

THESIS ABSTRACTS

2015 BATCH

ABSTRACTS
Students Research Projects – 2015 Batch

Student Name	Zohaib Nizamani (15-EnvE-MS-01)
Department	Environmental Engineering
Project Title	Environmental Impacts of Rice Production Systems in Sindh Province Using Life Cycle Assessment (LCA) Approach
Supervisor	Dr. Asmatullah
Co-Supervisor	Mr. Muhammad Ali

Abstract

Rice is one of the most important crops of the world and considered as staple food and source of income of many countries, including Pakistan. It is cultivated in different parts of the world under different climatic conditions.

Rice crop is a key contributor of Green House Gases (GHGs) as majority of GHGs in agriculture sector are emitted from rice. Besides, it does not have good economic efficiency in developing countries due to several reasons. Considering these facts, this research focused on the assessment of environmental impacts and economic performance of rice production systems of Sindh province of Pakistan. Environmental impacts have been assessed using Life Cycle Assessment (LCA) methodological approach. Four major rice producing districts of Sindh were selected: two from zone-III i.e. Dadu and Larkana and two from zone-IV i.e. Badin and Thatta. Quota sampling technique was used to assess the variation among farm sizes. Primary data were collected from the farmers during 2016-17 with the help of a pre-designed semi-structured questionnaires. System boundary of this study has been considered as cradle to farm gate. One thousand kilogram of unprocessed rice was taken as functional unit in this study for the analysis and comparison purposes. The data were analyzed using SimaPro 8.3.0 for environmental impacts. Economic performance indicators were analyzed using STATA. Overall results showed higher environmental impacts in zone-IV as compared to zone-III. In terms of district-wise comparison, Thatta produced the highest environmental impacts and Dadu produced the lowest. As for size of the farms, small and medium farms of Thatta produce the highest environmental impacts. Similar results have been observed in terms of economic performances of the rice production systems. It has been observed that if a system is performing well in terms of economic performance, it is also contributing less in terms of environmental degradation through certain reduced environmental impacts.

ABSTRACTS**Students Research Projects – 2015 Batch**

Student Name	Hammad Malik (15-EnvE-MS-02)
Department	Environmental Engineering
Project Title	Synthesis of Polyacrylonitrile and Magnetite Nano fiber for Heavy Metal Removal
Supervisor	Dr. Rasool Bux Mahar
Co-Supervisor	Dr. Zeeshan Khatri

Abstract

The scope of this research is to remove heavy metal lead ions from the synthesized water. Lead is known for its toxic and non-biodegradable behavior. The consumption of lead contaminated water is one of the major threat the world is facing nowadays. In this study, Polyacrylonitrile (PAN) and Magnetite (Fe_3O_4) composite nanofiber adsorbent was developed. The synthesis was done by a simple and scalable process of electrospinning followed by a chemical treatment. The nanofibers thus obtained were characterized and were analyzed for their adsorption capability for Pb^{2+} ions. The diameter, appearance and morphology of the electrospun fibers were checked using different characterization tools including scanning electron microscope (SEM). The nanofibers had diameter in the range between 200-700 nm. The surface charge and chemical characteristics of the nanofibers were checked using zeta potential analyzer and the FTIR spectra, respectively. The adsorption capability of the PAN and Fe_3O_4 nanofibers for lead ions was analyzed using the flame atomic absorption spectroscopy. The amount of metal ion adsorbed was influenced by the initial metal ion concentration, the amount of time the adsorbent was in suspension, the amount of nanofiber and pH of the solution. The adsorption study was essentially a batch mode adsorption study. The adsorption data were checked for different adsorption isotherm models and the adsorption kinetic study was also conducted. The data fitted well with pseudo second order and Langmuir adsorption isotherm model. The nanofibers showed high adsorption capability and strong affinity toward Pb^{2+} ion.

ABSTRACTS
Students Research Projects – 2015 Batch

Student Name	Hiba Muzammil (15-EnvE-MS-03)
Department	Environmental Engineering
Project Title	Socio Economic and Health Impact Assessment of Environmental Degradation of Manchar Lake
Supervisor	Ms. Uzma Imran
Co-Supervisor	Dr. Asmatullah

Abstract

The aim of this study was to assess socio-economic and health impacts degraded water quality of Manchar Lake on people of the neighborhoods that are directly or indirectly dependent on the lake for their living. For this purpose, the water-related health data were collected through questionnaire surveys of 210 households using stratified random sampling technique. The survey was conducted from the inhabitants living in boat houses, huts on lake bank, and in nearby villages. Additional data were also collected through focus group discussions and local doctors. The data were analyzed through descriptive statistics and health impacts of lake water degradation on men, women, and children were assessed. The results showed that 24% of the people were engaged in fishing followed by 17% people earning their living through day labor in the nearby cities, restaurants and shops on the lake bank; 39% of the respondents were unemployed, majority being women. Moreover; 61% of the respondents had annual income in the range of Rs. 1000-5000 and that 63% of the men in the houses had migrated to other cities for finding the jobs due to poor financial conditions. The chi-square result in SPSS showed significant association between the place of living and occupation. However; 52% of the general population from huts on Lake Bank, 50% respondents from villages near to lake and 66% from the boat houses were suffering from malnutrition. 47% of the people from the huts on Lake Bank, 30% from the villages near to lake and 77% of the boat house people showed different types of skin diseases. Besides, health status of 63% women and 36% children could be directly or indirectly attributed to malnutrition. 48% of the children in a similar vein, 43% of women and 7% of men are involved in skin diseases. Children were significantly affected as compared to women and men by lake water due to degraded water quality, unhygienic conditions, and poverty since their businesses are associated with Manchar Lake. Livelihood, health and water quality improvement interventions are required to avoid any disease outburst. Adoption of a community-based preservation method along with substitute livelihood strategies, and a detailed assessment of health impacts need to be carried out because most people living in the surroundings visit hospital only if they physically feel sick rather than going for routine checkups.

ABSTRACTS**Students Research Projects – 2015 Batch**

Student Name	Bushra Danish Talpur (15-EnvE-MS-04)
Department	Environmental Engineering
Project Title	Analysis of Environmental Impacts of Buildings: Through Life Cycle Assessment (LCA)
Supervisor	Dr. Asmatullah
Co-Supervisor	Dr. Muhammad Ali

Abstract

Modes of building construction and use of modern building materials have accelerated its contribution towards degradation of the environment. Building throughout its life cycle generates enormous environmental impacts. Nevertheless, sustainable building design and construction help to decelerate the upsurge to those environmental impacts. Green buildings are efficient in terms of conservation of resources including water, energy, and material and thus provide better indoor quality and fewer emissions to the surrounding environment. Currently, Pakistan is facing energy and water crises, therefore, it is necessary to adopt sustainable techniques and move towards the green innovation in all sectors that can help to mitigate the associated issues of resources availability and environmental degradation.

This study aimed to assess and analyze the environmental impacts of building at construction phase as well as at operation phase. Energy consumption during the construction phase and specifically at its operation phase has also been assessed and potential for renewable energy source at the case study building have been proposed in order to cope with the current energy crises in the country. Water consumption analysis and water conservation measures have been determined only at the operational phase of building.

Environmental impacts of the building were assessed through Life Cycle Assessment (LCA) methodological framework. Direct and indirect energy consumption i.e. the cumulative energy used in the construction of the building was assessed through LCA using SimaPro 8.3. Energy use, total energy cost, and potential for renewable energy source during operational phase were computed by considering the current occupants' number and future potential occupants' number. Similarly, water consumption in the building during operational phase was computed by using the above mentioned two scenarios considering the working hours in the building and conventional and high-efficient plumbing fixtures. These calculations were carried out as per standards provided by Leadership in Energy and Environmental Design (LEED) reference guide.

