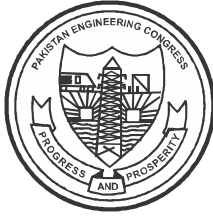




PAKISTAN ENGINEERING CONGRESS

73rd ANNUAL SESSION
January 2014 to December 2015

Abstracts of
Proceeding Papers



ON BEHALF OF PAKISTAN ENGINEERING CONGRESS

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COAL EXPLOITATION AND UTILIZATION FOR ECONOMIC DEVELOPMENT

By:

Prof. Dr. Shahid Munir

Director, Centre for Coal Technology University of the Punjab, Lahore.

Abstract:

According to electricity generation portfolio of Pakistan, oil and gas have 66.88% share out of which 38.5% is being generated from imported furnace oil. Electricity generation from imported furnace oil is costly and not viable for domestic and industrial consumers. Pakistan must develop its unutilized indigenous coal resources to replace imported oil and depleting gas reserves (only 24.07 TCF balance recoverable reserves) for power generation to combat ever worsening energy crisis and rising future demands, A detailed thermo-chemical analysis of indigenous coal from all provinces revealed that 175 billion tons of Thar coal is ideally suited for power generation without any upgradation as it contains 1% sulphur and less than 10% ash whereas other coals of Baluchistan, Punjab, KPK, Sindh and Kashmir require washing prior to blending or use for power generation to reduce sulphur and ash. Keeping in view the geology of Thar, open pit mining is found to be the best way for excavation of coal. The very reasons for the rejection of underground coal gasification (UCG) of Thar coal have also been discussed. An analysis of 21st century coal fired power plants is discussed. Clean coal technologies for power production in 21st century including co-combustion, air-staging, reburning, low No_x burners, desulphurization, CO₂ capture & storage technologies, selective catalytic reduction (SCR) and IGCC have been discussed. Integrated gasification combined cycle (IGCC) is found to be the best environment friendly and high efficiency technology for power generation from Thar coal. In addition, right strategies for excavation of indigenous coal and power generation technologies are presented in detail. Furthermore, eleven recommendations have been put forward for solving the present energy orisis and to fulfill future electricity demands of the country in the light of international Energy Agency (IEA) forecasting scenario.

IRRIGATION SCHEDULING

By

Mohammad Ashraf, Arif Anwar, Muhammad Aslam

Abstract:

This action paper is the result of a dialogue on irrigation scheduling among key actors; water authorities, technical experts, users and service providers. The nation-wide dialogue on irrigation scheduling was designed to identify and develop a consensus on critical issues, potential actions and actors willing to undertake actions to address the identified issues. Issues with regard to irrigation scheduling in Pakistan included (i) inadequate surface water due to low water allowances; (ii) rigidity of the *warabandi* system of water management; and (iii) inadequate availability of information on crop water requirements, weather data and equipment used to measure soil moisture. The identified consensus actions included; (i) upgrading of 33 national Ag-Met stations, (ii) estimation of daily potential evapotranspiration (ET_o) for all 33 Ag -Met stations, (iii) improving data sharing with Pakistan Council of Research in Water Resources (PCRWR) and publishing on website on a daily basis, (iv) estimation of ET_c for all major crops and all agro-climatic zones on a weekly basis, (v) dissemination of appropriate information for irrigation scheduling through media & smart phones, (vi) development of an on-line irrigation scheduling calculator, (vi) development of simple instruments/guidelines for farmers to assess irrigation needs (how much to irrigate and timing (when to irrigate), (vii) supply tensiometers and other low cost equipment, including training and support for equipment use, (viii) improved training of water professionals in irrigation for transfer of irrigation scheduling technology to farmers, and (ix) promotion of uptake of irrigation scheduling technology to increase agricultural productivity. This paper provides details of the key actors willing to implement these actions to improve irrigation scheduling in Pakistan. The Pakistan Water Dialogue project was supported by US Department of Agriculture (USDA) and implemented by International Water Management Institute (IWMI).

EFFICIENT APPLICATION OF WATER ON FARM

By

Bakshal Khan Lashari, Arif Anwar, Muhammad Aslam

Abstract:

This action paper on the efficient application of water on farm in Pakistan was developed through a national dialogue among key actors; water authorities, technical experts, users and service providers in Pakistan through the US Department of Agriculture (USDA) supported Pakistan Water Dialogue implemented by the International Water Management Institute (IWMI). The objective of this national dialogue on the efficient application of water on farm is to identify and develop a consensus on the issue, the potential actions and actors willing to take actions to address efficient application of water on farm issues. The consensus on the issue included; a lack of knowledge on improved water management technologies; inadequate institutional capacity, limited access to suitable literature (brochures, pamphlets, radio and TV programs); lack of institutional coordination, low adoption of laser land leveling; low adoption of practices such as bed and furrow, zero tillage, drip and sprinkler technologies due to both knowledge and financial constraints; and the very low price of surface water. The consensus actions for efficient application of water on farm included: promote land grading/levelling, zero tillage, furrow, border strip, and drip irrigation technologies, train professionals in improved water management technologies and skills, manufacture, supply and maintain equipment: eg. zero tillage, laser land levelers, promote low tech (low head drip-drip bucket technology). The paper provides details about different key actors who could take these actions to improve the on-farm water application efficiency.

