & dangerous gases. Not long ago it was reported in the press that the gases emanating from one such drain passing through erstwhile a posh locality badly damaged the rubber linings of the air conditioners installed on the buildings close to the drain. One just shudders to imagine what havoc these effluent gases would be playing with the health of the residents & passers by of the area. Don't these issues relate to environment?

One can go on counting & counting such issues, but the point to ponder is that shall we keep our eyes closed to these problems? Is it not the duty of all of us, engineers & environment experts to look into this aspect and pay more attention to this than what we are presently doing?

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News

MEET THE NEW PRESIDENT

Engr. Husnain Ahmad the newly elected President was born at Pasrur, district Sialkot in 1963. He was primarily schooled at Lahore till his graduation from the University of Engineering & Technology (UET), Lahore. From UET Lahore, he acquired Bachelor and Master Degrees in Civil Engineering. During his stay at UET, he also held University Colour for representing the University in Rifle Shooting Competitions and remained student's representative throughout his tenure.

After graduation, he started his professional career by joining Communication and Works Department, Government of the Punjab in 1989 as Assistant Executive Engineer / Assistant Project Manager, yet, he continued improving his educational qualifications and earned many distinctions. He was also awarded the Britannia Chevening Scholarship. During his stay in UK he earned Master Degree in Business Administration from Cardiff Business School, University of Wales and acquired the fellowship of Institute of Professional Financial Managers, London. His continued endeavour for improving his academic excellence inspired him to have Master Degree in Computer Sciences. His research aptitude made him author of more than eight technical refereed publications. He has also been awarded the Congress medal for co-authoring a paper on the topic : "USE OF ENVIRONMENTAL FRIENDLY FINELY DIVIDED MATERIALS IN BRITTLE MATRIX COMPOSITES".

Besides rich scholastic credentials, he has a remarkable diversified experience of serving in various organizations. He supervised construction of various prestigious buildings such as Pediatric Hospital Lahore and highways projects, such as Saggian Ravi Bridge and construction of over 400 kilometers of roads. He also headed Information Technology Department (ITD) of City District Government Lahore (CDGL) where he remained instrumental in planning and developing a vision for IT department and contributed significantly in getting Lahore declared as one of the first e-districts of Pakistan. He was also the first Project Director of the University of Veterinary and Animal Sciences, Lahore where he helped in envisaging the developmental needs and initiating practical execution of construction activities for developing the needed facilities.

Apart from his brilliance in academics and professional persuits, he not only participated in social activities but also possess a unique honour of representing his equals as well as community at all levels. During his stay at University of Wales, his efforts for the promotion of multi racial culture and image building of Pakistan were widely acknowledged. He also had the honour of getting elected as President Pakistani Students Society, National Union of Students UK. He has a large number of features in his cap, such as Member Chartered Institute of Marketing, UK. Life member Pakistan Engineering Council, Member of Executive Council, Institute of Engineers, Pakistan. Elected Vice President Britannia Alumni Association of Pakistan (BAAP) and life Member Old Uetians Association.

Ever since Mr. Ahmad came into the fold of Congress in 1991, he actively participated and made untiring efforts in uplifting of and promotion of the Congress. He served Congress as Treasurer, Business Manager and contributed in its various committees, such as, Public Relations, Welfare of Engineers, Symposium Professional Activities, Library and Publications, Constitution and Bye-laws, Building and Fund Raising, apart from convening Membership, Administration and Finance Committees. He was also elected as Vice President of the Congress during the 70th Session. Last but not the least, Mr. Husnain Ahmad is the ever youngest President of the Congress during 94 years history since its creation.

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WELFARE OF ENGINEERS

In keeping with the objective of the Pakistan Engineering Congress of promoting science, profession and practice of engineering, the executive Council of this August Body has Instituted 60 Nos. Scholarships for Graduate Level Engineering studies and 16 Nos. for Post-Graduate studies at Rs. 2,000/- per month each for the whole study period as under. The unique feature is that the numbers of scholarships tabled below are being increased appreciably from year-to-year.

GRADUATE LEVEL

Sr. No.	Name of University / Institute	Number of Scholarships
1	University of Engineering and Technology, Lahore	9
2	University of Engineering and Technology, Taxila	9
3	Baha-ud-Din Zakria University Multan College of Engineering and Technology	3
4	**Punjab University** Institution of Chemical Engineering and Technology, Punjab University New Campus, Lahore	3
5	National University of Sciences and Technology (NUST) Military College of Signals, Rawalpindi	3
6	NED University of Engineering and Technology, Karachi	6
7	Mehran University of Engineering and Technology, Karachi	6
8	Sir Syed University of Engineering and Technology, Karachi	3
9	Quaid-e-Awam University of Engineering and Technology, Nawabshah	3
10	NWFP University of Engineering and Technology, Peshawar	6
11	GIK Institute of Science and Technology Topi (Swat)	3
12	Balochistan University of Engineering and Technology, Khuzdar	3
13	Ali Ahmad Shah University of Engineering and Technology, (Mirpur) AJK	3
	Grand Total	**60**

POST-GRADUATE LEVEL

Sr. No.	Name of University / Institute	Number of Scholarships
14	University of Engineering and Technology, Lahore	5
15	NWFP University of Engineering and Technology, Peshawar	2
16	University of Engineering and Technology, Taxila	4
17	NED University of Engineering and Technology, Karachi	2
18	Mehran University of Engineering and Technology, (Jamshoro)	2
19	Balochistan University of Engineering and Technology, Khuzdar	1
	Grand Total	**16**

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- The Congress is also awarding Scholarships for the Education of the Children of deceased Engineers facing financial hardships. The amount of scholarship is Rs. 2,000/- per child capped at Rs. 5,000/- per month depending upon the pecuniary conditions of the families of departed Engineers.

- The Congress has given a donation of Rs. 5 Lac towards the fund for Liver Transplant in China of Engr. Capt (R) Latafat Qaseem Executive Engineer, of Irrigation and Power Department Govt. of the Punjab. He is suffering from Liver Cancer and Transplant Facility available in China is by far most economical.

- The Multi-purposes Mashhadi Hall (i.e. Auditorium) of the Congress located at 4th Floor of its Building named after Past President Engr. Syed Nazar Hussain Mashhadi in recognition of his services to the Engineering Congress is undergoing renovation / alternation to be able to cater for all its activities in it. It is being propely carpeted, Air Conditioned and equipped with multi-Media / LDC etc.

- The Congress has extensive Programme for holding Lectures on current issues concerning Engineers / Engineering Profession.

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NATIONAL TRADE CORRIDOR IN THE REGIONAL AND GLOBAL CONTEXT

Dr. Engr. Asad Ali Shah, Member Infrastructure and Energy Planning Commission, Govt. of Pakistan delivered lecture on "National Trade Corridor in the Regional and Global Context" at Pakistan Engineering Congress Headquarter on February 17, 2007. The lecture was largely attended in the jam packed Multi-purpose Hall of the Congress.

The learned speaker eloquently spoke on the concept of National Trade Corridor / its objectives.

He said that performance of the transport system in Pakistan has not been up to the mark with economic losses from congestion and poor quality roads and mismatch between supply and demand for transport services and supporting infrastructure. The logistic constraints are impact competitiveness of the country's trade and industrial development. The conventional system, documentation clearance, movement facilitation and electronic data interchange has yet to be modernized to international levels. These inefficiencies are resulting in increasing the cost of business. Constraining economic growth, reducing export competitiveness, and hindering social development. It is estimated that these inefficiencies are imposing a cost to the economy in excess of Rs. 220 billion annually or 3.5% of the GDP.

He added that in order to cope with the situation, a major initiative namely the "National Trade Corridor (NTC)" has launched to address the entire logistics chain in a holistic manner and revamp transport sector including ports and shipping, roads, railway, trucking, aviation and trade facilitative measures. The NTC initiative is in line with Medium Term Development Framework (MTDF 2005) strategy, which includes establishment of a multi-modal transport system ; emphasis on as management with consolidation upgrading, rehabilitation and maintenance of the existing system enhanced private sector participation in sector development and institution capacity building research and development and use of modern technology, procedures and processes to increase efficiency. The strategy also incorporates measures for enhancing regional connectivity through road, aviation and shipping sub-sectors to improve North-South and East-West trade

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links with Central Asian States, Iran, Afghanistan, India and Europe and development of energy and industrial corridors with these countries.

Talking about the objectives of establishment of NTCMU and TTFU, he said that the objective of the Project is to provide overall technical leadership and coordination with line ministries and other organizations in undertaking measures / reforms project to improve the logistics system that would lead to reducing the cost to trade and business in the country. Focusing on improving the infrastructure sector, services and streamline procedures, the proposed NTC and TTF components will :

1. Enable institutions of the infrastructure sector conduct project and studies and project preparation activities in a timely manner and in line with international standards and best practices.