The results showed that high-efficiency fixtures conserved 33-34% water as compared to conventional fixtures. During the construction phase, most of the impacts have been observed from glass and chipboard out of selected building materials. It was observed that 41,891.82 kg CO₂ eq. per m² area of the building can potentially be emitted during the construction phase of building and it ultimately contributes towards global warming. Results of cumulative energy demand during construction of building showed that most of the energy i.e. 482,336 MJ was generated and consumed through fossils fuel. Different impact categories have been analyzed and the results showed that the global warming potential accounts 4.11E4 kg CO₂-eq, human toxicity 4.61E4, metal depletion 2.81E4 and fossil fuel consumption 1.08E4.

To figure out the ways for installation of a renewable energy system in the building along with its feasibility at the site, in which photovoltaic payback period provides cost benefits during the

ABSTRACTS

Students Research Projects – 2015 Batch

operational phase, showed that photovoltaic payback period would start from 7-10 years considering different scenarios. Moreover, several impacts were observed during the construction phase of the case study building, to lower the burden of environmental impacts through high-efficiency water use methods and practices as well as through the renewable energy system that can be installed. By replacing the fixtures and placing the photovoltaic can withstand the environmental impacts during the operational phase of the case study building.

ABSTRACTS**Students Research Projects – 2015 Batch**

Student Name	Muhammad Hammad Siddiqui (15-EnvE-MS-06)
Department	Environmental Engineering
Project Title	Characterization of Polycyclic Aromatic Hydrocarbons in the Surface Water and Sediment of Left Bank Canals of Kotri Barrage in Hyderabad
Supervisor	Ms. Uzma Imran
Co-Supervisor	

Abstract

This study examines the spatial distribution and occurrence of sixteen Polycyclic Aromatic Hydrocarbons (PAHs) including naphthalene, acenaphthylene, acenaphthene, fluorine, phenanthrene, anthracene, fluoranthene, pyrene, benzo[a]anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-c,d)pyrene, dibenzo(a,h)anthracene, benzo(ghi)perylene in surface water and sediment of left bank canals of Kotri Barrage in Hyderabad region. These compounds are carcinogenic and mutagenic mentioned in the priority list of pollutants by EPA due to their toxic nature. Water samples were extracted by Liquid-Liquid Extraction method using n-hexane and dichloromethane as primary solvent; Soxhlet Extraction was used for the extraction of sediment samples by placing dried samples in thimble and extracted in Soxhlet for 16 hrs. Extracted samples were analyzed by Gas Chromatography with Flame Ionization Detector (GC-FID) and capillary column. Results highlighted that the concentration of PAHs in surface water ranged from 0.01 µg/L to 754.62 µg/L during high flood and 0.04 µg/L to 2593.33 µg/L in low flood period and in sediment it ranged from 6.26 µg/L to 127149.80 µg/L during high flood and 5.03 µg/L to 17507.34 µg/L in low flood period. The data showed that the concentration of PAHs in surface water was higher near the pollution source from upstream to downstream whereas sediments were badly polluted with PAHs as compared to water. The higher concentration was related to benzo(b)fluoranthene and benzo(k)fluoranthene which are the major pollutants emitted from burning of municipal waste, automobile emission and wood burning. The lowest concentration belongs to the acenaphthylene and acenaphthene which are caused by the coal tar or petroleum, and these compounds are mostly used in dyes, plastic and pesticides. The spatial variation of PAHs in canals was highlighted by using Microsoft excel tool. The greater portion of PAHs contained high molecular weight compounds that are majorly emitted from automobile exhaust or burning of woods.

ABSTRACTS**Students Research Projects – 2015 Batch**

Student Name	Sultan Shaikh (15-EnvE-MS-07)
Department	Environmental Engineering
Project Title	Exploring Groundwater Quality in the Areas Surrounding Manchar Lake for Drinking Purpose
Supervisor	Ms. Uzma Imran
Co-Supervisor	

Abstract

Groundwater is an important source of drinking water, especially in areas where surface water is scarce or where drinking water sources are contaminated, due to agricultural or industrial effluents. The community near Manchar Lake is one of such examples. This study explored the potential sites surrounding Manchar Lake where good quality groundwater can be obtained for drinking purpose. Vertical electrical sounding (VES) was conducted on twenty one sites in a shallow depth grid (5 x 5 km²), by adopting a Schlumberger electrode array configuration, with a maximum spacing of 300 m in the current electrode (AB/2) and 20 m in the potential electrode (MN/2). The data were collected using an ABEM terrameter SAS 4000. The quantitative interpretation was done, using the IX1D resistivity software. VES findings were verified by analyzing water samples collected from trial bores, made by the hand-percussion method at five sites out of twenty one sites. The trial bores were made up to 100 ft. in depth and soil and water samples were collected at an interval of approximately 10 ft. depth from all the trial bores.

The collected soil and water samples were analyzed for pH, electrical conductivity (EC), soil texture and total dissolved solids (TDS). In addition, groundwater samples were collected from 7 hand pumps in April and July 2016 and were analyzed for physical, chemical and microbiological parameters. The analysis of trial bores water showed the same results in terms of EC and TDS. The water samples parameters exceeded the World Health Organization (WHO) limits for EC (1,500 μ S/cm) and TDS (1,000 ppm) at all trial bore sites, which proved that the results obtained from VES are valid. However, the pH of water samples collected from all trial bores was within the WHO limit. Whereas, the analysis of soil (pH, EC and soil texture) collected from trial bores showed that all soil samples were within the WHO limit for pH and EC. The data for soil texture was also in a good match with VES data. The analysis of groundwater samples revealed that all groundwater samples collected from the seven locations in April and July 2016 exceeded the WHO limit for EC (1,500 μ S/cm), TDS (1,000 ppm), hardness (500 ppm), and total coliforms (0 CfU/mL). Overall, the quality of groundwater around Manchar Lake was not suitable for drinking, based on this study. Only two out of 21 VES sites showed good quality water. Trial bores should be made at these sites to confirm the quality of groundwater, so these sites can be used for drinking purposes. Similar kind of studies should be considered for deeper depths, by increasing the space between the current electrodes and by digging enough trial bores at deeper depths to validate VES findings. In addition, other parameters must be analyzed, which are necessary to determine water fitness for drinking purpose. Furthermore, the groundwater near the lake must be treated, before using it for drinking purposes. Also, there is a need to study the effect of lake water on the groundwater of the study area.

ABSTRACTS**Students Research Projects – 2015 Batch**

Student Name	Kaleemullah (15-EnvE-MS-10)
Department	Environmental Engineering
Project Title	Dispersion Modeling of Emissions from Thermal Power Station Jamshoro and Human Health Risk Assessment
Supervisor	Ms. Uzma Imran
Co-Supervisor	

Abstract

This study conducted dispersion modeling of emissions from Thermal Power Station (TPS), Jamshoro and evaluated its risks to human health. This study is significant, since 65% of the world's electricity is generated by thermal power plants that use fossil fuels. The use of natural gas, furnace oil and coal seriously affect the health of people living near these thermal power plants. Thus, there is a need to assess impacts of these TPSs in developing countries, such as Pakistan. In this study a health risk assessment is evaluated for air pollutants emitted from thermal power station Jamshoro, Sindh, Pakistan. Four non-carcinogenic pollutants (i.e. SO₂, NO, CO and CO₂) were selected for dispersion modeling, and three of these (i.e. SO₂, CO & NO) were assessed for health risk. CO₂ was not assessed for health risk because it is non-criteria pollutant. Although, NO was also a non-criteria pollutant, it was assessed for health risk, because it rapidly reacts with the surrounding oxygen and forms NO₂, which is a criteria pollutant. Both long-term and short-term health effects were estimated. AERMOD, the air dispersion model was used to predict the Ground Level Concentration (GLC) of selected air pollutants at twenty (20) sensitive locations within 10 km radius of the emissions source. Different health risks due to exposure to long-term and short-term dispersion of studied air pollutants were examined. The results showed that short-term concentrations of SO₂ at different sensitive locations were 1.5-3.6 times more than the guidelines set by the Agency for Toxic Substance and Disease Registry (ATSDR), but the long-term concentrations were found to be within limits. Also, the short-term and long-term concentrations of CO and NO were found within the National Environmental Quality Standards (NEQS) and the NAAQS guidelines. Thus, except SO₂, short term concentrations of all the other pollutants were found within limits of the ATSDR, NEQS and NAAQS guidelines. This study also recommended a detailed assessment of long term and short-term health effects at these locations, because these pollutants are not only being emitted from TPS Jamshoro, but they are also being emitted from other sources, i.e. the Lakhara Coal Power Plant, which is about 25 km from TPS Jamshoro. Moreover, this kind of pollutants are also emitted from vehicles.