RAINWATER HARVESTING

By

Abdul Wahab Kakar, Arif Anwar, Muhammad Aslam

Abstract:

This paper on rainwater harvesting is the result of a national dialogue across Pakistan amongst key actors; water authorities, technical experts, users and service providers. This dialogue was supported by the US Department of Agriculture (USDA) through the Pakistan Water Dialogue project which was implemented by the International Water Management Institute. The purpose of this country-wide dialogue was to identify and develop a consensus on the key issues in rainwater harvesting, and the potential actions and actors who may take actions to address RWH issues. The consensus on rainwater harvesting issues included; a lack of policy; inadequate institutional capacity; poor law enforcement; lack of financial resources for rainwater harvesting infrastructure development; a lack of awareness and any concerted effort to build capacity; and lack of improved rainwater harvesting techniques. The consensus on some of the actions included: research & training on rainwater harvesting structures; develop and manage a data acquisition network for rainfed areas; implement community water infrastructure development projects in rainfed areas; provide through banks, loans to farmers to develop rainwater infrastructure; establish demonstration sites for rainwater harvesting technologies; prepare a master plan for appropriate rainwater harvesting programs; strengthen existing institutions to promote rainwater harvesting; effective legislation. The paper provides details of the key actors who would take actions to address some of the rainwater harvesting issues.

GROUNDWATER ISSUES

By

Ahmad Khan Bhatti, Arif Anwar, Muhammad Aslam

Abstract:

This paper on groundwater in Pakistan is the output of a dialogue on groundwater amongst key actors including; authorities, technical experts, users and service providers. This dialogue was supported by the US Department of Agriculture (USDA) through the Pakistan Water Dialogue which was led by the International Water Management Institute in Pakistan. The aim of this dialogue on groundwater was to identify and develop a consensus on; the major issues, potential actions and actors who might take actions to address groundwater issues. The major groundwater issues on which the key actors reached a consensus included; the declining groundwater table; high pumping costs; a deterioration of groundwater quality and a degradation of soil quality (soil salinization). Some recommended actions to address these issues include; approve a national water policy; strengthen institutional capacity; finance research and development; monitor groundwater, establish a groundwater data bank, enforce groundwater regulations and provide soft loans to farmers for initial installation of solar power system for tube wells. This paper provides details of the various key actors who could take these actions to address various groundwater issues.

SURFACE WATER ISSUES

By

M. Waseem Asghar, Arif Anwar, Muhammad Aslam

Abstract:

This paper on surface water issues in Pakistan was developed through a dialogue amongst key national actors categorized as; water authorities, technical experts, users and service providers. This dialogue was supported by the US Department of Agriculture through the Pakistan Water Dialogue implemented by the International Water Management Institute in Pakistan. The objective of this dialogue on surface water issues was to identify and develop a consensus on the issues, potential actions and actors who may take appropriate action. The consensus on the key surface water issues included; an as yet draft national water policy, inadequate budgets for water reservoirs, lack of advocacy and communication strategy for building socio-political consensus for implementation of trans-provincial water projects; poor institutional coordination; little if any interaction between Government agencies and research/academia; inadequate water pricing and fee collection; and unresolved trans-boundary and inter-provincial water disputes. The consensus actions identified include: approve the national water policy, manage hill torrents, improve operation & maintenance of irrigation canal infrastructure, research on climate change, construct medium & large water reservoirs, and strengthen institutions e.g. WAPDA, IRSA, Indus Water Commission & PIDs; establish water industry and academia linkage; create think tanks on surface water issues, constitute panel of water experts; launch an awareness campaign on water scarcity and improved water conservation practices; develop a central data bank of surface water bodies for real assessment of available surface water flows in Pakistan. This paper provides details of the actors who indicated an appetite to take some of these actions forward.

MINIMIZING FLOOD DAMAGES TO AGRICULTURE

By

Nazir Ahmed Memon, Arif Anwar, Muhammad Aslam

Abstract:

This action paper on minimizing flood damages to agriculture in Pakistan was developed through a comprehensive dialogue on flood damages to agriculture. Key actors in this dialogue included; water authorities, technical experts, users and service providers. This dialogue was part of the Pakistan Water Dialogue supported by the US Department of Agriculture (USDA) through a project implemented by International Water Management Institute in Pakistan. The objective of this national flood damages to agriculture dialogue was to identify and develop a consensus on; the key issues, potential actions and actors willing to take actions to minimize flood damages to agriculture. The consensus on key issues included; a lack of a flood policy and laws; inadequate institutional capacity and coordination; lack of integrated national flood management plan; lack of pre-flood preparedness and post-flood management; inadequate existing water storage capacity; lack of new storage reservoirs; inadequate and ineffective flood and drainage infrastructure. The consensus on the actions to address minimizing flood damage to agriculture were; approve the national water policy; develop and implement a flood early warning system (FEWS); develop a community based FEWS; build capacity of students (future professionals); current professionals and community leaders in FEWS; improve flood & drainage infrastructure' improve watershed management; conduct research on climate change; enhance water storage capacity; map zones for flood lakes/flood overflow depressions and mapping and synthesizing of Met and Stream gauging stations in the country. The paper provides details about the key actors who showed willingness to take these actions to minimize flood damages to agriculture in Pakistan.