2. Ensure implementation readiness of the infrastructure projects.

3. Improve institutional capacities within the infrastructure agencies to meet business management and process changes as required by recent sector policies, reforms regulatory agencies.

4. Work with the private sector to improve in-house logistics.

He went on to say that the technical assistance will further enhance the internal capacity of infrastructure agencies develop a project program and implement identified projects successfully. The proposed steps will ultimately build intellectual leadership and also enhance the productivity of all those involved in Trade and Transport Facilitation.

He concluded that the crux of the talk was that with gigantic modernization of Ports, Roads, and Railway Net-Work Road and Freight Industry, State of Art Air-Terminals, Media and Communication expansion, under the "Trade and Transport Facilities Project" will usher in an economic revolution (in a period of 5 Years) in the country with "Gawadar" playing a pivotal Role. According to the speaker "Gawadar" will be one of the most advanced city of the World in a decade and a hub of economic development. A film on Gawadar was also shown.

The session was followed by questions from the audience which were elaborately answered by the speaker.

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TARGETS SET FOR ACHIEVEMENT IN THE 2ND MEETING OF THE 71TH SESSION OF THE EXECUTIVE COUNCIL

President PEC, informed the House, that he would greatly appreciate the In-Put of the members of Executive Council in respect the cardinal goals that ought to be achieved in 71th Session to make the Congress a progressive and vibrant organization. Engr. Iftikhar-ul-Haq suggested that all members of the Congress may be invited to convey their proposals in this respect.

Elaborating his vision for 71th Session, the President outlined some of the major objectives i.e.

- Membership Committee should embark on a well-planned programme to visit Chief Engineers / Administrative Heads of various engineering departments / organizations and Faculty Members of Engineering Universities with the twin purpose of (a) introducing the congress and (b) increasing the Congress Membership.

- Building Committee may prepare a "Short Term" and a "Long Term" plan of maintenance / construction activities i.e. construction of Additional Block Cum Parking Lot in the existing premises (if feasible) or alternatively acquire additional Space / Building etc. for future use.

HONORARIUM TO CONGRESS STAFF AS WELL AS OTHERS WHO WORKED DURING THE LAST ANNUAL SESSION WAS GRANTED AS UNDER IN RECOGNITION OF THEIR SERVICES TO THE PAKISTAN ENGINEERING CONGRESS

Congress Personnel	Rs. 69200
Computer College Personnel of PEC	Rs. 10000
Personnel of NDC (Regd.)	Rs. 22000
Others for Receiving Congress Subscription / Election Duty etc. during the Session	Rs. 23500

WELCOME TO NEW MEMBERS

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Members admitted on 08-04-2006

1 Engr. Zia ul Hassan Khan
2 Engr. Muhammad Atif ur Rehman
3 Engr. Danish Rafique
4 Engr. Luqman Zaffar
5 Engr. Muhammad Shafqat Khalid
6 Engr. Mashood Ahmed
7 Engr Muhammad Riaz Zahid
8 Engr. Mian Nadir Qayyum
9 Engr. Hafiz Muhammad Ramzan
10 Engr. Intizar Ali
11 Engr. Irfan Ullah
12 Engr. Roshan Ali Bhatti
13 Engr. Khurshid Ahmad Mirza
14 Engr. Naveed Abbas

Members admitted on 20-05-2006

1 Engr. Muhammad Usman Rashid
2 Engr. Muhammad Shahzad
3 Engr. Shafiq Ahmad
4 Engr. Asif Hayat Bhatti
5 Engr. Zameer Hussain
6 Engr. Muhammad Tayyab Ahmad
7 Engr. Muhammad Akbar Nawaz
8 Engr. Muzaffar Abbas
9 Engr. Atiq Ullah
10 Engr. Ali Jawaid Ghuman
11 Engr. Najamuddin Sheikh

Members admitted on 29-07-2006

1 Engr. Arif Saeed
2 Engr. Mian Babar Qayum
3 Engr. Muhammad Saeed
4 Engr. Muhammad Hamid Mahmood
5 Engr. Shahzad Ahmad
6 Engr. Muhammad Asif
7 Engr. Naseer Ahmad Zia
8 Engr. Arshad Saeed Khan
9 Engr. Aamir Miandad
10 Engr. Nisar Ahmad
11 Engr. Muhammad Yasir Malik
12 Engr. Ch. Muhammad Nadeem
13 Engr. Muhammad Kashif Khan
14 Engr. Syed Abid Ali Abid
15 Engr. Qasim Haq
16 Engr. Muhammad Ashraf
17 Engr. Hafiz Waqas Haider Shah
18 Engr. Imran Ghani
19 Engr. Asrif Masood
20 Engr. Syed Fayyaz Hussain
21 Engr. Amir Nadeem
22 Engr. Muhammad Zaman Khan Dawer

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Members admitted on 21-10-2006

1 Engr. Hafiz Faisal Hassan Abid
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USE OF SALINE GROUNDWATER FOR CROP PRODUCTION ON SALT AFFECTED SOIL

By

Aziz Ahmed Malik, Khalid Mahmood Subhani and M. A. Shad[1]

ABSTRACT:-The study was carried out on saline-sodic, non-gypsiferous and silty clay loam soil adjacent to Shorkot city. Ten treatments were tested in Completely Randomized Block Design. The treatments included:- **T_1-** Irrigation with canal water-No amendment (control), **T_2** -Irrigation with Canal Water + Gypsum @ 25 % GR of soil, **T_3** - Irrigation with Canal Water + FYM @ 25 tons ha^{-1}, **T_4** - Irrigation with Canal Water + Press mud @ 10 tons ha^{-1}, **T_5 -** Irrigation with Canal Water + Deep Ploughing, **T_6** - Irrigation with Tubewell Water-No-amendment, **T_7** - Irrigation with Tubewell Water + Gypsum @ 25 % GR of soil, **T_8** - Irrigation with Tubewell Water + FYM @ 25 tons ha^{-1}, **T_9** - Irrigation with Tubewell Water + Press mud @ 10 tons ha^{-1}, **T_{10}** - Irrigation with Tubewell Water + Deep Ploughing. The initial EC_e and SAR of 0-30 cm soil ranged within 6.3 to 16.4 (dS m^{-1}) and 7.8 to 19.6 (mmol $L^{-1})^{1/2}$ respectively. Kharif fodder - wheat crop rotation was followed. Tubewell water having EC 4.03 (dS m^{-1}), SAR 8.74 (mmol $L^{-1})^{1/2}$ and RSC almost nil was applied to the crops. The EC_e of 0-30 cm soil depth decreased at the end of the study in all the treatments. Maximum reduction by 58 percent was recorded under the treatment where Pressmud @ 10 tons ha^{-1} was applied with canal water irrigation. SAR of the soil decreased at the end of the study in all the treatments except T_6 under no amendment application. Maximum decrease by 56 percent was observed where Pressmud @ 10 tons ha^{-1} was applied with canal water irrigation. The highest kharif fodder yield of 18621 kg ha^{-1} was observed with Pressmud application @ 10 tons ha^{-1} with canal water irrigation. The highest wheat grain yield of 2817 Kg ha^{-1} was recorded with Pressmud @ 10 tons ha^{-1} with canal water irrigation. Pressmud application @ 10 tons ha^{-1} proved to be the best option for soil improvement and crop production. Use of poor quality groundwater with no-amendment reduced soil salinity to negligible extent, increased soil sodicity and produced lower crop yields. However, poor quality water can be used for sustaining agriculture in combination with amendments in the soil. Saline groundwater irrigation helped in mitigating crop water shortage, cropping on sustainable basis and lowering watertable at farm level and improvement of soil environment by reduction in upward movement of salts and crop production on sustainable basis on salt-affected soil.

Key words: Use , Saline Groundwater, Crop Production, Salt-Affected Soil

1. INTRODUCTION

Pakistan has an extensive irrigation system in the country. Canal seepage, defective conveyance and inefficient irrigation methods have created the problem of waterlogging and salinity. Drainage provision to the irrigated land helps in mitigating the adversities of these two serious problems. Consequently, a dire need arises to adopt appropriate strategies to provide drainage facilities in order to provide aerobic conditions for crop growth. Vertical drainage can be helpful at local level in controlling waterlogging to safer level. Lowering of water table indirectly reduces salt accumulation in the crop root zone area by hindering the access of salts in the upper soil horizon. The present canal supplies are not sufficient to meet with the crop water requirements. Exploitation of the groundwater reserves can be an alternative to supplement crop water shortage. About 50% of the groundwater reserves are fit for irrigation whereas the remaining 50% require amending prior its irrigation to the crops. Application of amendments in the soil with tubewell irrigation can be helpful in growing salt-tolerant crop cultivars on salt-affected soil in order to mitigate the enhanced food and fiber requirement of the

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increased population. Withdrawal of groundwater helps in lowering depth to water table, reduces upward salt movement, provides aerobic conditions for sustaining agriculture and helps in improving soil environment by controlling soil salinization/sodication.