ABSTRACTS**Students Research Projects – 2015 Batch**

Student Name	Azizullah (15-EnvE-MS-12)
Department	Environmental Engineering
Project Title	Assessment of Chemical Parameters for Detecting the Quality of Drinking Water
Supervisor	Dr. Syeda Sara Hassan
Co-Supervisor	Dr Abdul Khaliq Ansari , Dr Nusrat Begum Jalbani

Abstract

Agricultural sector and the industries are major consumers of water. However, fresh water gets contaminated through discharge of very large quantity of wastewater into fresh water bodies. Contaminated water causes a number of diseases and millions of rupees are used for curing them. Numerous studies have been conducted worldwide on water quality and this study is aimed as one contribution to it.

In this study, Kalri Baghar Feeder and Mehran University water quality was assessed using water and sediment samples secured during the period June 2016 to May 2017. Sediment samples were collected from sedimentation tank situated at water treatment plant. The samples were analyzed for chloride, total alkalinity, total hardness, total dissolved solids, fluoride, sulfate, nitrate, mercury, copper, iron, zinc, arsenic, chromium, lead, and cadmium using titration of Chemical Parameters for Detecting the Quality of Drinking Water, ultra-violet visible absorption spectroscopy and atomic absorption spectrometry standard methods.

The concentration ranged for chloride, total alkalinity, total hardness and sulfate from 5 to 240mg/L; lead, cadmium, chromium, copper, arsenic and mercury ranged from 0 to 22.23µg/L; whereas zinc and iron ranged from 0.5 to 580µg/L. The correlation between parameters, contamination factor and pollution load index were determined. The observed concentration of water samples was compared with reference values of World Health Organization guideline limits.

ABSTRACTS**Students Research Projects – 2015 Batch**

Student Name	Muhammad Awais(15-EnvE-MS-15)
Department	Environmental Engineering
Project Title	<u>Disinfection of Antibiotic Resistant Bacteria in the Water of Hyderabad City by Using Different Disinfectants</u>
Supervisor	Dr. : Dr. Rasool Bux Mahar
Co-Supervisor	Dr. Zulfiqar Ali Mirani

Abstract

The bacteria are natural gift and have strong ability to resist antibiotics. Due to continuous evolving nature of bacteria, they have gained resistance to antibiotics at greater extent. Moreover, the people infected by antibiotic resistant bacteria (ARB) spend much time in hospitals for proper treatment, again using two or three more antibiotics, which can become more toxic, less effective and expensive. The bacteria have acquired the ability to survive under antibiotic treatment by having different antibiotic resistant genes. There are two major reasons for the abundant release of antibiotic resistant bacteria into the aquatic environment i.e. excessive usage of antibiotics and the usage of conventional system for disinfection or absence of disinfection process in water treatment systems. Therefore, antibiotic resistance these days is the major human health challenge for the whole world.

In this study, antibiotic resistant bacteria that were isolated from drinking water sources of Hyderabad city and its surrounding areas were disinfected by using 3 disinfectants namely chlorine, ultraviolet (UV) light and silver nanoparticles. The samples were collected randomly from different drinking water sources including ground water, surface water, tap water, and distribution network. In all, 62 water samples were collected from Hyderabad city and its surrounding areas, and only 14 samples were selected for disinfection process having highest number of heterotrophic plate count. Areas covering Hyderabad city included: Latifabad, Qasimabad and main Hyderabad city whereas, surrounding areas included Jamshoro and Kotri. Disc diffusion method was applied to observe antibiotic resistance pattern of bacteria against commonly used antibiotics in the Hyderabad city. Antibiotic sensitivity and resistivity testing were performed for 62 samples collected in this study. The most common organisms that were isolated in the samples were: *Escherichia coli*, *Pseudomonas aeruginosa*, *Shigella* species and *Vibrio* species. Antibiotic resistance was checked for 16 antibiotics and out of 16 antibiotics; each sample was seen to resist at least two antibiotics, which means that there was not even a single sample that was completely sensitive to antibiotics used in this study.

Findings of this study showed that all the isolated ARBs were completely disinfected, when chlorine dose of 1.5 mg/L was applied for 30 minutes time period. UV radiations disinfected all the isolated organisms when UV light (11 W, 254 nm and 30, 000 μ W/cm²/sec) was applied for the time period of 180 seconds while silver nanoparticles (10 nm) showed complete disinfection of the isolated ARBs when their minimum inhibitory concentration (MIC) value reached at 128 μ g/mL. All six isolated organisms were disinfected completely by 3 disinfectants i.e. chlorine, UV and silver nano particles, which means that their selected doses are likely to have similar impacts on other types of antibiotic resistant bacteria present in the drinking water of Hyderabad city and its surrounding areas.

ABSTRACTS
Students Research Projects – 2015 Batch

Student Name	Maheen Saeed (15-EnvE-MS-17)
Department	Environmental Engineering
Project Title	Water Quality Assessment Around Kotri Barrage
Supervisor	Dr. Abdul Khaliq Ansari
Co-Supervisor	Ms. Uzma Imran

Abstract

Increased industrialization and urbanization have resulted into high levels of heavy metals in water sources. This study was aimed at examining the water quality of Indus River at Kotri Barrage from where four canals off-take which is a source of water supply to millions of people of lower Sindh, including Hyderabad, the second largest city of Sindh Province, Pakistan in the year 2016-17. This study was carried out to determine the concentrations of heavy metals lead, iron, zinc, cadmium, magnesium and copper in water and sediments. It was also meant to find out various physio-chemical parameters such as temperature, turbidity, total dissolved solids, electrical conductivity, total suspended solids, pH, dissolved oxygen, hardness, chloride, alkalinity, sulfate, and nitrate etc. in monsoon and pre-monsoon seasons. The analytical data for monsoon season samples showed higher levels of heavy metals than their respective permissible limits i.e. 0.434-2.378 mg/L for iron, 0.205-5.917 mg/L for zinc, and 0.099-0.172 mg/L for cadmium. But, manganese and copper were found within permissible limits because of high dilution factor in monsoon season. As for physico-chemical parameters turbidity range was found above permissible limits i.e. 758-966 NTU, while other parameters i.e. temperature (31-34°C), total dissolved solids (129.8-135 mg/L), electrical conductivity (250-270 $\mu\text{S}/\text{cm}$), total suspended solids (1108-1684 mg/L), dissolved oxygen (7-14 mg/L), total hardness (25-45 mg/L), sulfate (18.413-27.451 mg/L), nitrate (16.252-31.03 mg/L) were found within permissible limits. All six heavy metals at some locations in pre-monsoon season samples were found above WHO permissible limits. Their ranges were 0.57 to 3.52 mg/L for iron, 0.482 to 4.02 mg/L for zinc, 0.001 to 0.198 mg/L for cadmium and 0.026 to 0.589 mg/L for manganese, 0.014 to 0.031 mg/L for lead, and 1.236-4.227 mg/L for copper. The ranges of the concentration of physio-chemical parameters in pre-monsoon season were found mostly within permissible limits, the values being 27 to 32°C temperature, 4.24 to 61.6 NTU turbidity, 410 to 690 mg/L total dissolved solids, 820 to 1370 $\mu\text{S}/\text{cm}$ electrical conductivity, 17 to 48 mg/L total suspended solids, 6.9-16.3 mg/L dissolved oxygen, 80-185 mg/L chlorides, 135-250 mg/L total hardness, 104.78 to 178.34 mg/L sulfate, and 0.411 to 13.199 mg/L nitrate. Concentration of heavy metals in sediments were: zinc 30-861 mg/kg, copper 2-75 mg/kg, iron (37-50) mg/kg, cadmium 0-50 mg/kg, lead 0-3 mg/kg and manganese 12-41 mg/kg. In pre-monsoon season, the results for contamination factor and pollution load index showed high contamination and pollution, respectively. Zinc, copper and cadmium levels were found higher than the permissible limits from USEPA, SEPA and CEPA. Geo-accumulation index indicated that the sediment samples were heavily contaminated with zinc and copper, and extremely contaminated with cadmium. The results of this study can be utilized for monitoring the effects of pollutants over a period of time and thus would help in controlling these contaminants. This study has thus made a baseline on water quality, which may contribute in analyzing the Indus water basin model in future.