CAPTURING THE FLOOD WATERS

By

Yawar Hamid, Arif Anwar, Muhammad Aslam

Abstract:

This paper is the output of the dialogue on flood waters capture in Pakistan developed through discussion amongst key actors namely; water authorities, technical experts, users and service providers. This dialogue was held as part of the Pakistan Water Dialogue supported by the US Department of Agriculture (USDA) through a project implemented by the International Water Management Institute in Pakistan. The objective of this dialogue on the capture of flood waters was to identify and develop a consensus on; key issues, potential actions and the actors willing to take actions to address the issues. The key issues on which consensus was reached; included lack of new large dams; inadequate capacity of existing dams; lack of a multi-role like flood mitigation; irrigation; power generation and environmental flows of water reservoirs; climate change; and floods dealt with sporadically and arbitrarily; more as remedial measures and not preventative. Key actions on which there was consensus from the actors included: develop new water storage infrastructure like wetlands, recharge dams, rehabilitation of waterways and reservoirs; develop hill torrents; enhance capacity of canals to accommodate flood water; identify potential water storage sites, prepare a master plan for floods, develop and manage a data bank; construct new link canals from Marala Barrage linking Ravi and Sutlej Rivers; construct new storage lakes and ponds; construct new irrigation systems using flood water; construct new head works on River Jhelum, upstream of Trimmu; and construct infiltration ponds and infiltration trenches. This paper also details the key actors who might take these actions to address the capture of flood waters in Pakistan.

EFFECTIVE REGULATIONS FOR SUSTAINABLE CONSTRUCTION

By:

Engr. M. Mazhar-ul-Islam

Abstract:

Presently there is a huge construction activity, primarily in Infrastructure development mostly in public sector, which is executed that includes \$ 46 billion dollars CPEC, metro, orange line. There must have to be a balance between quality of construction and time duration of the project besides ascertaining right costs of construction. Unfortunately, in some provinces, there remain trends of the political leadership to dictate the Professionals, who are otherwise responsible for such Professional Engineering Works as defined under section 2(xxv) of the Pakistan Engineering Council Act (PEC) 1976 as amended in 2011, a statutory regulatory body to regulate; among others, the construction sector of Pakistan. Unrealistic and politically motivated dictates by the politicians regarding project completion time resulted into poor quality of construction, frequent extension of time and cost overrun causing huge loss to the National Exchequer.

Construction of a project to become sustainable, it is desired that construction should be of desired quality, at right cost completed on time and also environment friendly. Applicable design and construction standards, environmental standards, building codes, safety codes etc are to be adhered to. In Pakistan, Country regulations for sustainable construction include Local regulations and adopted International regulations such as FIDIC documents for transparent bidding and award of construction and consultancy contracts which is the prime concern particularly to eliminate rampant corruptions in the construction sector prevailing in Pakistan.

Although International organizations, such as, FIDIC has developed and updating standard bidding documents, standard conditions of contract, procedure for bid evaluation and award of contracts; however, such standards and rules can effectively be enforced in a particular country by issuing the Statutory Notifications. Funding agencies, such as, World Bank and Asian Development Bank has encouraged development and up keeping of Country specific regulations based on the international standards and regulations in conformity with relevant country laws.

In Pakistan, in order to create such regulations, Parliament of Pakistan has created, among others, Public Procurement Regulatory Authority, Pakistan Engineering Council and Competitive Commission of Pakistan. Whereas, Public Procurement Regulatory Authority provides certain fundamental rules to be adhered for bidding, evaluation, award and contracts for all type of procurements to be procured; PEC regulation includes development and enforcement of nineteen PEC Country Bidding/ Contract Documents, Procedures for bid evaluation and award of contracts, Price Adjustment methods, Rules for Conciliating & Arbitration are required to be enforced in true spirit. PEC regulations also include development of construction Bye-laws, Conduct & Practice of Consulting Bye-laws, Code of Ethics, Licensing requirement by the constructors, consultants and the individual engineers. The PEC country regulations in Pakistan has provided the effective tools for transparent bidding and award of construction and consultancy contracts which are designed to ensure quality construction and timely completion of the project.