2. MATERIAL AND METHODS

The study was initiated in the suburbs of Shorkot Tehsil of Distt. Jhang during July 2005.
Salt-affected field, measuring about one hectare, situated on Shorkot Cantt. Road, about 3-kilometers away from Shorkot city was selected for this study. Soil samples from 0-30, 30-60 and 60-90 cm depth were collected in the beginning of the experiment to determine soil texture and salinity/sodicity status of the selected field (Table 1 and 2). Subsequent soil sampling was carried out after harvesting of each Kharif and Rabi crop. Kharif fodder and wheat crops were sown in Completely Randomized Block Design with three repeats. Recommended cultural practices were followed. The treatments included:- **T_1-** Irrigation with canal water-No amendment (control), **T_2** -Irrigation with Canal Water + Gypsum @ 25 % SGR, **T_3** - Irrigation with Canal Water + FYM @ 25 tons ha^{-1}, **T_4** - Irrigation with Canal Water + Press mud @ 10 tons ha^{-1}, **T_5 -** Irrigation with Canal Water + Deep Ploughing, **T_6** - Irrigation with Tubewell Water-No-amendment, **T_7** - Irrigation with Tubewell Water + Gypsum @ 25 % SGR, **T_8** - Irrigation with Tubewell Water + FYM @ 25 tons ha^{-1}, **T_9** - Irrigation with Tubewell Water + Press mud @ 10 tons ha^{-1}, **T_{10}** - Irrigation with Tubewell Water + Deep Ploughing. Tubewell water having EC 4.03 (dS m^{-1}), SAR 8.74 (mmol $L^{-1})^{1/2}$ and RSC almost nil was applied for irrigation to the crops. The crop yields were estimated on the whole plot basis and converted as kg ha^{-1}. The study continued from July 2005 to June 2008 over a span of three years.

Table 1 Physical Condition of the Study Site

Depth (cm)	Sand (%)	Silt (%)	Clay (%)	Textural Class
0-30	14	52	34	Silty Clay Loam
30-60	12	49	39	Silty Clay Loam
60-90	13	41	46	Silty Clay Loam

Table 2 Baseline Chemical Analysis of the Study Site

Depth (cm)	pH	EC_e (dS m^{-1})	SAR (mmol $L^{-1})^{1/2}$
0-30	8.5	11.6	19.6
30-60	8.4	6.4	8.6
60-90	8.4	6.3	7.8

3. RESULTS AND DISCUSSION

The effect of different treatments on soil salinity/sodicity build-up and crop yields is discussed as under:-

3.1 Soil Salinity (EC_e dS m^{-1})

The study continued from July 2005 to June 2008 over a span of three years comprising six crop seasons. EC_e reduced in 0-30 cm soil depth in all the treatments. Maximum reduction by 58 % was observed in T_4, where Pressmud was applied @ 10 tons per hectare with canal water irrigation. Minimum reduction by 9 percent was recorded under T_6, Deep Ploughing with tubewell water irrigation. All the other treatments fell within these two ranges. Canal water irrigation depicted more decrease in soil EC_e than tubewell water irrigation. Application of amendments and gypsum facilitated in reducing soil EC_e compared to the treatments where amendment was not applied with both the sources of irrigation (Table 3). Ameliorants reduced soil EC_e. Higher reduction was observed under Pressmud treatment. The results are in agreement with the findings of Niazi et al. 2001.

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Table 3 Effect of Different Treatments on EC_e of 0-30 cm Soil Depth (dS m^{-1})

Treatments	Pre Kharif 2005 S_1	Post Kharif 2008 S_7	Percent Dec Over Initial
T_1 Canal Water (Control)	18.6	13.5	-27
T_2 Gyp @ 25 % SGR	16.5	10.7	-35
T_3 FYM @ 25 tons ha^{-1}	16.6	8.3	-50
T_4 Pressmud@10 tons ha^{-1}	14.0	5.9	-58
T_5 Deep Ploughing	18.1	15.7	-13
T_6 Tubewell Water	12.4	11.3	-9
T_7 Gyp @ 25 % SGR	24.6	16.8	-32
T_8 FYM@ 25 tons ha^{-1}	10.5	6.8	-35
T_9 Pressmud @10 tons ha^{-1}	15.3	7.2	-53
T_{10} Deep Ploughing	19.1	17.2	-10

3.2 Soil Sodicity (SAR mmol $L^{-1})^{1/2}$

Sodicity of 0-30 cm soil decreased to the maximum extent by 56% in T_4, where Pressmud was applied @ 10 tons ha^{-1} with canal water irrigation. Conversely tubewell water + Pressmud application @ 10 tons ha^{-1} depicted minimum reduction by 19% over initial value. Reduction in soil SAR in other treatments ranged within these two limits. SAR reduced under all the treatments except T_6, where amendment was not applied, depicted 9% increase over initial value. Canal water reduced soil SAR more than tubewell water application. Higher reduction rate was observed under Pressmud treatment (Figure 1). Generally reduction rate decreased with increase in depth. Application of amendments desodicated the soil. The results are in consistent with the work of Hyas et al., 1997, Wahid et al., 1998 and Sahin et al. 2002.

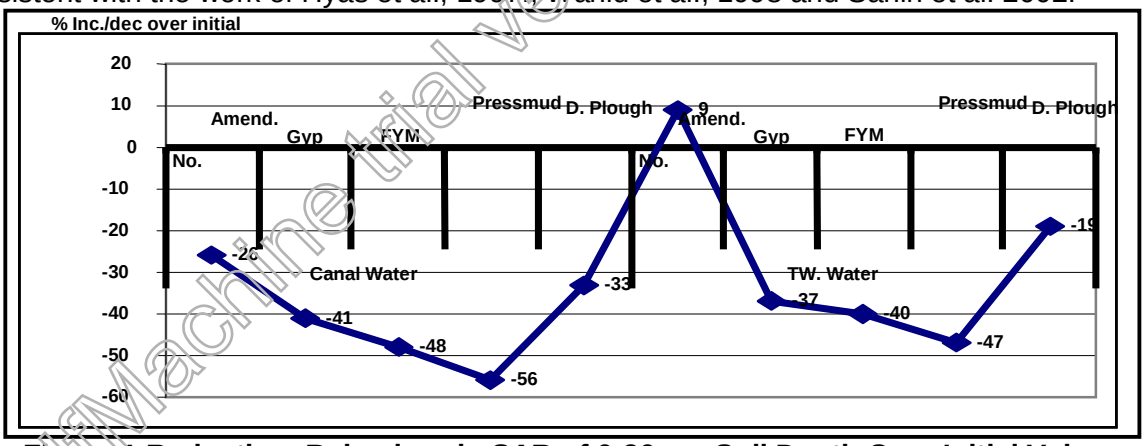

Figure 1 Reduction Behaviour in SAR of 0-30 cm Soil Depth Over Initial Values

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3.3 Crop Yields

Kharif fodder and wheat grain yields were estimated on the whole plot basis and were calculated as kg ha^{-1}.

3.3.1 Kharif Fodder Yield

Maximum average kharif fodder yield of 18621 Kg ha^{-1} was obtained where Pressmud @ 10 tons ha^{-1} was applied with canal water irrigation being 57 percent higher than control. Minimum kharif fodder yield of 10264 Kg ha^{-1} was recorded where no amendment with tubewell water was applied. Gypsum application @ 25% SGR with canal water irrigation gave 25% higher kharif fodder yield than control whereas tubewell water irrigation depicted 21% higher yield than control treatment. Similarly farmyard manure application with canal water irrigation indicated 41 percent higher yield than control whereas under the same treatment 33 percent higher yield was obtained with tubewell water irrigation. Deep ploughing did not depict satisfactory impact on kharif fodder yield (Table 4 and Figure 2). Amendments application increased kharif fodder

yield. The results are in agreement with the findings of Haider et al. 1976, Jerald et al. 1977, Ali et al. 1978, Tripathi and Pal, 1980, Yadav 1980, Ghafoor et al. 1998 and Chaudhry et al. 2004.