ABSTRACTS**Students Research Projects – 2015 Batch**

Student Name	Sadaf Sher (15-EnvE-MS-18)
Department	Environmental Engineering
Project Title	Evaluating the Capacity of Keenjhar Lake to Meet Various Demands
Supervisor	Dr. Kamran Ansari
Co-Supervisor	Dr. Salim Khoso

Abstract

Keenjhar Lake is an artificial water reservoir which provides water for irrigation, domestic, industrial, fishing, transportation and recreational purposes. Due to over usage and decrease in rainfall, this lake has decreased in depth and could pose a problem. The objective of this study was to develop a water-balance model for the lake and evaluate the capacity of lake to meet the future water demands. The water balance model is prepared by using continuity equation in the Excel spread sheet. The monthly water budget of the Keenjhar Lake was determined from inflow components such as rainfall and Kalri-Baghar (K.B.) Feeder (upper) and outflow components such as evaporation, K.B. Feeder (lower) and Keenjhar-Guju (K.G) canal from the lake. The model was developed by using water budget component values. The result of lake water balance revealed that the contribution of direct rainfall and the annual inflow components to the lake was 22.03% and 77.91%, respectively, whereas, evaporation, outflow to K.B.F Lower and water supply to K.G. Canal constituted about 5.78%, 92.55% and 1.57%, respectively, of the total annual outflows from the lake. Annual inflow components of the water budget of the lake showed declining trend while outflow components showed increasing trend of the lake.

The continuous decrease in the lake water volume is an alarming situation which is a challenge to researchers, policy makers and water managers to look for a solution to this problem. In the dynamic simulation, there are various factors which are contributing to the water volume changes. The question is how these factors affect and interact over time in the water balance of the lake. In this study, the hydrological system of Keenjhar Lake is studied by using Stella, which is a system dynamics model. In this study, hydrological data and meteorological data were used for the period of 2000-2016. The system dynamic model simulation also tracks and uses the population growth of the study area which directly affects the water usage from the lake. The model gives a clear picture about how the main components of the water balance of the lake change over time. The main factor in the reduction of the lake volume is overdrawn water from the lake accompanied by decreasing rainfall. There is dire need to study the overdrawn of water from the lake and a need for better water management of the lake.

ABSTRACTS
Students Research Projects – 2015 Batch

Student Name	Danyal Aziz (15-EnvE-MS-19)
Department	Environmental Engineering
Project Title	Research Project Title: Assessment of Chemical Parameters for Detecting the Quality of Drinking Water
Supervisor	Mr. Waqas Ahmed
Co-Supervisor	Dr. Rashid Rehan

Abstract

Population growth and climate change have exerted stress on freshwater resources in Pakistan and thus, food and energy security are threatened. Developing countries such as Pakistan are particularly susceptible, due to rapid population growth, scarce water resources and inadequate capacity to cope with climate change. For sustainable development and Vision 2025 goals for Pakistan to be realized, a nexus approach is necessary to adopt synergies and avoid trade-offs in water-energy-food sectors with emphasis on agriculture. Different approaches have been used to develop nexus frameworks suited for various scenarios and targeted outcomes. Application of system dynamics modelling in nexus is largely an unexplored area. The main benefit of system dynamics is to model complex nonlinear systems such as the water-energy-food nexus. In this research, a system dynamic model has been developed relevant to the agriculture sector of Pakistan with the aim of achieving security and realizing sustainable development goals related to the water-energy-food nexus. Causal loop diagrams and stock-flow models are developed. Different scenarios are modelled, based on various probable policy interventions in the future. The results show that only by increasing per-unit area yield of crops with a simultaneous shift to solar pumping, it can sustain future scenarios with decreased water and emission footprints in agriculture sector accompanied by decreased cost of production, at the same time. Neglecting trade-offs and following conventional approaches to meet demand has negative environmental impacts, which can only be mitigated by employing efficient irrigation techniques, conserving water to serve increasing domestic demand and decreasing greenhouse gas emissions, by shifting from conventional to renewable energy resources.

ABSTRACTS
Students Research Projects – 2015 Batch

Student Name	SHOAIB AHMED (15-EnvE-MS-20)
Department	Environmental Engineering
Project Title	Effluent Treatment of Biodigested Spent-wash using Coal Fly ash
Supervisor	Dr. Abdul Khalique Ansari
Co-Supervisor	Dr. Farman Ali Shah

Abstract

The study was aimed to utilize fly ash, a waste by-product produced in coal thermal power plant, in order to develop a cost effective and sustainable treatment technique for COD and melanoidins removal from biodigested distillery wastewater. In this regard, real distillery wastewater samples were treated through coal fly ash as adsorbent. The fly ash was treated with acid after several washings with distilled water to enhance its adsorption capacity.

The mineralogical composition and specific surface area of the raw and treated coal fly ash adsorbent were determined through the X-ray diffraction and Brunauer-Emmett-Teller (BET) analyzer. The results indicated that specific surface area of the coal fly ash increased from 10 m²/g to 11.93 m²/g after acid treatment. The batch experiments were performed as a function of contact time, initial dilution, particle size, pH, and adsorbent mass. The maximum 91% melanoidins and 62% COD reduction were observed at 5 gm optimum dose. The pH-7, 0.15mm particle size, 5% initial dilution were other optimum conditions.

Moreover, experimental adsorption data were interpreted through the adsorption isotherms and kinetic modelling. Both Langmuir and Freundlich adsorption isotherm models were found best fitting to the experimental adsorption data. Furthermore, pseudo-second order kinetic model best follow the adsorption kinetic data with R² value 0.994. The batch experimental study was further extended to simulate packed adsorption column. Dynamic simulation of melanoidins as a function of feed flow rate, bed height and initial concentration were performed using Aspen Adsorption[®]8.4 (Aspen Tech). Maximum adsorption saturation time was observed to be 27,500 seconds at constant flow rate of 0.01 m³/min, at bed height 1.5 meter and initial concentration of 2 K mol/m³.

ABSTRACTS
Students Research Projects – 2015 Batch

Student Name	Saira Halepoto (15-EnvE-MS-21)
Department	Environmental Engineering
Project Title	Evaluation of Drinking Water Quality of Hyderabad City
Supervisor	Dr. Rasool Bux Mahar
Co-Supervisor	Dr. Sheeraz Ahmed Memon

Abstract

Provision of clean and safe drinking water and hygienic sanitation facilities are important in improving the health and for saving human lives otherwise affected due to consumption of contaminated water. Global statistics shows an alarming situation for poor and vulnerable communities because of lack of easy access to potable water and proper sanitation as per standards set by World Health Organization (WHO). Problem of water pollution is mainly because of two factors i.e. decrease in water supplies and increase in water demand from all sectors, therefore deterioration of water quality. Water from various sources such as rivers and ground in Pakistan is unfit for human consumption because of inferior quality. In this study, Hyderabad city was selected as study area to identify the available water resources, to monitor water supply system and to evaluate the drinking water quality. Sampling locations were marked using Google Earth and GPS. Water samples were secured from four water treatment plants and their service areas and analyzed for various water quality parameters. Physical parameters were checked for three months at monthly interval. Parameters viz. temperature, electrical conductivity, pH and turbidity were checked in the field during sampling while TDS was checked in the laboratory. Biological and chemical testing were also performed by standard sampling methods. The results of many samples showed that the values for various parameters exceeded National Drinking Water Quality Standards (NEQS) and among all the parameters turbidity and total coliform were significantly higher. This research is aimed to contribute towards achievement of sustainable development goal of clean water for all. The results of this research may be used by WASA Hyderabad to address the pressing issue of water quality.