GEOMORPHOLOGICAL AND GEOLOGICAL INVESTIGATION USING DIGITAL ELEVATION MODELS (DEM) OF ISLAMABAD DISTRICT, PAKISTAN

By:

Sajid Rashid Ahmad, Usman Ahmad, Muhammad Asim Rizwan

Abstract:

Digital Elevations Models (DEM) are useful to access the Topography, landforms, geomorphology as well as modeling of surface processes. Various geological & geomorphological features characteristics can be identified and delineated by incorporating remote sensing data and conventional data with sufficient ground truth information. Present study aims to delineate the geology and geomorphology in Islamabad district using integrated approach of the remote sensing and GIS techniques. The processing involves Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) DEM to observe the elevation, slope, aspect, shaded relief and drainage pattern to identify faults and lineaments. To interpret location of fault plane in the study area DEM drainage network and relative drainage density has been used. Slope and lineament maps are produced using ASTER DEM that suggests that entire study area is covered by very low slope (0° - 5°). Lineaments are generally oriented $\leq 180^{\circ}$ NS while in SE of study area, the direction is largely NW to SE. The change in lineament direction suggests that the northern side of the study area is covered by hilly terrain i.e. Margalla hills. DEM has been an excellent supplementary information database for interpretations in the present study area along with data from other sources.

GROUNDWATER MANAGEMENT USING MODFLOW- A CASE STUDY OF RECHNA DOAB, PUNJAB, PAKISTAN

By

Ghulam Zakir Hassan, Faiz Raza Hassan, Sultan Ahmad Rizvi

Abstract:

Faisalabad is the 3rd largest city of Pakistan where underlying aquifer mostly contains saline water. The burgeoning population of the city needs huge quantity of fresh water. Water requirements for the existing Faisalabad city are being met by installation of well-fields along Jhang Branch canal, where groundwater is fresh. The increasing population pressure requires more water and identify more suitable sites for installation of well-field on sustainable basis. It was deemed imperative to elevate the existing well field. The MODFLOW, a numerical groundwater model developed by United States Geological Survey (USGS) for simulation and future prediction of aquifer behavior in response to pumping by various well fields was developed, calibrated and validated satisfactorily. A groundwater decomposition approach was also developed to tune various coefficients used in estimation of inflow and outflow components of groundwater system. The calibrated model was used to predict the future response of aquifer under different scenarios of pumping by existing and future/proposed well-fields. The Calibrated flow model revealed that a sink has already been developed at the center of existing well-field of Water and Sanitation Agency (WASA) due to excessive pumpage. Future predictions of model indicate that there is no conspicuous change in regional groundwater flow pattern, even with all the existing tubewells remaining in operation. However, the sink in the WASA well field area further deepens and flow gradients become comparatively steep showing increase in groundwater flow velocity. Depth to watertable has already increased from 12 m in 2005 to 16 m in 2011 in the critical area of WASA well field. Model has predicted that this depth will further increase to 24 m in 2018. It has also been observed that groundwater quality along the river is fresh and becomes saline towards Faisalabad city. Due to pumpage in the fresh water zone model predicts that saline water will rush towards well fields deteriorating the quality of fresh water along Jhang Branch Canal. Therefore, it has been suggested that site for further pumping should be moved towards upstream of Jhang Branch Canal at least up to RD 180-187 and possibly on right side of the canal instead of left side.

IMPACTS OF CLIMATE CHANGE ON WATER RESOURCES OF PAKISTAN

BY

Javeed Iqbal Bokhari, Ather Hameed Awan, Dr. Qazi Tallat M. Siddiqui

Abstract:

The economies of South Asian nations are highly dependent on summer of monsoon and water supplies from glaciers and snowmelt. However, excessive and inadequate rainfall causes floods and droughts respectively, which have damaging effects threatening food security in many cases. Global climate change is an emerging concern, which may cause serious impacts on the monsoons, frequency, intensity and distribution of rain spells on temporal and spatial scales, accelerated melting of glaciers and increased number of floods and droughts. Potential direct impact of climate change include reduction in inflows to water reservoirs, water shortage for agriculture, insufficient recharge of groundwater and sharp decline in per capita water availability.

Current vulnerabilities to climate are strongly correlated with climate variability, in particular precipitation variability. These vulnerabilities are largest in semi-arid and arid low-income countries like Pakistan. According to IPCC Fourth Assessment Report 2007, with the increase in temperature, the increase in frequency and intensity of extreme events is "very likely" i.e. 90% sure. Under warming conditions, the summer season will expand while winter will shrink. Ultimately, the snowfall will occur for a shorter duration and melting will continue for longer period bringing drastic changes in water balance. Snowmelt and supply of water will be available much earlier than the present (prior to Kharif sowing) and may be inadequate when required in early autumn for Rabi sowing. Soil degradation will be the major challenge for sustainable crop production. Both summer and winter weather patterns are expected to yield the same amount of precipitation in a highly erratic behavior over time and space. The economies where water management practices would not be able to face the challenges posed by climate change will be highly vulnerable to the vagaries of global warming.