Table 4 Effect of Different Treatments on Kharif Fodder Yield

(kg ha^{-1})

Treatments		Period					% Inc/Dec. over Control
		2005	2006	2007	2008	Average Yield	
Canal Water	T_1 No amendment	10734	13166	6422	17095	11854	-
	T_2 Gypsum @ 25 % SGR	14668	16821	8084	19900	14868	+25
	T_3 FYM @ 25 tons ha^{-1}	16915	16207	12391	21256	16692	+41
	T_4 Pressmud @ 10 tons ha^{-1}	17422	18783	15919	22341	18621	+57
	T_5 Deep ploughing	12000	13783	6512	18422	12694	+7
Tubewell Water	T_6 No amendment	9196	11224	5879	14758	10264	-13
	T_7 Gypsum @ 25 % SGR	13000	14905	10763	18924	14349	+21
	T_8 FYM @ 25 tons ha^{-1}	15500	16332	11397	19643	15718	+33
	T_9 Pressmud @ 10 tons ha^{-1}	15668	16688	17276	21527	17789	+50
	T_{10} Deep Ploughing	10300	12046	6331	15578	11064	-6

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Figure 2 Kharif Fodder Yield Comparison With Control Treatment

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3.3.2 Wheat Grain Yield

Maximum average wheat grain yield of 2817 Kg ha^{-1} was obtained where Pressmud @ 10 tons ha^{-1} was applied with canal water irrigation. This yield level excelled by 70 percent over control. Treatment T_6 where amendment was not applied, indicated the lowest yield of 1513 Kg ha^{-1} with tubewell water irrigation. Gypsum application @ 25% SGR with canal water irrigation gave the highest yield amongst the treatments except Pressmud application @ 10 tons ha^{-1} (Table 5 and Figure 3). Application of ameliorants increased wheat grain yield. The results are in agreement with the findings of Oster, 1982 and Swarup. 1994.

Table 5 Effect of Different Treatments on Wheat Grain Yield (Kg ha^{-1})

Treatments		Period				% Inc/ Dec over control
		2005-06	2006-07	2007-08	Average Yield	
Canal	T_1-No amendment (control)	1779	1990	1345	1705	-
	T_2-Gypsum @ 25% SGR	2263	2544	1563	2123	+35
	T_3-FYM @ 25 tons ha^{-1}	2061	2885	1993	2312	+53

	T_4- Pressmud @ 10 tons ha^{-1}	2379	4032	2040	2817	+70
	T_5-Deep ploughing	1890	2442	1452	1928	+15
Tubewell	T_6-No amendment	1700	1628	1210	1513	-12
	T_7-Gypsum @ 25%SGR	1950	2653	1235	1946	+22
	T_8-FYM @ 25 tons ha^{-1}	2010	3528	1270	2269	+47
	T_9-Pressmud @ 10 tons ha^{-1}	2053	3618	1756	2476	+50
	T_{10}-Deep Ploughing	1780	1990	1307	1692	-2

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Figure 3 Wheat Grain Yield Comparison With Control Treatment

4. CONCLUSIONS AND RECOMMENDATIONS

4.1 CONCLUSIONS

- Pressmud treatment with canal water irrigation reduced EC_e of 0-30 cm soil to the maximum extent amongst the treatments.
- Impact of pressmud application on soil SAR was similar to EC_e.
- Saline groundwater irrigation helped in supplementing crop water requirement and producing relatively sustainable crop yields.
- Pressmud application gave higher Kharif fodder and wheat grain yield than other treatments.

4.2 RECOMMENDATIONS

- Saline ground water can be used for sustaining agriculture in combination with amendments like Pressmud @ 10 tons ha^{-1} & FYM @ 25 tons ha^{-1}.
- Continuous use of pure saline ground water be avoided.

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WATER QUALITY CHALLENGES AND OPPORTUNITIES

By

Zia Mustafa[1]

Abstract

Water is an essential element for our survival. High population growth rate, urbanization and unsustainable water consumption have placed immense pressure on the quantity and quality of water. As the whole human population needs drinking water for sustaining life, the provision of a safe water supply is a high priority issue for safeguarding the health and well beings of population. The production of adequate and safe drinking water is the most important factor contributing to decrease in mortality and morbidity in developing countries. More than 1 billion people in the developing world have no choice but to use potentially harmful water for drinking. More than 6,000 children under five die every day from diseases associated with contaminated water. According to World Health Organization (WHO), more than 80% of illness are reported due to poor water quality in developing world. In much of the world, polluted water and poor water management cause serious public health problems. Water related diseases such as diarrhea, hepatitis, cholera, typhoid cause over 5 million deaths per year and about 2.5 billion illness. In Pakistan, 25% of the adults and 40% of children attending hospitals are ill from water related diseases. Realizing the importance and role of safe drinking water in the improvement of human health as well as the commitment to achieve the MDG, there is an urgent need to control waterborne diseases and provision of safe drinking water to community. This paper presents a general overview of the unsafe drinking water problem at global & national level, their evaluation and effects on human health. Finally sustainable strategies have been proposed to mitigate contaminated drinking water problems.

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Backdrop / Introduction

Pakistan Potable drinking water and sanitation facilities have emerged as one of the most critical issues adversely affecting human health and increase in poverty, particularly in rural areas of major parts of Pakistan. Most pressing issue is the water security for meeting basic provision of water supply and sanitation.

Availability of safe drinking water and proper hygienic facilities are a pre-requisite for health and success in the fight against poverty, hunger and child mortality. It is also the human right and personal dignity of every human being on earth to have safe drinking water and improved sanitation facilities. Inspite of this, 2.6 billion people, nearly half of the population of developing world does not have proper sanitation facilities while more than one billion people have no choice but to use potentially harmful water for drinking. More than 6,000 children under five die every day from diseases associated with lack of access to safe drinking water. According to World Health Organization (WHO), more than 80% of illnesses are reported due to poor water quality in developing countries. The consequence of our collective failure to tackle this problem dimmed prospects for billions of people locked up in a cycle of poverty and disease. In much of the world, polluted water and poor water management cause serious public health problems. Water related diseases such as diarrhea, hepatitis, cholera, typhoid kill over 5 million people per year and about 2.5 billion illness. In Pakistan, 25% of the adults and 40% of children attending hospitals are ill from water related disreases.

Moreover, the leading cause of deaths in infants and children upto 10 years of age, is because of contaminated water. The mortality rate of 136 per 1,000 alive births due to diarrhea is reported, while every fifth citizen suffers from illness caused by unsafe water.

2. Global Perspective

In September 2000, 189 member countries of the United Nation adopted Millennium

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Development Goals (MDGs) setting time bound targets for making progress on the most pressing development issues we face. Achieving targets will directly affect the lives and future prospects of billion of people around the globe. One of the MDG is to reduce by half the proportion of people without access to safe drinking water and improved sanitation facilities by 2015. Target 10 of MDG 7 deals with sustainable access to safe drinking water and basic sanitation which is given as under:

Millennium Development Goal 7: *Ensure Environmental Sustainability*
Target 10:
By 2015, half the proportion of people without sustainable access to safe drinking water and basic sanitation

Joint Monitoring Programme (JMP) by WHO/UNICEF 2008 indicates that global pressure on safe water supply and sanitation has been generally encouraging in major parts of the world except in sub-sarharan region of Africa. The percentage of people using safe drinking water has risen by 13% to 87% in South Asia between 1990 and 2006. Globally, 87% of global population now uses an improved source of drinking water, compared to 77% in 1990. An additional 784 million people worldwide will need to get access to an improved drinking water source to meet the MDG target. Getting on track to meet the target in drinking water will mean better health, longer lives and greater dignity for billions of world's poorest people.

3. Pakistan Perspective

It may be worth mentioning that improvement in domestic water supply has not received the consideration it merits. It remains neglected in terms of allocation of resources as well as adequate attention at policy and decision making levels. It may be attributable to the fact that addressing water supply issues require financial commitment upfront. However, an important change is already underway in form of Tehsil Municipal Administration (TMA).

Presently, more than 65% of the total population in the country has access to safe drinking water including 85% persons living in more than 500 urban areas including the cities and towns. In rural areas, 55% of population living in about 30,000 large villages are served with planned water supply, while in remaining 20,000 rural settlements, the water supply schemes are yet to be developed. Most of the water in urban areas is supplied from groundwater except for the cities of Karachi, Hyderabad and part of the supply to Islamabad, which mainly uses surface water. Rural water supply is mostly from groundwater except in saline ground water areas, where irrigation canals are the main source of domestic water.

The main source of drinking water in Pakistan is hand pumps. Hand pumps and motor pumps together provide 57% of households with drinking water, whereas tap water provides drinking water to 36% of households. Table 1 shows main sources of drinking water by each province and region.