ABSTRACTS
Students Research Projects – 2015 Batch

Student Name	Sohail Raza Langah (15-EnvE-MS-22)
Department	Environmental Engineering
Project Title	Strategic Environmental Assessment for Sustainable Water Resource Management in Sindh Province
Supervisor	Dr. Awais Anwar Chandio
Co-Supervisor	Dr. M. Munir Babar

Abstract

Sindh Province of Pakistan is the lower riparian of the Indus basin system. The main source of water for irrigation in Sindh is dependent on Indus River. Sindh is suffering from the menace of waterlogging and salinity, low water productivity, land degradation, surface and groundwater pollution, sustainability issues of the river ecosystem and Indus delta resulting in devastating economic, social, and ecological losses. The first part of this research addresses the water sector issues and challenges in Sindh province being riparian state by identifying the critical factors in water resource management through SWOT-AHP analysis conducted from water experts in the region. The conclusions from this research will help to achieve sustainable water resource planning and management in Sindh province. And in the second part, this research aims to highlight the importance of SEA in policy making process of Pakistan via undertaking a strategic environmental assessment (i.e. to assess the environmental impacts) of the policy to introduce a participatory irrigation management (PIM) in Sindh province. The policy was designed in 1997, and first implemented in Sindh in 2002. The assessment was accomplished by carrying out comparative analysis in which two canals were selected, one with PIM and one without PIM for the assessment. Water availability, groundwater level, waterlogging, salinity, and number of trees on canals were used as environmental variables. The results revealed that the conditions are still same, and no significant improvements have been observed in the environmental variables in the areas with PIM.

ABSTRACTS
Students Research Projects – 2015 Batch

Student Name	Asad Ali (15-EnvE-MS-23)
Department	Environmental Engineering
Project Title	Identification of Antibiotic Resistant Bacteria in the Drinking Water Sources of Hyderabad City and its Surroundings
Supervisor	Dr. Rasool Bux Mahar
Co-Supervisor	Dr. Zulfiqar Ali Mirani

Abstract

Resistance offered by bacteria to the antibiotics is a global public health issue today. The areas where large quantities of antibiotics are used, greater concentration of antibiotic-resistant bacteria in the water is commonly observed. These bacteria make their way into the aquatic ecosystem quite easily. They also possess the quality of gene transfer. Therefore, they have started to become a threat to the world. In this study, antibiotic-resistant bacteria were identified from different drinking water sources of Hyderabad city and its surroundings. For proper representation of the city, the samples were collected randomly from different drinking water sources including surface water, ground water, tap water, and distribution network. Antibiotic resistance pattern of bacteria was determined against commonly used antibiotics of the Hyderabad city, using standard Disc Diffusion method. Antibiotic sensitivity and resistivity testing was performed for 62 samples, collected for this study. The most common organisms that were isolated in the samples were: Shigella Species, Pseudomonas Aeruginosa, Vibrio Species, and Escherichia coli. Antibiotic resistance was checked for 16 antibiotics and each sample was seen to resist at least two of the 16 antibiotics. The findings of the study showed that the different drinking water sources in Hyderabad city were contaminated potentially with pathogenic multi-drug resistant strains of different organisms.

ABSTRACTS
Students Research Projects – 2015 Batch

Student Name	Iram Sifat (15-EnvE-MS-25)
Department	Environmental Engineering
Project Title	Treatment of Domestic Wastewater by Sustainable Microbial Fuel Cells with Simultaneous Electricity Generation
Supervisor	Dr. Rasool Bux Mahar
Co-Supervisor	

Abstract

Treatment of wastewater by using Microbial Fuel Cells (MFCs) have been proven as a promising but challenging technology so far. Researchers are coming up with different techniques every time to overcome the bottle necks in this technology. One of the current issues is fouling of the electrodes which is hindering higher power generation and its commercialization. Depositions on electrodes reduce the working efficiency of the cell. In such cases, material selection of electrodes plays a significant role. The electrodes must be low-priced, non-corrodible, reliable and reusable. This research deals with the designing and fabrication of a single chamber MFC with an inexpensive, recyclable material (acrylonitrile butadiene styrene substrate (ABS) used as anode to treat the domestic wastewater. Activated carbon air-cathode was used where a biofilm was developed. The current and voltage across the cell were measured by a data acquisition model. The efficiency of the fabricated single chamber MFC was checked by measuring the instantaneous Chemical Oxygen Demand (COD) and power generation with the utilization of organics in the wastewater. A current density of 89.74 mA/m² and power density of 2.75 m W/m² was produced in a single-chamber microbial fuel cell having a hydraulic retention time of 37.6 hours. The COD reduction varied from 58.7% to 60.5% which proved the existence of exoelectrogens in the domestic wastewater. These bacteria can be identified and used as inoculum in future studies to obtain high COD removal rate treating the same domestic wastewater. The experimental results also showed the successful application of carbon nanotube-based conductive paint polymer support as anode in treating the domestic wastewater. However, the performance decreased gradually due to the deposition of inorganics on the cathode which could be studied further in future along with design of this new anode to maximize the surface area for microbial colonization and to obtain more power output.

ABSTRACTS
Students Research Projects – 2015 Batch

Student Name	Mansoor Ali (15-IWRM-MS-01)
Department	Integrated Water Resources Management
Project Title	Potential for Conjunctive Use of Surface Water and Groundwater in Rajo Nizamani, Sindh
Supervisor	Ms. Rakhshinda Bano
Co-Supervisor	

Abstract

Focusing on the wheat crop, this study aimed at identifying the appropriate ratios of ground and surface water used to obtain acceptable crop yield. It involved co-relating water and soil salinity with the crop yield and testing the water allocation for the study area of Rajo Nizamani. Data related to water demand and supply, crop yield and net return were collected through field surveys, while analysis of water and soil salinity was done through in-situ measurements of Total Dissolved Solids (TDS), using a TDS meter. It was observed that farmers on the right side to the water-course had more surface water availability than left side of the study area and had slightly higher crop yields. Groundwater salinity was higher on the Left side of the study area compared to that of the Right side. Soil salinity was greater in the fields irrigated with the higher proportion of groundwater. The average wheat crop yields obtained for the year 2017 for farmers of Left and Right side of the study area were 4.137 tons/ha and 4.88 tons/ha, respectively. Using Tyagi's linear regression model for the crop yield (2004), in R statistical software, crop yields of the study area were modeled against total irrigation (total supply of water), canal water percentage and soil and water salinity. Where, the first two parameters were observed to have a positive effect on crop yield, and other two (water salinity and soil salinity) negatively affected the crop yield, with the regression co-efficient of 0.049978, 0.005925, -0.187931 and -2.501899, respectively. Suitable groundwater usage values were obtained based on the difference between simulated and observed crop yield values.