PAKISTAN'S WATER SECURITY ISSUES AND ADDRESSING STRATEGY

BY

Riaz Nazir Tarar

Abstract:

With finite water resources and progressive deterioration of quality, Pakistan's water needs are rapidly increasing basically due to burgeoning population. The position is being further exacerbated by: Indian water aggression on Western Rivers; and adverse impacts of global climate change. In this backdrop, water security of Pakistan has acquired critical importance for its economic sustainability if viewed in the context of close linkage between water, food and energy.

This paper attempts to synthesise Pakistan's water security issues / challenges and proposes a strategy for addressing them. For this purpose, a review has been made of: present scenario covering transboundary and in-country issues; internal water conflicts; overview of current utilization of resources; and challenges of effective management including governance, existing legislation and institutional set-up. This leads to suggestions for addressing strategy through: holistic approach; improved institutional mechanism; resolution of internal conflicts over water use; realistic water pricing; and priority implementation of multi-purpose dams starting immediately with fully engineered Diamer Basha Dam and Kalabagh Dam Projects.

RAIL LINK BETWEEN PAKISTAN AND CHINA- PRE-FEASIBILITY STUDY

By:

Abdul Rehman Chaudhry¹

The building of a railway line between the northern end of the existing railway network at Havelian and Pakistan / China border is, first of all an international transportation project, aimed at developing and improving the economic and living conditions not only in Pakistan, but also in the western parts of the People's Republic of China. Secondly, and in a wider context, this railway line offers a chance to again link the western and the eastern hemisphere in the same way as the legendary silk route did – but now with state-of-the-art means of transportation.

Realising the importance of the above stated rail link, Pakistan Railways awarded a contract in February 2007, through international competitive bidding process, to a Consortium headed by ILF Consulting Engineers, Austria, for carrying out its prefeasibility study. The author of this paper was the local project coordinator for this study.

The Consortium submitted the Pre-feasibility Study Report in May, 2008 along with the recommendations for the next planning stages (especially feasibility study). The PC-II for the feasibility study of this project, prepared by Ministry of Railways in accordance with the above referred recommendations, is awaiting sanction of the Government of Pakistan.

The present Government in Pakistan signed an agreement with China in June, 2013 for the establishment of “Pakistan-China Economic Corridor” (CPEC) which included the linking of Kashgar in Xinjiang with Pakistani port of Gawadar, by road as well as rail. The construction of the proposed “Karakoram Railway” between Kashgar and Havelian, and its further linkage with Gawadar Port, will reduce substantially the existing distance between Kashgar and Indian Ocean.

China, by expanding its stakes in Pakistan's rail sector, is poised to exploit the country's advantageous geographical position- strategically located at the confluence of South, Central and West Asia.

¹ Abdul Rehman Chaudhry, MSc. (Structural Engineering), Chief Engineer (Civil & Structures) ILF Pakistan (Pvt.) Ltd Lahore

Paper No. 764

PHYSICAL HYDRAULIC MODEL STUDIES OF NEELUM JHELUM HYDROELECTRIC PROJECT, PAKISTAN

By:

Khalid Mehmood, Engr. Muhammad Sehroosh, Dr. Engr. Mazhar Hussain**Abstract:**

The Neelum Jhelum Hydroelectric Project, expected to be completed by about October 2017 will utilize a gross head of about 420 meters by diverting the Neelum River flows from Nauseri to the lower limb of Jhelum River through a 28.6 km long headrace tunnel system and would generate capacity of 969 MW with an estimated annual energy output of about 5150 GWh. The main civil works include dam and river diversion, diversion dam, intake and sedimentation basins, ogee spillway, debris flow channel, headrace tunnel and surge chamber, underground power station complex, tailrace tunnel and outlet Structure. The project has a number of interesting hydraulic characteristics, which were tested through Physical model studies at Nandipur hydraulic field research station. This paper highlights physical hydraulic model tests performed with specific reference to hydraulic performance of ogee spillway for energy dissipation and downstream scour pattern.

WATER SECURITY FOR SUSTAINED DEVELOPMENT OF PAKISTAN

By

Engr. Ishteqaq Ahmad Kokab, Engr. Husnain Afzal

Abstract:

Pakistan ranks thirteenth in the 2015 Global Index of Fragile States. Beyond political and social instability, the availability of and access to fresh water has emerged as a major security challenge. The country must contend with declining water availability, growing pollution and climate change-induced rainfall and river flow variability. It also suffers from systemic corruption, ineffective governance and an illegal water trade that undermines water management. The country does not presently have the governance capacity to manage urban growth and this will exacerbate Pakistan's water insecurity. Severe water shortages, surface and ground water pollution caused by industrial and domestic effluents and underdeveloped infrastructure in sprawling metropolitan areas are just some of the urban challenges that Pakistan must address. Water is at the heart of Pakistan's development needs. With the assistance of the international community, Pakistan must move beyond strategizing and begin implementing its Vision 2025 if it is to mitigate the national water crisis.