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Table 1: Main Sources of Drinking Water by Each Province

Province and Water Source	2004-05 PSLM			2005-06 PSLM			2006-07 PSLM		
	Urban	Rural	Over-All	Urban	Rural	Over-All	Urban	Rural	Over-All
Punjab									
Tap Water	52	17	28	50	16	27	53	17	29
Hand Pump	13	50	39	11	47	35	10	48	35
Motor Pump	32	27	29	37	31	33	34	30	31
Dug well	1	2	2	1	3	3	1	2	2
Other	2	4	3	1	2	1	3	2	3
Total	100	100	100	100	100	100	100	100	100
Sindh									
Tap Water	71	19	44	71	11	43	74	19	47
Hand Pump	13	60	37	14	63	37	8	55	32
Motor Pump	10	3	6	9	9	9	11	4	8
Dug well	2	8	5	1	9	5	0	8	4
Other	5	11	8	5	9	7	6	13	10

Total	100	100	100	100	100	100	100	100	100
N.W.F.P									
Tap Water	62	40	44	56	45	47	63	40	44
Hand Pump	8	12	11	11	13	13	11	11	11
Motor Pump	17	4	6	24	10	12	15	8	9
Dug well	11	18	17	9	17	16	9	15	14
Other	2	27	23	1	15	13	2	26	22
Total	100	100	100	100	100	100	100	100	100
Balochistan									
Tap Water	84	22	33	77	25	36	81	24	37
Hand Pump	3	5	4	3	6	6	2	7	6
Motor Pump	5	4	4	8	9	9	7	2	3
Dug well	4	28	23	9	15	14	3	20	16
Other	5	42	36	4	45	36	7	47	38
Total	100	100	100	100	100	100	100	100	100
Pakistan									
Tap Water	60	21	34	59	21	34	62	22	36
Hand Pump	13	44	33	12	42	32	9	41	30
Motor Pump	23	18	19	25	23	24	24	20	21
Dug well	2	7	5	2	7	5	1	6	4
Other	3	11	8	3	8	6	4	10	8
Total	100	100	100	100	100	100	100	100	100

Source: Pakistan Social and Living Standard Survey (PSLM), 2006-07

Notes:

1. Household obtaining water from the source indicated expressed as a percentage of the total number of households.
2. Categories: `Tap Water' consists of both tap water inside and outside house; `Hand Pump' includes hand-pumps both inside and outside. Motor pump includes motor pump and tube well outside the house; `Dug Well' includes well open and well closed both inside and out side the house; and `Other' includes public standpipe (supplied by tanker), water seller, canal, river, spring, stream, pond and other.
3. Totals may not add to 100 because of rounding.

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4. Drinking Water Quality

The poor quality of drinking water all over the country is the major problem which is required to be addressed in a holistic manner under all future water supply strategies. The majority of the population in the country is exposed to hazards of unsafe and polluted water. Based on the National Water Quality Monitoring Programme carried out by Pakistan Council of Research in Water Resources (PCRWR), four major quality tribulations in drinking water source of Pakistan include bacteriological (68%), arsenic (24%), nitrate (13%) and fluoride (5%). On an overall basis, out of a total of 357 sources studied, only 45 water source (13%) were found safe, the remaining 312 (87%) were unsafe for drinking purpose. The bacterial contamination ranged from 40-74% for Islamabad, 37-63% for Lahore, 38-79% for Faisalabad, 52-76% for Bahawalpur, 29-71% for Gujranwala, 31-87% for Multan, 53-87% for Rawalpindi, 75-92% for Sargodha, 48-68% for Quetta, 100% for Ziarat, 40-70% for Mangora, 31-77% for Peshawar, 73-100% for Hyderabad, 61-100% for Karachi and 67-83% for Sukkur during 2002-06.

This indicates that in most of the cities of Pakistan, municipal water is unsafe to drink and does not meet WHO guidelines. Further, poor maintenance and intermittent shutting down of piped supply leaving water lines empty, thereby allowing sewage to seep in and make the water quality hazardous. The microbial quality of drinking water supplies is extremely poor in the rural areas as well. In rural areas, there is simply no system in place to assess the quality of drinking water. The availability of drinking water where groundwater is saline, is also a serious problem. The Government of Pakistan, while recognizing that access to safe drinking water is the basic human right of every citizen and that it is the responsibility of state to ensure its provision to all citizens, is committed to provision of adequate quantity of safe drinking water to the entire population at affordable cost and in an equitable, efficient and sustainable manner.

5. Contaminated Water and Health Impacts

Communicable diseases associated with contaminated waters include viral, bacterial, protozoal and worm infections. Viral diseases associated with water include hepatitis and poliomyelitis. The bacterial diseases include Cholera, Gastroenteritis, Leptospirosis, Paratyphoid Fever, Typhoid fever, Shigellosis and Salmonellosis. Protozoans such as Giardia and Cryptosporidium

can produce gastroenteritis and are very resistant to disinfectants. Schistosomiasis, Dracunculiasis and Ascariasis are caused by worms. Table 2 shows diseases associated with contaminated water.

Table 2: Diseases Associated with Contaminated Water

Diseases	Effects
Viruses	
Hepatitis	Fever, nausea, loss of appetite, fatigue, jaundice
Poliomyelitis	Headaches, nausea, vomiting, stiff neck, nasal voice, runny nose, difficulty in swallowing
Bacteria	
Cholera	Extremely heavy diarrhea, rice-water stool, vomiting, thirst, pain, dehydration, high death rate
Gastroenteritis	Vague term for abdominal discomfort, characterized by mild to severe diarrhea, nausea, indigestion, vomiting, cramps, and possibly fever
Leptospirosis (Weil's disease)	Fever, rigors, headaches, nausea, muscular pains, vomiting, prostration, jaundice
Paratyphoid fever	Continued fever, diarrhea, occasional rose spots on body
Salmonellosis	Abdominal pain, diarrhea, vomiting and nausea, chills, fever
Shigellosis	Diarrhea, fever, mucus and blood in stool
Typhoid Fever	Continued fever, usually rose spots on body, abdominal discomfort
Protozoa	
Amebiasis	Prolonged diarrhea, abdominal discomfort, blood and mucus in stool, abscesses of liver and small intestine
Giardiasis	Mild to severe diarrhea, nausea, indigestion, flatulence
Cryptosporidiosis	Diarrhea, abdominal cramps, fever, nausea, and vomiting
Worms	
Ascariasis	Worm in stool, abdominal pain, skin rash, protuberant abdomen, nausea, large appetite
Dracunculiasis	Abnormal redness of skin, itching, giddiness, difficulty in breathing, vomiting, and diarrhea. Symptoms gradually manifest themselves over the entire incubation period and become pronounced a few hours before the appearance of the worm beneath the skin
Schistosomiasis	Worm enters blood stream. Itching of skin, dermatitis rash, body pain, dysentery, anemia, vigors. Snail is intermediate host. The disease is prevalent in tropics and Nile Deltas

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6. Action Plan – Way Forward

Realizing the importance and role of safe drinking water in the improvement of environment as well as the commitment to achieving the MDG, following paragraph would amply summarize the national vision, which forms the foundation for National Water Supply Programme.

"By 2025, every Pakistani should have adequate water supply facilities. The water supply should be of potable quality, adequate in quantity, equitably distributed to meet all basic needs of drinking, bathing and washing. Water supply facilities should be with due consideration of quality of life, economic value of resource, ability to pay and participation of all stakeholders".

In order to meet the vision, Pakistan would require additional water resources to the tune of 4 MAF/year by the year 2025, in addition to existing uses of 4.5 MAF. The major constraints to meet the vision targets for water supply are:

6.1 Major Constraints / Issues

i) Lopsided / unsymmetrical exploitation of groundwater. Water tables are falling in many areas. This requires in depth analysis of groundwater.

ii) A very important parameter for water supply is the quality of available water. It plays vital role for the health of people. It is reported that 40% of all diseases in Pakistan are attributable to poor quality of water, while for children below 5, it is 60 percent.

iii) Lack of operational sewage treatment facilities and industrial effluent is resulting in pollution and hazardous conditions in many streams and rivers.

iv) Groundwater pollution due to vertical and lateral movement of saline water is adversely affecting water quality of groundwater reservoirs which is limiting the availability of potable water.
v) Lack of proper funding for the water supply sector.

6.2 Strategies / Recommendations

- Resource Availability:

The two major sources of water for water supply and sanitation are groundwater through open wells, tubewells, hand pumps springs etc. and surface water through canals. Through the introduction of Devolution Plan, the responsibility of water supply has been transferred to Tehsil Municipal Administrations (TMAs). TMAs are responsible for planning, implementation and administration of water supply sector. In order to plan and implement the schemes, it is essential that water resource availability and quality on sustainable basis be determined at each Tehsil level. Existing water uses with quality be determined and future requirements be estimated for planning horizons of each 5 years upto 2025 and onward.

- Capacity building in TMA would have to be developed to meet the technical requirements.

- Periodic evaluation of some important parameters like bacterial load especially indicating faecal pollution, (coliforms, e.coli etc.) free residual chlorine, turbidity, pH and TDS should be carried out both at source and consumer's end. To ensure safe water supplies for drinking, there is a need to formulate an effective management strategy based on multi barriers of protection from source to the point of use.