ABSTRACTS
Students Research Projects – 2015 Batch

Student Name	Syeda Fatima Zehra Zaidi (15-IWRM-MS-02)
Department	Integrated Water Resources Management
Project Title	Identifying Sustainability Indicator's Metrics for Safe Water Services
Supervisor	Ms. Rakhshinda Bano
Co-Supervisor	Mr. Waqas Ahmed

Abstract

With an aim to identify the relevance of metrics defined by the UN for the monitoring of SDG 6.1 'safe and affordable drinking water supply for all' in urban systems, this research study constitutes a case study of the Hyderabad city, Sindh, Pakistan. The study highlights the existing condition of domestic and drinking water supply in the city and identifies the relevance and progress of SDG 6.1 metrics (defined by WHO and UNDP) as applied to the Hyderabad City. This study may serve as a reference document for the water managers and the decision makers, giving them the interventions needed to achieve the SDG 6.1 indicators. Data about the existing condition of water supply were collected through household surveys from three major areas of the city. Water and health expert interviews were conducted to obtain expert opinions on the relevance of the metrics to the urban setup in general and Hyderabad city in particular. Data were also collected from local hospitals to obtain information on the prevalence of water-related diseases. The domestic water supply in Hyderabad city was found to be poor, except in a few areas within the city. The majority of the experts interviewed were of the view that effective monitoring of SDG 6.1 may require localized metrics, especially in the urban setup. Since chemical contamination of water is a major issue in Hyderabad City, integration of chemical parameters in the metrics is important to monitor the progress of safely managed drinking water in the city. While 'distance from the source' might not be a relevant metric in an urban setup, as the water is mostly supplied at the door step, 'number of hours of water supply' / 'intermittent supply' can be a useful metrics to monitor the progress of 'safely managed water supply' in the city.

ABSTRACTS**Students Research Projects – 2015 Batch**

Student Name	Daniyal Hassan (15-IWRM-MS-05)
Department	Integrated Water Resources Management
Project Title	Assessment of Historical and Future Performance of the Pakistan Water Apportionment Accord-1991
Supervisor	Ms. Rakhshinda Bano
Co-Supervisor	Dr. Kamran Ansari

Abstract

The Indus River Basin is the fourth largest irrigation system in the world, contributing 25% of the gross domestic product and 90% of food production in Pakistan. Numerous water users (e.g., rural, urban, subsistence and commercial irrigated agriculture) rely on flows from the Indus to support their lives and livelihoods in this water-stressed country. The Water Apportionment Accord (WAA) of Pakistan was instituted in 1991 to allocate Indus River water among Pakistan's provinces. The WAA has been a historical point of conflict, and in the future with rising population, growing demands, and climate change, water shortages may increase in magnitude and frequency, leading to increased and intensified conflicts. Past studies on WAA have investigated impacts from climate changes, economy, and allocations. This thesis assesses the historical and future performance of the WAA in the context of supply and demand changes. Historical flow data and a calibrated Water Evaluation and Planning (WEAP) system model of the Lower Indus River were used to investigate downstream demand, and adaptation solutions. The results elucidated the effect of the accord and water management solutions on the reliability, resilience, and vulnerability of three barrages (Guddu, Sukkur, and Kotri). During past 46 years, at Guddu Barrage, the system remained reliable for 25 years. In Sukkur and Kotri Barrages, the system reliability remained satisfactory for only 16 and 14 years, respectively. During the post-accord period, the system was highly vulnerable, and the expected reliability and resilience were not achieved. The future demands were estimated using the Water Evaluation and Planning (WEAP) system. The various scenarios: reduction in Agricultural Water Demands (Drip and Sprinkler) and the lining of canals to avoid losses and water theft were introduced to compare the baseline year 2015 and the reliability, resilience, and vulnerability of the three barrages managing the Lower Indus River in the future.

ABSTRACTS
Students Research Projects – 2015 Batch

Student Name	Muhammad Touseef (15-IWRM-MS-07)
Department	Integrated Water Resources Management
Project Title	PREDICTING THE CLIMATE CHANGE IMPACTS ON FUTURE PRECIPITATION TRENDS IN PAKISTAN USING CMIP5 CLIMATE SCENARIOS
Supervisor	Mr. Ghulam Hussain Dars
Co-Supervisor	

Abstract

This study predicts the impacts of climate change on future precipitation trend over Pakistan using CMIP5 climatic scenarios. The simulations of eight (8) CMIP5 climate model outputs for two RCPs (Representative concentration pathways) 8.5 and 4.5 are analyzed for the future period of 31 years i.e. 2040-2070. CMIP5 output having coarse resolutions approximately 200 by 200km grid size are statistically downscaled to 1/8-degree equivalent to 1 by 1 km grid size. Global Precipitation Climatology Center (GPCC) 0.5-degree historical time-series grid dataset is used for bias correction using Quantile Mapping approach. Downscaling has been performed by Delta downscaling method. The bias corrected, and downscaled data has been validated with Global Historical Climatology Network (GHCN) data. The study estimated precipitation trend for annual, winter (December-January-February) and summer (June-July-August-September) seasons. Differences for the future precipitation patterns are computed with respect to the historical period (1960-1990) simulations.

Results show that Northern part of the country including Gilgit-Baltistan and disputed Kashmir are likely to have a decreasing trend in the future period. Khyber Pakhtunkhwa, capital administrated area Islamabad and Azad Jammu Kashmir belt could get more precipitation ranges from 121-255 mm/month of maximum precipitation by CSIRO-MK3.6 and GFDL-ESM-2G. Northern and central parts of the Punjab province are likely to get more precipitation whereas the west and southern part probably could get less precipitation. Baluchistan and coastal belt could have more dry days. However, Baluchistan has great variation in precipitation trends except GISS-E2H which project 127mm/month of rainfall. Season wise scale showed frequent high magnitude peaks in summer and winter seasons. Annual average monthly precipitation projection trend showed more than 450 mm/month.

ABSTRACTS**Students Research Projects – 2015 Batch**

Student Name	Muhammad Naseer Rais (15-HID-MS-01)
Department	Hydraulics,Irrigation and Drainge
Project Title	Estimation of Evapotranpiration and Potential Water Consumption By Different Crops at Canal Command Level: A Case Study of Indus Basin Irrigation System
Supervisor	Mr. Waqas Ahmed
Co-Supervisor	Ms. Rakhshinda Bano

Abstract

The substance and sustenance of life is water, without which survival of being is impossible. It is not only required for drinking purpose, but also for growing food and fiber. The sustainability of this most unevenly distributed resource has been seriously threatened by rapid population growth. In such circumstances, its improper management and inequitable distribution is a grave problem and root cause of all conflicts. The Indus Basin Irrigation System (IBIS) Pakistan being the largest contiguous irrigation system is not an exception to twin problem of improper management and inequitable distribution. Therefore, this study has been undertaken under the context of climatic and political considerations for proper management and equitable distribution. The agriculture sector is largest consumer of water in Pakistan accounted of its 97% share hence, evapotranspiration is very important concept in this context. Therefore, evapotranspiration is estimated using penmanmonteith method at canal command level by procuring metrological data from 11 metrological stations namely: Thatta, Nawabshah, Jacobabad, Khairpur, Bahawalpur, DG Khan, Multan, Sialkot, Lahore, Faisalabad and Jhelum. Ultimately crop water requirement is estimated. It was observed that areas of Sindh have comparatively high rate of evapotranspiration, particularly Guddu Left, Khairpur East and Khairpur West Command areas are most climatic disadvantageous areas due to high rates of evapotranspiration and crop water consumption. While speaking about political context, the inequity in distribution of the supplies was addressed. For that, the water withdrawn by canals of Sindh and Punjab was estimated for 23 years from 1991 to2013. From the analysis it was observed that every year Sindh has faced extreme deficiency cutoff from its allocated share. The Punjab has also faced deficiency and cut off from its allocated share in every Kharif season but in lower proportion. Whereas, Punjab has extracted excess of its share 11 times in 23 years in Rabi Season.