Pakistan's transboundary water issues with India and Afghanistan are also threatening domestic, political and environmental security in an already fragile region. Intrastate conflicts can cause more damage and violence than interstate water disputes, evidence from Pakistan is clear that water scarcity, floods, droughts, and domestic mismanagement can embitter the inter-ethnic relations and prompt political tension, which can in-turn lead to violence.

The occurrence of water-related environmental extremes, such as floods and droughts, accentuate this social stratification and highlight climate change as one of Pakistan's emerging threats. In order to devise a strategy to ensure water security for sustained development of the country, the following aspects have been studied in this research.

- Efficient water use in agriculture.
- Water pricing.
- Water use in Industrial/domestic sectors and its conservation.
- Importance of Storage Reservoirs and Government Policies on water sector.
- Inter-Provincial Disharmony.
- Trans-boundary water issues.
- Re-use of saline effluent.

ON-FARM WATER STORAGE

By

Mushtaq Ahmad Gill, Arif Anwar, Muhammad Aslam

Abstract:

This paper is the result of a dialogue on the “On-Farm Water Storage” among key actors; water authorities, technical experts, users and service providers. The nation-wide dialogue on irrigation scheduling was designed to identify and develop a consensus on critical issues, potential actions and actors willing to undertake actions to address the identified issues. Issues with regard to irrigation scheduling in Pakistan included (i) inadequate development of command areas of both off-farm and on-farm storages (small and mini dams, ponds and wells), (ii) constructed delay-action dams act more or less as evaporation ponds due to silting and sealing of beds; (iii) difficulty in installing on-farm storages because of the loss of land for cultivation for small farmers with land holdings less than 5 ha; and (iv) limited opportunity for increased on-farm storage for tail reach farmers who receive inadequate irrigation delivery volumes. The consensus on actions identified to resolve key On-Farm Water Storage issues include: (i) recommendations to conduct more detailed research on on-farm water storage to develop user friendly evaluation, design and construction techniques; (ii) raise awareness and build capacity of all stakeholders; (iii) establish pilot demonstration projects show-casing On-Farm Water Storage; (iv) disseminate knowledge and information on On-Farm Water Storage; develop demonstration Water Storage structures at distributary level, and (v) undertake feasibility studies of designed storages. The paper provides details of the key actors willing to implement these actions to improve On-Farm Water Storage in Pakistan. The Pakistan Water Dialogue project was supported by US Department of Agriculture (USDA) and implemented by International Water Management Institute (IWMI).

MODELING OF CHLORINE DECAY IN NUST DRINKING WATER DISTRIBUTION SYSTEM

By:

Wajeha Tauqir, Syeda Rida e Zanib, Ifrah Imtiaz, Zohaib Mansha,
Imran Hashmi

Abstract:

Water quality deterioration in drinking water distribution network has a great impact on public health. Residual chlorine in distribution system decays gradually and should be maintained within the acceptable limit to avoid recontamination and microbial growth. The objective of this study is to investigate the ability of EPANET 2.0 and WaterCAD V8 XM to simulate residual chlorine decay along drinking water distribution network, while taking water-age analysis into consideration and to locate points on the network where chlorine boosters should be installed. Water distribution network of National University of Science and Technology (NUST) H-12, Islamabad was selected for the research. Hydraulic model was run by using the data provided by University's project management office. Bulk decay coefficient was calculated by regression method in the laboratory and wall decay coefficient was assumed from the literature review. Calculated bulk decay coefficient value is -0.071h^{-1} . EPANET and WaterCAD V8 XM models were calibrated using field measurements. Water quality analysis indicated that the initial chlorine dosage currently used is not enough to provide clean drinking water to all the consumers. Also an inverse relationship is established between water age and residual chlorine that is with an increase in water age residual chlorine decreases. Comparison between EPANET results and field measurements of residual chlorine has a root mean square error of 0.152 whereas root mean square error of 0.254 is calculated while comparing WaterCAD V8 XM results with field measurements. 8 set point chlorine boosters of 0.3 – 0.6mg/l are recommended to install at different locations in order to provide water with required chlorine levels to the consumers.

HILL TORRENTS OF PAKISTAN

By:

Tariq Altaf¹, Abdul Khaliq Hashmi²

Abstract:

Hill Torrent is a rushing stream descending from a hill / mountain having a very high ratio of maximum and minimum flow which is generally of very short duration but heavily impregnated with sediments.

Floods and landslides accounted for 49 per cent of all natural disasters in 2014, causing 63 per cent of the total number of disaster related deaths and 34 per cent of the total number of people affected by disasters.

Hydro-meteorologically, Pakistan lies in semi-arid to arid region of the Earth. Mighty Indus and its four main tributaries – Jhelum, Chenab, Ravi and Sutlej traverse through Pakistan before out-falling into Arabian Sea. Gross catchment area of the Indus Basin is about 1,258,400 Km² of which 190,000 Km² comprises some of the world's largest glaciers and snow-covered mountain ranges. Part of the drainage area of Indus River System lies outside the country comprising some of the world's highest peaks and major ranges of Pakistan.