- Chlorine, in a variety of chemical forms, has been the disinfectant most commonly used in the world. If only chlorination is practiced, it would eradicate large percentage of water borne diseases. Chlorination equipment must be installed at every tubewell and its efficient operation should be ensured because it is the only choice to provide persistent residual in water supply network to kill pathogens.

- Public awareness campaigns should be launched to educate people about the importance of safe drinking water supplies. The hazards of unsafe drinking water should be publicized. Media and non-government organizations can play a pivotal role in this aspect.

- Water borne diseases data from hospitals should be collected on seasonal basis to propose precautionary measures against water borne diseases in most critical seasons. It would help in devising special monitoring and disinfection programmes during critical period of the year.

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Address of Welcome
By
Engr. Husnain Ahmad
President
Pakistan Engineering Congress
On
World Water Day March 22, 2010
At
"Mashhaddi Hall" of Pakistan Engineering Congress

Honourable Mr. Shakil Durrani Sahib, Respected Scholars,
Executive Council Members,
Fellow Engineers,
Ladies & Gentlemen !

It is the importance of water in the life of individuals and nations that the United Nations Conference on Environment Development (UNCED) held in Rio de Janerio in 1992 declared 22nd March as "World Water Day". Since then, it is being celebrated the world over. At the occasion of World Water Day, experts on "Water Resources" speak on the Theme & the related issues laid down for that particular year.

The theme for this year is:

"Communicating Water Quality Challenges and Opportunities".

Ladies & Gentlemen !

The Allah Tabarak wa Ta'ala, Himself through numerous verses in the Holy Quran signifies about the crucial role played by "Water" in the socio-economic life of mankind.

"And He is Who created the Heavens and the Earth in six days and His Throne was on water" (Sura Hud).

"He showeth you the lightening for a fear and for a honour sendeth down water from the sky and thereby quincheneth the earth after death" (Sura Rome).

"And have sent down from the raining clouds abounded water thereby to produce gram and gardens of thick foliage" (Sura An Naba i.e. Tidings).

Ladies and Gentlemen !

Let me begin by drawing your kind attention towards the importance of Climate Change on Water Resources:

- Environmental experts have visualized that unless the present levels of **"carbon emissions"** are drastically reduced, there will be earth-shattering 2-degree-celsius increase in global temperatures by 2050. The "Copenhagen" formulations will even if scrupulously implemented would arrest the increase at the most by 1-degree Celsius.

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- A second study by sustainability institute of USA reveals that “Copenhagen” proposals will possibly result in 3.9 degree increase in world temperatures by 2100.

- A German study reveals that even if “Copenhagen” proposals are fully implemented, there will be approximately 3.2 degree Celsius increase in temperatures by 2100.

  The UNEP’s chief spokesman Nick Nuttal is reported to have said,

  “It becomes increasingly difficult to achieve reduction and increasingly costly if you wait”.

The leading greenhouse gas emission polluters & further predictions in their respect are given below:

		Million Metric Tons of CO2		
		2007	**2020**	**2050**
1	**China**	8106	11,292	16,232
2	**U.S.A**	6087	6308	7098
3	**European Union**	4641	4804	6912
4	**India**	1963	3194	5027

Pakistan ranks amongst lowest greenhouse gas emitters on the world (135th), but in terms of impacts and vulnerability it ranks in the top 20 category.

Ladies & Gentlemen !

The repercussions of 2-degree temperature increase are visualized as under:

i. Most parts of Amazon rain forest will stand dried / burnt throwing-out millions of tons of extra dioxide.

ii. Greenland’s ice will melt away thereby raising the sea levels by as much as seven (7) meters submerging low lying coastal areas, uprooting millions of people with devastating economic fall-out, altogether disappearance of some of the islands.

iii. Accelerated Himalayan Glaciers melt. The Himalayas Glaciers (12000 to 15000 occupying 500,000 Sq. Km) are receding fast.

    - A study involving 1387 selected glaciers reveals 16% reduction in area since 1962. (over a 48-year period).

    - Another study including Pindari, Gangotri & Dokriani glaciers show the annual retreat by 5 to 49 meters.

The Himalayan Glaciers are the source of sweet water to Asia’s seven (7) river systems including:

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- Indus
- Yangtze
- Mekong
- Ganga
- Brahmaputra

A critical study of the data reveals that if stringent measures are not put in force to check the expected temperature increase visualized at 3 to 3.2 degree Celsius by 2100 (next 90 years).Himalayan glaciers would disappear by 2300. However, the crux of the matter is that the catastrophic consequences are manifestly imminent in the shape of:

- Flooding.
- Drastic reduction in river in-flows resulting in food shortages, Famines, Starvation
- Prolonged electricity outages & the consequent falling living standards.
- Agricultural yields would stand drastically reduced in global terms especially creating food shortages, starvation and throwing millions below poverty lines.

In a recent statement Dr. Zafar Adeel who is an eminent scholar and a member of United Nations Think Tank Team on water said:

"The impact of climate change on water resources was quite central for a country like Pakistan. The general public as well as the political & policy leadership needs to be fully aware of the challenges, being imposed on Pakistan due to climate change"

The question is why so and where does Pakistan Stand in Water Availability?

Ladies & Gentlemen!

Please have a look at the table which shows the rapid reduction in per Capita water availability in Pakistan.

Year	Population (Millions)	Growth Rate (R)	Total Water Availability		Per Capita Water Availability (M3)
			MCM	MAF	
1951	34	0	178840	144.9	5260
1961	43	2.38	178848	144.9	4159
1971	63	3.89	178815	144.9	2838
1981	84	2.72	178836	144.9	2129
1991	111	2.38	178825	144.9	1611
2001	143	2.60	178780	144.9	1250
2010	172	2.10	178584	144.7	1038
2020	204	1.70	178948	145	877
2025	221	1.60	178880	145	809
2030	238	1.50	178710	144.8	751

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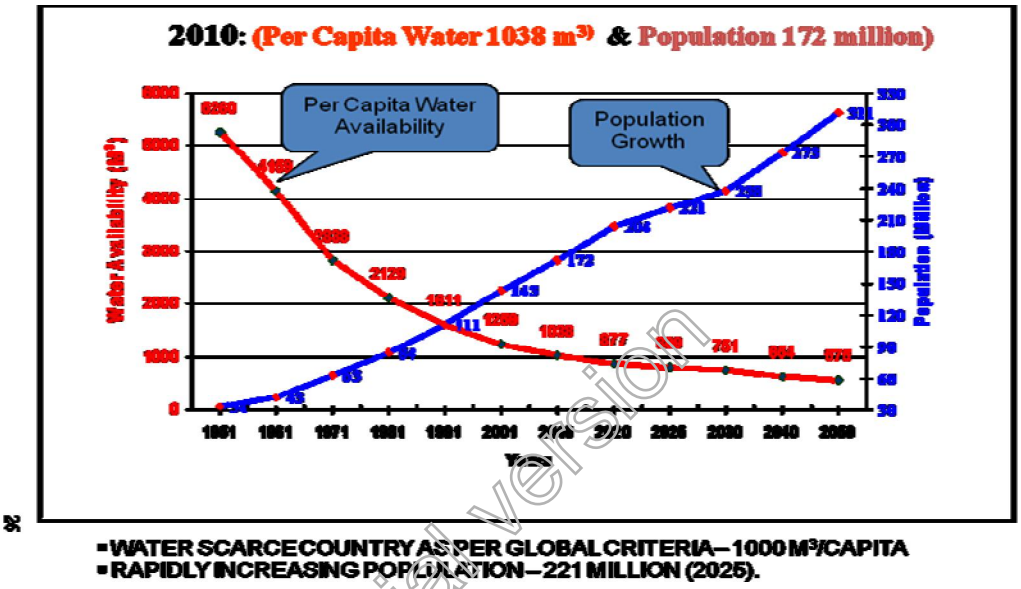
2040	273	1.40	178668	144.8	654
2050	311	1.30	178800	144.9	575

In 1951, per capita water availability was 5260 (Cubic Meter) which stands slided to 1038 (Cubic Meter) in 2010 – a very steep and worrisome position. With the country's population increased from 34 million to 172 million and visualized at 311 million by 2050, the country will be a severely water scarce country with per capita water availability reduced to a miserable 575 (Cubic meter) an alarming and distressing scenario indeed.

A diagrammatic presentation would make the position even more glaring for an understanding mind.



What are the reasons behind this entanglement and what is in store for us in future.