ABSTRACTS
Students Research Projects – 2015 Batch

Student Name	Engr. Moazzam Ali Rind (15-HID-MS-04)
Department	Hydraulics,Irrigation and Drainge
Project Title	APPLICATION OF GIS AND HEC-RAS IN FLOOD FORECASTING: A CASE STUDY OF LOWER INDUS, SINDH, 2010
Supervisor	Dr. Kamran Ansari
Co-Supervisor	

Abstract

Flood is one of the most disastrous natural calamities because of the irreversible damage followed by the loss of assets. Even with the extensive amount of research, studies and findings in the field, flood control is still not an easy task; especially in developing countries where resources and expertise have always been an issue. Remote sensing and GIS (Geographical Information system) has emerged as one of the innovative and widespread tools in this regard. Pakistan, specifically lower Indus region has always been prone to natural calamities like droughts and floods in particular. The area mainly comprises of cultivable delta regions; but counted under backward part of the country. Therefore, the study aimed to integrate the remotely sensed data with hydrodynamic river modeling tool namely HEC-RAS (Hydrologic Energy Center – River Analysis System), in order to create detailed flood inundation maps of this overshadowed region. In addition, the study utilizes "ALOS World 3D - 30m" (AW3D30) DSM (Digital surface model) as base terrain layer, land Cover derived Manning's roughness coefficient, cross-section interpolated bathymetry and upstream flow hydrograph. An unsteady flow analysis was undertaken for a period of almost one month (15th August to 25th September 2010). The result depicts the flood risk maps along with the identification of vulnerable zones with respect to the 2010 flood characteristics (depth, velocity, depth time velocity, arrival time, and duration). Whereas, all the acquired maps confirm that active flood plains are totally uninhabitable areas under every sort of flooding and should be declared as 'no habitant zone'. Additionally, the study also reports that with minor modifications, the newly launched DSM data coupled with hydrodynamic model (HEC-RAS) can be an efficient approach for flood forecast simulation and levees breach scenario testing. Thus, this study could be replicated for any part of the world; provided terrain model is of high resolution, and inflow hydrograph of the required period.

ABSTRACTS
Students Research Projects – 2015 Batch

Student Name	Aftab Ahmed (15-HID-MS-05)
Department	Hydraulics,Irrigation and Drainage
Project Title	Remote Sensing and GIS Application for Flood Management: A Case Study of Larkana Division
Supervisor	Dr. Altaf Ali Siyal
Co-Supervisor	

Abstract

During flood 2010, Larkana Division was inundated due to a breach of a flood protection bund (levee) 'Tori" of the River Indus in District Kashmore-Kandhkot. Except for substantial economic losses due to damages to agriculture, livestock, and infrastructure; hundreds of the people lost their lives. Though the Sindh Irrigation Department has repaired the damaged levee, yet the communities living in the division have concerns about the quality of the repair work on the bund. They fear that in future due to high flow in the river Indus if the levee breach occurs again, then they will be doomed entirely as they do not have capability and capacity to face the fury of nature again. Considering the concerns of the communities and gravity of the problem the present study was conducted using field and satellite data to assess crop damage, prepare flood risk maps and delineate possible flow paths for safe disposal of flood runoff in case of any future breach of protective bunds on the right side of the river. For the current study, Landsat data for the years 2009, 2010 and 2011 along with ASTER Digital Elevation Model (DEM) were analyzed with ArcGIS 10.3, and ERDAS IMAGINE for assessing crop damage, preparing flood risk maps and delineating possible flow paths for safe disposal of flood runoff. The results of the study showed that about 567,830 tons rice worth 26.1 billion rupees was damaged due to flood 2010 in Larkana Division. The created flood risk map showed that most of the area of Larkana and Qamber-Shahdadkot has low elevation. Therefore, the risk of floods to these areas is high, while the Kashmore-Kandhkot district has comparatively high altitude. Thus, the risk of flood is low in that district. The most prolonged flood flow path delineated from DEM using geospatial tools shows that the flow path starts from the southern part of Kashmore-Kandhkot, and then it enters Shikarpur and eventually disposes-off into Hamal Lake in Qamber-Shahdadkot which could be revived for safe disposal in future flood scenarios. Therefore, the government should take steps to revitalize the abandoned natural waterways for safe disposal of runoff generated either due to river or rainfall flood.

ABSTRACTS
Students Research Projects – 2015 Batch
Abstract

Student Name	Abdul Basit (15-HID-MS-06)
Department	Hydraulics,Irrigation and Drainge
Project Title	Water Balance Study and Assessment of Groundwater Resources in Matiari Distributary Command Area: A Modflow Perspective
Supervisor	Dr. Shafi Muhammad Kori
Co-Supervisor	Dr. Abdul Latif Qureshi

Abstract

As most of the fresh water lies underneath the ground surface, it constitutes an important vital source of water for any community at national and international level. The areas where groundwater is available in enough quantity, people of those areas extract water without any scientific or engineering management nor does the government monitor it. In this regard, this study was aimed to model the groundwater by assessing the aquifer parameters and investigate various input and output sources. The command area of Matiari distributary has been selected for modelling. It lies in town of Matiari district of Sindh province. There are two objectives of this study: one is to determine the aquifer parameters like transmissivity (T) and storage coefficient (S), which are required for groundwater modelling and secondly, to assess the water balance by measuring various recharges to and discharges from the selected aquifer. The aquifer parameters were determined by using AQTESOLV software whereas the groundwater modelling was done on the Visual Modflow flex 2014. The data for both the analyses were obtained from the concerned department and some of the data were observed at field physically. Two pumping tests (i.e. at head and tail) were conducted for determination of aquifer parameters while field surveys were conducted for obtaining the data for modelling. The pumping test results revealed that S and T at the head was higher than at tail by 25% and 32%, respectively, because of less availability of water at tail and high extraction. Furthermore, the analysis of recovery data obtained for head and tail suggested that wells be shut off for 4.0 and 2.5 hours after every six-hour's pumping, respectively, whereas recovery ratio was found to be 0.67 and 0.42, respectively. Similarly, the simulation of MODFLOW model found that there is still a deficit of 571 m³ of water per day which causes a decline in water table especially at the tail reach. In addition, a difference of 2m in water table was predicted by the model between the head and tail reaches. Additionally, three scenarios were developed by increasing the well discharges by 10%, 50% and 100% to check the corresponding effects on drawdown heads. The results of this study showed a noticeable decline in water table in these scenarios and revealed that it is linearly proportional to extraction rate.

ABSTRACTS
Students Research Projects – 2015 Batch

Student Name	Alina Usman (15-HID-MS-08)
Department	Hydraulics,Irrigation and Drainge
Project Title	Comparative Evaluation of Implementing Participatory Irrigation Management (PIM) in Sindh Pakistan
Supervisor	Dr. Abdul Latif Qureshi
Co-Supervisor	Dr. Ali Asghar Mahesar

Abstract

This study was conducted to compare the performance of conventional and participatory irrigation systems through some selected distributaries/minors of two largest canals of Sindh, namely Rohri and Nara canals, off-taking from Sukkur barrage on left hand side of the River Indus. The selected distributaries are from the extreme middle and tail reaches of these canals, from Matiari, Hyderabad and Mirpurkhas divisions.

The performance of canal irrigation system was examined through various performance indicators such as water availability or how much water is available at the head of the distributary/minor, delivery performance ratio (DPR, that is ratio of actual discharge to design discharge), which will describe equity among stakeholders, water distribution among farmers through turnouts/ watercourses (observed by walk-thru survey) and water availability at the tail end/reach including in term of tail-end supply ratio (TSR) and recovery cost ratio (RCR) of secondary canals.

The discharge was measured at various gauge heights and Rating Curves were developed for all selected six secondary canals. The DPR values were computed for all three distributaries of Rohri Main Canal (RMC) which were more than 1.0, indicating availability of water at tail reach of RMC and better performance of Irrigation Department. On the other hand, DPR in selected FO distributaries varied from 0.4 to 1.5, which showed an un-judicious water distribution by Area Water Board (AWB) and failure in equitable distribution of water among its distributaries/minors at the tail reach.