Hill Torrents in various parts of Pakistan drain about 65 percent of the total area of the country. Hill Torrents terrains possess enormous potential of water and land resources. However, at the same time unmanaged flood flow cause heavy monetary losses during every major flood. Major part of catchment areas of hill torrents lie in arid to semi-arid region, thus requiring artificial means for sustained agriculture. Pakistan has already harnessed major part of the conventional resources. In order to meet the needs of the growing population, concerted efforts are required to conserve non-conventional resources of water, of which hill torrents occupy the most prominent position.

¹ Vice President / Head, Water Resources Division, NESPAK, Lahore E-mail: ta@tariqaltaf.com

² Advisor, Water Resources Division, NESPAK, Lahore E-mail: akh549@gmail.com

INSTREAM HYDROKINETIC POWER TECHNOLOGY- A CASE STUDY OF GHAZI BAROTHA POWER CHANNEL

By:

**Muhammad Mohsin Munir, Tariq Altaf, Javed Munir, Muhammad Muneeb
Khan**

Abstract:

Pakistan is facing acute problem of shortage of electricity both for domestic and industrial usage. This puts immense pressure on the government functionaries to support the development of new means for power production by different energy sources. Instream energy technology is the energy which is derived from the movement (kinetic energy) of water in rivers, streams and canals. This is different from low head hydropower generation which is dependent upon the available working head. The proposed paper envisaged review of applications of instream hydrokinetic turbines all over the world. A brief description of the technology opted by various countries is also presented. Based on the existing knowledge, our case study of power potential through hydrokinetic turbines at Ghazi Barotha power channel is presented. Based on preliminary power potential study, it is concluded that a potential of 12-20 MW can be harnessed using instream Hydro-kinetic turbine technology on Ghazi Barotha power channel. It is recommended that detailed investigations of the site may be carried out to ensure its impact on the canal and on the power channel using physical model studies. Further, it is recommended that similar technology may be adopted at Barrage Gates as minimum infrastructure will be required

WATER SECURITY ISSUES AND WAY FORWARD

By:

Dr. Izhar-ul-haq, Abdul Khaliq Khan

Abstract:

Pakistan is among the world's most water stressed countries. There is seasonal and temporal availability. Water demand is on the rise. In order to ensure water security, Pakistan has to store water when surplus from its use when it is short. Pakistan should harness its hydropower potential also. Harnessing these assets requires a paradigm shift in water policy and management. It should start building dams as soon as possible.

The stakeholders should also focus on demand side measures that promote conservation, efficient use and regulation of ground water use. Water conveyance loss can be reduced by lining of canals. Water demand can be reduced by drip and sprinkler system instead of flood irrigation. Crop zoning would also alleviate pressure on water demand. Ground water exploitation needs to be regulated for its sustainability. Climate change would exacerbate floods and droughts which can be only mitigated through storages. Rationalized water pricing would curle the wastage of water and promote its efficient use.

FLOOD MANAGEMENT CHALLENGES IN PAKISTAN: SHAPING IMPROVEMENT STRATEGIES IN THE CONTEXT OF PREVAILING CONSTRAINTS, CONFLICTING INTERESTS AND GLOBAL EXPERIENCES

By:

Asrar-ul-Haq

Abstract:

The Paper presents the backdrop of floods and flood management in Pakistan. It highlights flood management challenges and the flood management strategies in the context of global experiences. The Paper also brings out the interventions for improving flood management in Pakistan and the implementation challenges in this behalf.

Floods are created by unusual water level rises in rivers, torrents or lakes that overflow their natural or artificial confinements. Floods are a natural and random phenomenon sparked by intense rainfall, storm surges, dam failures or glacier lake outbursts. In Pakistan, monsoon rains are the most important flood-causing factor. The flood damages are exacerbated by long dry spells resulting in aggradations of river beds, sub-optimal health of the flood protection infrastructure, gaps in flood forecasting and dissemination, unplanned and extensive encroachments in the floodplains, and lack of holistic flood management strategies.

Flood management strategies may be broadly categorized as structural, non-structural or management and a mix of structural and management strategies. The structural measures include dams and reservoirs, embankment and levees, river training works and interventions for enhancement of river channel capacity. The non-structural measures comprise flood forecasting, floodplain management, flood insurance, education and awareness raising of the population and flood proofing.

The cross-country experience indicates that the emphasis till recent past had been on structural or engineering solutions. It has however been progressively realized that the structural measures alone cannot totally manage floods. Attention is therefore being increasingly focused on a balanced approach for flood management by optimizing the structural and non-structural measures. This also appears to be the way forward for Pakistan.

In the above backdrop, the challenges for effective flood management in Pakistan are highlighted that include physical and resource constraints, the conflicting interests of the stakeholders and the gaps in governance. The improvement strategies are accordingly outlined for phased implementation.