The people at the helm of affairs of the country as well as the planners of socio-economic development schemes without any exception have shown apathetic negligence towards building-up of water reservoirs. Almost 3- precious decades have been wasted away in political wranglings about construction of kalabagh Dam, an engineering matter sacrificed at the altar of political egoistic behavior. What is even more incomprehensible is the non-construction of other Dams now belatedly taken-up and which will take 10-16 years to bear fruit.

- Diamer Basha
- Dasu
- Akhori
- Kurram Tangi & Munda

And let me also share the consequential effect in a comparative manner, if no rains occur over a prolonged period. To quote Engr. Mumtaz A. Khan:

- America has water storage enough for a number of years.
- China has 200 days water storage.
- India has water enough for 170 days consumption
- Pakistan has water storage enough for barely 30-days.

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A disappointing & an enigmatic situation and in the meantime 35 MAF water is wasted away untapped to the sea.

Decades back world renowned veteran Engineer, Engr. S. S. Kirmani (Late) bluntly told that if proper attention is not given to storage and conservation of water , the country would not have enough water for domestic, agriculture and industrial consumption and now due to our ostrich like attitude, we have come to a dead end & do not find an escape route.

Pakistan Scenario

Ladies & Gentlemen !

Let us now have a bird's eye view of access to water etc in the country:

- Compared to 93% MDG target by 2015 an overall 66% of the country's population has access to safe drinking water.
- 85% people of urban areas have facility of safe drinking water.
- Out of 30,000 villages about 1/3rd villages (55% of the population of these villages) have access to safe drinking water. Remaining population of 20,000 or so villages have no such facility.
- 25% of adults and 40% children are exposed to water-borne diseases.
- Ground water should normally be less exposed to bacteriological contamination than surface water. However, even ground water is becoming un-safe due to leakage of pipes, un-treated municipal wastes (both waste water & solid waste) un-checked use of pesticides, nitrogen, fertilizers, industrial wastes etc.
- Tap water availability position is:
    - 62% Urban
    - 22% Rural (a dismal position)
    - 36% overall
- Studies of selected cases reveal that most of the people (almost 80%) are exposed to use of un-safe drinking water.
- Streams & Rivers have been heavily polluted due to defective, out-dated & inadequate sewage treatment facilities and dumping of chemical, agriculture waste. Even lakes like "Mancher" have been polluted to the brink.
- Due to over-mining of water through tubewells and the declining re-charging of underground water reservoirs, the water table has fallen by 40-50 feet.

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Water Quality Scenario

Ladies & Gentlemen !

Water is one of the most precious commodities for sustenance of life. Whilst abundant water is available around us, fresh water resources have depleted at an alarming rate.

Changes in weather patterns are adding more challenges to our experts of water resources management. Pakistan is rapidly becoming a water deficient country.
Excessive ground water exploitation (the number of tubewells is touching 1-million mark) by industry and agricultural sectors have forced untreated industrial and municipal waste water into our fresh water resources. Care free attitude towards water by everyday rising population need comprehensive measures and awareness about water re-use and re-circulation. Non-availability of dams is costing us in billions of rupees annually in terms of ground water pumpage for irrigation. India's building of dams is further aggravating our water resources situation. In order to develop sustainably, we must involve U.N in resolving water issues between us and our neighbors. Any further delay would force us into a water war rather than long waited peace that is so overdue.

On one hand we are losing our fresh water resources and on the other hand we are destroying the quality of the available resources by indiscriminate discharge of all kinds of waste water into our rivers, reservoirs and fresh water streams. Most of the hospital beds in our country are occupied by patients of water related diseases (loss of 0.6% to 1.44% GDP). Hepatitus B and C which were almost non-existent have become an every family's affair.

Pakistan is confronted with all kinds of water related problems. Good quality raw water is only available underground which requires energy resources for pumping. Most of the water supply agencies have poorly trained and carefree manpower. Supply networks are old, rather expired, and occasionally cross-linked with sewerage lines. A system of water quality monitoring at the consumer end is totally non-existent. High Arsenic content in ground water in the southern belt is already taking its toll. Experts have reported high Arsenic in Lahore's groundwater. Menace of high nitrates is spreading around most of our rural areas. Shortage of Iodine is spreading Goitar in the outer fringes of Pothohar region. Earthquake of 2005 has modified groundwater quality in most of the earthquake struck areas. Many springs have disappeared. Surface water quality has deteriorated to a very poor level. Water filtration plants installed could have helped improving drinking water quality but very poor maintenance is taking away all the good-work and with the passage of time these filtration plants are becoming sources of biologically polluted water. In fact, such a temporary arrangement was bound to fail. All around the developed world one will hardly find such a solution for supply of safe drinking water to large communities.

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The only answer to our safe water supplies is the standard treatment plant involving coagulation, flocculation, sedimentation, filtration and disinfection. Every water treatment facility must be equipped with a trained water quality monitoring team and a decent laboratory. All existing water supply networks must be thoroughly examined for leakage and cross-contamination. Expired lines must be replaced with fresh lines. Good quality, high strength PVC pipes, made up of food grade resin, can be used for supply lines. These pipes have smooth inner surface and offer low head-loss when compared with traditional G.I pipes. Water meters at the cost and security of every household would help returning the cost of such endeavors. In fact, if the cost of medical bills for water related diseases is compared with the cost of these conventional plants and supply networks, the latter will outweigh the former within a period of less than two years.

A clean drinking water for all (CDWA) project launched several years back envisaged setting-up of 6626 filtration plants all over the country. This could have gone a long way, however, only 822 filtration plants have been installed.

Availability and Quality of Water in Punjab

Ladies and Gentlemen !

Punjab can be divided into four major zones on the basis of drinking water quality:

a) Sweet zones
b) Brackish zones
c) Barani zones
d) Mixed (brackish / barani) zones

The quality of underground water depends on geo-formation of the zone and is generally manifested in terms of Total Dissolved Solids (TDS).

- Predominantly Water Scarce Barani Districts 3 Nos
- Predominantly Brackish Districts 11
- Sweet Water Districts 13
- Mixed (Brackish Barani) Districts 7

34 Nos

The below given table and diagram will make the matters all the more clear:

Predominantly Water Scarce / Barani Districts	Predominantly Brackish Districts	Sweet Districts	Mixed (Brackish/ Barani) Districts
Rawalpindi	Faisalabad	Lahore	D.G. Khan
Attock	T.T. Singh	Sheikhupura/Nankana	Rajanpur
Chakwal	Multan	Gujranwala	Khushab
	Jhang	Sialkot	Jhelum
	Lodhran	Hafizabad	Gujrat
	Bahawalpur	M.B. Din	Narowal
	R.Y. Khan	Bhakkar	Kasur
	Okara	Pakpattan	
	Sargodha	Mianwali	
	Bahawalnagar	Layyah	
	Vehari	Muzaffargarh	
		Khanewal	
		Sahiwal	

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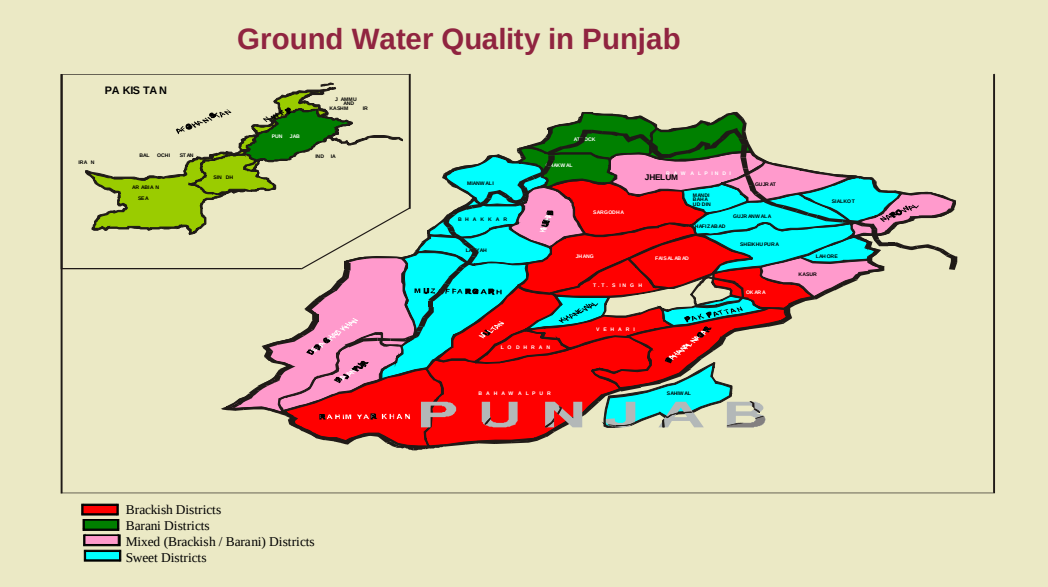

Recommendations:

- There is no substitute of big dams for conservation of water & these need to be completed in record time.
- Presently drinking water availability is about 4.5 MAF. If MDG goals are to be met and drinking water made available to the urban and rural population, water supply would have to be augmented by additional 4-MAF.
- Small Dams (no substitute for big dams irrespective of the numbers built) need to be constructed. In POTHOHAR Plateau 15. Such dams were built (another 5-dams nearing completion). It has created 91746 AFT water storage bringing about 29760 acres of culturable commanded area. It is heartening that small dams are being constructed in all provinces.
- Responsibility of supplying drinking water rests with Tehsil Municipal Administration (TMA's). However, these need to be technically & financially empowered (presently highly deficient).
- Direct supply of water from the ground through tubewells is open to serious health hazards. It should be through "overhead" water tanks and supplied after chlorination & treatment.
- Fiscal measures are required to be undertaken to ensure assured supply of safe drinking water in adequate quantities and at a price that at least covers the cost.
- For conservation of water metered supply should be resorted to in all cases.
- Experts have suggested adoption of the following measures to avoid wasteful use of water:
  i. Hotel industry be encouraged to install ultra-low flow toilets.
  ii. High efficiency washing machines be introduced.
  iii. Planting of low water / drought resistant plants in lawns / gardens.
- Underground water levels have gone down alarmingly due to over-pumping of water by tubewells as well as the set-back to the re-charging of underground aquifer. Govt. of Punjab plans to develop a lake over 500 acres of dried-up bed of sutleg river. It aims to bring 120,000 acres of land under-cultivation besides checking the menace of arsenic substances & brackish water. Such like schemes ought to be launched wherever possible in all provinces.
- India should be made to realize that Pakistan will not allow violation of Provisions of Indus Basin Treaty – 1960. The case in point is the "Kishanganga" Project that

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would significantly impact “Neelum Jhelum Hydro-Electric Plant” besides having additional environmental impacts.

PAKISTAN ZINDABAD

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Inaugural Address
By
Mr. Shakil Durrani
Chairman
Water and Power Development Authority
On
World Water Day March 22, 2010
At
"Mashhaddi Hall" of Pakistan Engineering Congress

President Pakistan Engineering Congress, Distinguished Guests, Participants, Ladies and Gentlemen!

Assalam-o-Alaikum !

1. I deem it an honour and a duty to deliver the inaugural address to this concerned gathering on the occasion of World Water Day being celebrated with the theme "Communicating Water Quality Challenges and Opportunities" organized by Pakistan Engineering Congress in collaboration with WAPDA.
Let me begin with a cliche.

2. Water has a pivotal position in all development activities for its enormous importance in food security, livelihood, environment, economics, power generation and in fact life itself. However, the quality of water whether for use in agriculture, municipalities, drinking, household and in industry acts like a quality multiplier. So it is not only the quantity but the utility which determines the levels a society or a country reaches. This can be appreciated from the fact that out of total available water on the earth, only about 3 percent is directly usable. And of the fresh water, 69 percent is locked up in ice caps and glaciers primarily in Antarctica and Greenlands, 30 percent is stored in ground water reservoirs and only a tiny quantity is available in fresh water lakes, rivers and streams.

3. The water situation in our country as you are aware, is facing both quantity and quality issues. The water availability at the time of independence was 5260 cubic meter (M^3) per capita which has reduced to 1,038 M^3 in the year 2010 and will further reduce to 809 M^3 in 2025. Soon we would be a water starved and not just a water stressed country. Despite these critical shortages, we in Pakistan remain extravagant in its use. Our biggest concern should be the surface irrigation with very low efficiencies and considerable waste. Our farmers are unaware of the benefits of modern irrigation techniques and the responsibility for this primarily lies with Government. Similarly our standards for drinking water and increasingly of irrigation water as well leaves much to be desired.

4. Pakistan has 75 million acres (MA) of land suitable for agriculture. However, by making the additional water available through more storages and high efficiency irrigation system, nearly 20 million acre of additional land can be brought under cultivation.

5. Another aspect which needs attention at the national level is the water which escapes to sea and is more than the requisite amount. Between the period 1976-2009 average annual flows below Kotri have been 31.5 MAF. The flows during the last 10 –

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15 years have often been lower. What is heartening is the realization that we have the land and the water potential not only to feed us but to generate surpluses as well.

Ladies & Gentlemen !

6. In the years ahead we need to concentrate upon the following five priorities for balanced growth and equity:

i) Development of additional reservoirs.
ii) Increasing irrigation water efficiency through modern irrigation modes like drip and sprinkler system.
iii) Ensuring provision of clean drinking water.
iv) Treatment of saline water for use in agriculture and fishery.
v) Recycling of urban and industrial waste water for different uses.

7. These five priorities could be achieved efficiently if only we cost our irrigation and drinking water economically. Currently, for instance only about 25% of O&M charges for irrigation water are actually recovered as Abiana. This recovery does not include the capital costs of the storages and channels. No wonder we are so profligate. For providing drinking water to the disadvantaged sections, an element of intervention by the State in the form of subsidies would be required for some time. For the rest of the population and especially for the large farmer it is important that the real cost of water is recovered from them.

8. As far as increasing storage is concerned, I would also like to mention that after the creation of Pakistan, only 3 Mega water storage reservoirs – Mangla, Tarbela and Chashma have been constructed. Their storage capacity has been reduced by 28% due to siltation. The daily silt deposit in Tarbela is nearly half a million tons. With this reduction in storage capacity, it was felt necessary to start construction of new storage reservoirs. In this regard WAPDA has been executing many projects for the development of surface water resources on fast track basis. These include the Mangla Dam Raising (3 MAF) and Gomal Zam (0.89 MAF). The big one at Diamer Basha Dam (6.4 MAF), Kurram Tangi Dam (nearly 1.0 MAF) and some other projects are currently in various stages of planning and implementation. Diamer Basha Dam Inshallah shall be started early next year. A dozen Small and Medium Dams are also in different stages of planning and implementation in all the four provinces with potential of storing 2.5 MAF and will be completed by 2013. Studies for storages and other sites are also underway by WAPDA.

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9. Wastage in irrigation needs rectification by adopting high efficiency irrigation systems like drip and sprinkler irrigation. In drip irrigation, there could be a saving of upto 50% of irrigation water and also a concomitant reduction in the use of fertilizer. The initial costs are high at about Rs.50,000 to Rs.70,000 per acre but then water is even more valuable. In any case the costs can be recovered in a few years. The flood irrigation system requires 3,470 M^3 of water per crop acre whereas drip irrigation system requires 1,590 M^3 of water per crop acre and sprinkler requires 1,690 M^3 of water per crop acre. Drip can save 1,880 M^3 of water, whereas, sprinkler can save 1,780 M^3 of water per crop acre. A comparison of flood and drip irrigation is shown in the slides. By adopting high efficiency irrigation system, the additional area can be brought under cultivation with the saved water.

10. The water channels pollution is frequently associated with the disposal of untreated effluents from municipal, industrial and agricultural wastes. The natural streams are always considered as an easy way to dispose off many kinds of effluents. The psychology behind this practice is that the wastes are washed away and are not visible at dumping sites. Besides this, indiscriminate pumping of groundwater is causing over mining which is enhancing salt water intrusion and polluting the groundwater.

11. WAPDA is presently undertaking a study for treatment of saline water of the RBOD-I. Our consultants would soon submit the initial recommendations for treating water for a pilot project of 40 cusecs. The costs are doubtlessly high but their long term benefits are more alluring. Imagine, if we can save 10 MAF of saline and polluted water and use this for agricultural purposes. This adds a Tarbela Dam equivalent reservoir for us.

Ladies & Gentlemen !

12. We have no more time for sterile discussions and debates; now is the time to act. Planned usage of available resources and developing a time bound action plan are central to our survival. Organizing and engaging local communities to help themselves through practical schemes and creating awareness among masses about the precious resource scarcity is need of the day. For managing water scarcity, WAPDA is recommending adoption of high efficiency irrigation system in both public and private sectors. Each province needs to earmark at least 10,000 acres next year for drip and sprinkler irrigation through PSDP as pilot project in collaboration with private sector. Credit facilities for such innovative programmes are urgently required. Distinguished individuals like yourselves and organizations like the Pakistan Engineering Congress could act as agents of change in this regard.

13. In the end, I would like to thank Pakistan Engineering Congress, WAPDA and representatives from other organizations for their participation and commitment to the goal of the World Water Day. We should not just be observing the World Water Day as a one-off event but move forward to celebrating it in the years ahead through achieving our objectives. Your contributions would certainly be helpful in better understanding the water quality problems; its magnitude and solution. I would suggest that the recommendations of the seminar should be sent to all the federal and provincial institutions dealing with water.

Thank you and Allah Hafiz

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