Regarding availability of water at the tail of distributaries, three approaches, collection of gauge heights (if available), field monitoring/survey and collection of information through farmers interviews, were made. From interviews, about 30% farmers were of the view, that there is shortage of water in the tail reach i.e. less supply from head. However, these shortages are because of tempering of outlets, as also observed during walk-thru survey. This suggested that, still there is a gap between FO and other farmers/stakeholders which needs to be filled, so that there will be no or negligible shortage at all stages.

The availability of water in terms of tail-end supply ratio (TSR) is better in distributaries/minors managed by Farmers Organizations (FOs). However, these TSR values are less than 0.66 in all distributaries of Rohri canal system. The RCR of Mir minor was 100% as this was the only minor which supplied sufficient water at the tail reach. Keeping in view the population increase, which requires more food and fiber, it is suggested to redesign these distributaries and lining of the watercourses so as to supply required amount of water to fulfill crop water requirement with enhanced irrigation intensities,

ABSTRACTS**Students Research Projects – 2015 Batch**

Student Name	Hafiz Usama Imad (15-HID-MS-09)
Department	Hydraulics,Irrigation and Drainge
Project Title	Consumer's Willingness to Pay for Municipal Supplied Water: A Case Study of Hyderabad City
Supervisor	Mr. Muhammad Ali
Co-Supervisor	Dr. Asmatullah

Abstract

Water is the most important utility among all other services provided to a citizen of a state. Unfortunately, it is one of the most unserviceable utilities in most of the towns, districts, cities and even in the metropolitan areas of Pakistan. Improvement can only be made by changing the system and eliminating flaws from the scheme. To design a sustainable system, an economic analysis is necessary, for which public opinion is an essential ingredient of the study when the public is directly involved. In this case, public's willingness to pay for fresh water in urban Hyderabad is analyzed. A total of 380 samples from the three administrative subdivisions (Latifabad, Qasimabad, and Hyderabad City) were randomly chosen for the survey through discrete choice experiment method to discover the minimum price that policymakers should consider in choosing a level for a water tariff that would be acceptable by the citizens of the district. A suitable water supply scheme can be designed that is beneficial mutually for management and populace. The study found that more than 70% of the individuals in the city were spending enormous amounts of money on such activities, which are directly or indirectly associated with water. Five key factors are analyzed in this study to propose the best water-supply scheme for the city which includes methods of delivery, methods of payment, price recommendations, provider, and quality of water that will be supplied. Most of the people preferred to get water through taps at a low price. Most of the people from medium and high-income class and of high education level preferred treated water as their water source. Method of payment and method of delivery were found to be secondary factors and, they did not affect the consideration of any choice set.

ABSTRACTS**Students Research Projects – 2015 Batch**

Student Name	Dhanji Mal (15-HID-MS-10)
Department	Hydraulics,Irrigation and Drainge
Project Title	GIS-Based Decision Support System for Runoff Harvesting Potential Sites: A Case Study of Karoonjhar Mountainous Area
Supervisor	Dr. Altaf Ali Siyal
Co-Supervisor	Mr. Ghulam Hussain Dars

Abstract

The Karoonjhar mountainous area, situated at the southeast corner of Thar Desert, faces water scarcity most of the year due to erratic rainfall and limited groundwater resources. Though the area receives sufficient rainfall during the monsoon period, but due to unavailability of reliable data about rainfall runoff harvesting potential of the mountainous area, the local communities and the concerned public departments have not considered it seriously, to harvest all the runoff and conserve it in small dams and ponds for use during the dry periods. Looking at the gravity of the problem, the present study was conducted to delineate watersheds, quantify runoff, and identify potential runoff conservation sites in Karoonjhar mountainous area using Remote Sensing and GIS tools. Primary data were collected through ground trothing survey and soil sampling while secondary data about rainfall were obtained from Pakistan Meteorological Department, and the satellite data were obtained from USGS Global Visualization Viewer (GloVis) and The Japan Aerospace Exploration Agency (JAXA). The data were processed in ArcGIS 10.3 and HEC-Geo HMS for delineation of watersheds, flow paths and runoff generation due to rainfall storm. The present study revealed that the probability of return period of a rainstorm of 52.5 mm was optimum. For a single rainstorm event of 52.5 mm, runoff generated at Karoonjhar mountainous area was about 7055 acre-ft. Thirteen small watersheds with a total area of 82314 acres were delineated for runoff harvesting. The curve number (CN) of the study area ranged from 54 to 100 and runoff was more sensitive to CN. Based on the historical rainfall data, runoff volume of 7055 acre-feet could be generated during monsoon period in every two years and 3527 acre-ft per year and conserved for domestic and other uses during the dry period. Based on the present study, it is recommended that the water conservation structures such as dams, ponds for each watershed, at identified places in the present study should be considered for construction.

ABSTRACTS**Students Research Projects – 2015 Batch**

Student Name	Shamotra (15-HID-MS-11)
Department	Hydraulics,Irrigation and Drainge
Project Title	Farm-Based and Model-Based Evaluation of Sustainable Alternative Irrigation Practices for Water Conservation
Supervisor	Ms. Hadiqa Maqsood
Co-Supervisor	Dr. Abdul Latif Qureshi

Abstract

Water management is one of the crucial components for various dimensions such as agribusiness, municipality, urbanization, and fisheries. One of the water-oriented dimensions is irrigation. In Pakistan, there is lack of water system planning and management for water conservation. This study was an effort to focus on water conservation using cost effective irrigation practices and the field data were used in SIRMOD model to simulate all the efficiencies. This study is based on comparative field based analysis between four irrigation techniques: flood irrigation (conventional), furrow, alternate furrow, raised bed, and model based analysis on wheat crop to determine the most efficient irrigation technique and optimum efficiencies for each practice on clay loam soil.

Wheat crop was cultivated in Rabi season (2016-17) on an area of one acre on a land of a local farmer of district Sujawal, Sindh. Randomized complete block design (RCBD) method was used to design and allocate three subplots for irrigation method and determine four application efficiencies for each practice such as application efficiency of system, irrigation efficiency, distribution uniformity and requirement efficiency. The results showed that efficiency of water conserved by using furrow irrigation system was 25%, alternate furrow conserved 49% and raised-bed gave 31% in comparison to conventional method. Crop yield indicated that furrow irrigation and raised-bed technology gave higher yields than the others as increase in yield was 26% by using raised-bed technique and 17% by furrow irrigation technique whereas by using alternate irrigation it was 13% in comparison with conventional irrigation using at farm level. The model-based analysis was performed by using SIRMOD model: it was concluded that raised bed and alternate furrow produced better yield as compared to flood irrigation.

ABSTRACTS**Students Research Projects – 2015 Batch**

Student Name	Rubab Sahar (15-HID-MS-13)
Department	Hydraulics,Irrigation and Drainge
Project Title	POTENTIAL FOR HYDROPOWER GENERATION IN NARA CANAL SINDH AND COMPARATIVE STUDIES WITH RENEWABLE ENERGY RESOURCES
Supervisor	Mr. Muhammad Ali
Co-Supervisor	Ms. Hadiqa Maqsood

Abstract

Pakistan's hydel energy potential has escalated to 8000 MW having northern areas with major share and Sindh with minimal. For Sindh, the reason for the absence of hydel energy, is the concept that it has plain terrain and not enough head for river projects. This study acts as a testimony for the availability of head as well as discharge, enough to light hundred houses. Power generation and financial feasibility have been simulated for hydropower. Furthermore, this study has compared the potential with solar and wind power generation at Nara Main Canal in Sindh province. The present study has untapped approximately 12 megawatts of electricity at different locations. RET Screen model was used to analyze the techno-feasibility which concluded that at 11% inflation rate, 9% discount rate and 20 years of life span with 300 USD per kW and 25% sensitivity analysis, an average of 5000 MWh electricity on each site can be supplied to grid.

The study undertook the comparison of techno-feasibility analysis with solar energy and wind energy. The solar energy turned out to be more expensive than hydel energy whereas no any potential for wind energy generation was encountered on sites.

ABSTRACTS
Students Research Projects – 2015 Batch

End of the Report!