GROUNDWATER POLLUTION AND THREAT FOR ENVIRONMENT IN MEGA CITY FAISALABAD

By:

Engr. Dr. Muhammad Saeed, Engr. Hafeer-ur-Rehman, Engr. Syed Javed Sultan, Mr. M. Noman Younis

Abstract:

It is well known fact that with the increase of population, the developments of different kinds of industries like tanneries, textile, sugar and food processing taken place for fulfilling the requirements of our population. These industries and domestic use of water are producing chemical mixed effluents and sewage water. Ultimately these effluents are being thrown in the surface drains.

As the irrigation supplies are limited and not sufficient to fulfill the crop water requirements, therefore, this contaminated effluent is being used for the irrigation to the crops. This contaminated effluent seeps from the surface drains as well as from the crop fields and it reaches to the groundwater and pollutes the groundwater.

Health risks related to water quality, primarily due to agrochemicals, represent a growing problem. This is mainly due to the intensified production and the expansion of irrigated agriculture, often in association with food processing industries. In this context, both subsurface and open drains can have an impact on human health.

The measured values of different parameters were compared with those of National Environmental Quality Standards (NEQS) for precise assessment of their quality. The analysis of the parameters showed that almost all of the samples were unfit according to NEQS. This situation is indeed a serious threat for the environment and biodiversity and hence policy makers in the region have to start waste water monitoring program with the help of local wastewater management authorities. Based upon the measured data, waste water treatment plants should be installed to make the water clean which latter can be used for other purposes e.g., agriculture. It is added that the highest amount of the industrial effluent is coming from the leather and textile industries followed by ceramic and ghee industries, respectively. Excepting Ghee industries, all other releases are extremely toxic and, therefore, demand for immediate remedial actions.

Paper No. 773

WATER POLICY ISSUES AND OPTIONS: SOME IDEAS TO USE ECONOMIC TOOLS TO CLOSE THE GROWING SUPPLY AND DEMAND GAP

By:

Dr. Mahmood Ahmad**Abstract:**

Agriculture accounts for approximately 3,100 billion m³, or 71 percent of global water withdrawals, and without efficiency gains will increase to 4,500 billion m³ by 2030. The case of Pakistan where 94% of water is being used by agriculture, situation is not any different. With climate change happening, agriculture has to produce more and better quality food with less water. The paper will briefly reviews the impact of growing water scarcity, degradation of its quality and lack of funds on the maintenance and development of large scale of water assets we carry. It also argues that these are symptoms of much deeper problems related to policy, institutional and market failure, all of which impact the overall development and management of water resources in Pakistan and other countries. Except for a few water scarce countries, progress has been slow to adopt policy measures that would reduce the water gap of excess demand. From an economic point of view, scarcity of water means that agriculture should release water to other uses, because the economic value of water is much lower in its present use. In many cases, however, political lobbies strongly oppose initiative to improve allocated efficiency to rationalize water use in agriculture. In many countries, existing weak regulatory and economic policies have led to mining of groundwater. At the same time, water quality in rivers and aquifers is deteriorating because of a number of externalities that if not corrected, will result in enormous long term costs to the society. This in turn could lead to irreversible damage to the quantity and quality of available water resources. The possible options to address water gap range from traditional approaches to more innovative ideas that see agriculture policy as an effective instrument to develop or save water and using solar energy to desalinize water.

LESSON LEARNED WHILE DESIGNING AND CONSTRUCTING OF NEW KHANKI BARRAGE

By:

Muhammad Azam Chaudhry

Abstract:

New Khanki Barrage is being constructed on River Chenab 900 ft. Downstream of Old Khanki weir which has outlived its life and sustainable utility. The initial Feasibility Studies conducted during 2005-2008 by the Feasibility and Design Consultants (NESPAK-NDC-ATKINS JV). The project was detailed designed by PIAIP Consultants in year 2010-11 and then reviewed by Design Review and Supervisory Consultants in 2013. The project is jointly funded by Asian Development Bank and Government of the Punjab through Project Management Office Barrages Government of the Punjab.

SMEC International PTY. in JV with W. S. Atkins UK, Engineering General Consultants (EGC) and Barqab are the Project Consultants. The Project is being executed under FIDIC Contract 2010 (Harmonized Version). The work was awarded to M/S Descon Engineering Ltd through ICB.

NECESSITY OF NEW KHANKI BARRAGE

While evaluating Khanki Headworks for safety, it was recommended by Feasibility Consultants (Nespak, NDC, and Atkins JV) to construct of New Khanki Barrage instead of remodeling the old one due to following reasons

- Aging
- In capacitation
- Huge sediment accretion and masking
- Reduction in Pond Capacity
- No Communication and control among central portion, left and right banks of the River across the weir
- Constraints in regulation and leakage control
- Poor and cumbersome operation arrangement
- High crested weir shuttered weir management
- Obsolete construction technique and conglomerate material.

The new barrage is being constructed with state of the art technology, design and construction methodology and materials.

