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In 2007, BWDB engaged IWM to carry out a detailed hydro-morphological study of the Jamuna River to protect the vulnerable river bank reaches near Gaibandha district. IWM developed a morphological model of the Jamuna River based on primary data of 2007 to forecast the future bank erosion conditions along the right bank of the river near Gaibandha. The trend of future right bank line migration/erosion of the Jamuna in the study area was investigated for the prevailing condition against different hydrological events.

The study identified vulnerable locations on the right bank of the river and simulated a number of protection options having revetments and spurs of different numbers and lengths. It concluded that revetments would be the most suitable protection measure and suggested an option with segmental revetment option named, Option-2, to protect the vulnerable reaches of the Gaibandha Sadar and Fulchari upazilla of Gaibandha District.

After six years of the previous study, updating of the mathematical modelling study was felt necessary as the planform, upstream/downstream condition and river banklines have changed from the previous study scenario and BWDB has only partially done protective works as per the recommendation of the study. In this regard, BWDB again engaged IWM for updating of the previous study in the context of concurrent hydro-morphological features of the Jamuna right bank around Gaibandha District.

The ongoing study is aimed to assess viability of the recommended option, suggested in the mathematical modelling study, completed in May 2008, in the present context. Updated model outputs are projected to be helpful to obtain adaptive approach towards combating the continuing erosion of the target area before execution of protection measures under the prevailing situation.

The objectives of the study are to:
- Investigate the erosion problems of vulnerable sites along the right bank of the Jamuna River, namely Balashighat and Fulcharighat in the district of Gaibandha, and
- Update the Report, submitted earlier for BWDB in 2008, incorporating recent findings from model results as well as pertinent data analysis.

The approach of the study is to update the 2 dimensional hydro-morphological model of the Jamuna River, developed earlier in 2007-08, using concurrent bathymetric and hydrometric data. Then simulation of the model is be carried out for some design hydrological events, and analysis of model results to assess the status of vulnerability of the erosion prone areas as well as suitability of Option 2 as per earlier study. Finally to update the earlier report submitted to BWDB in May 2008 by IWM.
The main focus areas of this project include capacity building for flood forecasting, establishment of a regional flood information system, methodologies to obtain real-time hydrological observations for Hindu Kush Himalayan (HKH) region. The core of the project is to develop a regional based flood information system that will be accessible to all participating countries and relevant regional entities.

The major contribution of IWM in this project is to work jointly with ICIMOD and DHI to develop a flood outlook system for Ganges-Brahmaputra basins utilizing freely available data and weather forecasts. An integrated hydrological and hydrodynamic model has been developed using MIKE 11 (NAM and HD) for the Ganges-Brahmaputra Basins. The model covers 88 nos of sub-catchments including the major river channels in the basin area. The source of precipitation data is from Tropical Rainfall Measuring Mission (TRRM) with the exception of few catchments where observed point rainfall data are available. The topographic information of the basin are derived from Shuttle Radar Topography Mission (SRTM).

The partner countries includes Bhutan, Bangladesh, China, India, Nepal and Pakistan which reached consensus on need for sharing of high river flow data. River level/flow, rainfall and related information will be observed at specific sites and transmitted in real-time using agreed and reliable means for telecommunication to the National Hydrological and Meteorological Services to be used for flood forecasting purposes. The observations would be transmitted simultaneously to a dedicated Regional Centre and National Hydrological and Meteorological Services.

Besides development of model, IWM also trained professionals from ICIMOD for successful implication of mathematical model in this project. To operate this flood outlook system, an extensive training program is being organized to train resources from the participating countries.
Bangladesh faces great challenges in water resources management, with floods in the wet seasons and water scarcity in the dry seasons. Due to the success of agriculture in coping with population growth in Bangladesh, the Ganges, Jamuna and Meghna River watershed in the NW, NC, SWSC, SE and NE hydrological regions has been subjected to considerable changes in water-use over the last 2 to 3 decades. Availability of water resources and water use varies in different hydrological regions. Floods have several causes, principal being the heavy monsoon rainfall occurring simultaneously over entire catchment area as the main player. Ground water is the major contributor to irrigation with about 78% of the total area under irrigation in most of the hydrological regions. Surface water irrigation covers the remaining area. Lack of rainfall, in addition to upstream flow diversion in India, causes droughts in Bangladesh. Withdrawal of surface water of the Ganges at Farakka Barrage leads to siltation of the Gorai river off-take and severe salinity intrusion in south west region during dry seasons. In addition, climate change may affect water availability and demand in the future.

This water balance tool was first developed for the study area. It is a planning level assessment designed to evaluate the hydrologic and climate change impacts associated with groundwater withdrawals for irrigation, stream discharges and runoff. The research aims to support integrated water management policies to meet the demand of water in the future.

The input data are rainfall, irrigation, potential evapotranspiration and land use including crop types and their irrigation requirements. The regional water balance was computed for historical base case and 4 climate change scenarios. These include the year 2030 wet and dry projected climate, and year 2050 wet and dry projected climate to assess the impacts on the components of the water balance. Bangladesh has abundant annual supply of water with annual average inflow for the period 1980 to 2009 of the combined main rivers to the tune of 981 km³. However, the dry season from November to April inflows is only 148 km³ which is 15% of the total average.
Morphological Assessment of Meghna Estuary

Bangladesh is a great delta formed by the alluvial deposits of three mighty Himalayan Rivers: Ganges, Brahmaputra and Meghna. These mighty rivers discharge huge sediment loads in the order of 1 billion tons per year in the Meghna estuary and continuously changes the coastal morphology. With the anticipated sea level rise, a greater part of the upstream sediment load to the coastal zone will be deposited near the coast. However it is unknown as to what extent this increased deposition can balance the sea-level rise. This will to a large extent depend on: 1) the flow of water and sediment load from the upstream, 2) the tidal flows and surges, and 3) the wave climate in the Bay of Bengal. All these processes may be affected in the future by climate changes either directly or indirectly.

With a view to enhancing the cooperation between UNESCO-IHE and Bangladeshi knowledge institutes in the water sector, a research project titled "Bangla-Dutch research initiative on flood risk management and morphological assessment (Acronym: MorphoFlood: Morphological Assessment of the Meghna Estuary MorphoFlood)" has been initiated under DGIS UNESCO-IHE Programmatic Cooperation. Under the research theme, the specific objective of the project is to study the morphological changes in the Meghna estuary due to sea-level rise, as consequence of climate change. The focus will be on the bed level adjustments in connection to the sea-level rise.

The study area covers the coastal region of Bangladesh though the main focus will be in the Meghna Estuary. The Meghna is one of the largest estuaries in the world in terms of sediment-water discharge. This area is morphologically highly dynamic. The tidal behavior, upland discharges and wind fields vary distinctly from season to season. This induces noticeable variation in hydrodynamics in the estuary and the adjacent bay region. The specific objective of the research is to study the morphological changes in the Meghna estuary due to sea-level rise, consequent to climate change. The focus will be on the bed level adjustments in connection to the sea-level rise.

Morphological model has been developed using MIKE21FM and DELFT 3D. Ten-year morphological simulation for model runs were carried out using MIKE21FM and DELFT 3D. Morphological simulation were carried out continuously using MIKE21FM and morphological factor used for 10 year morphological simulation using DELFT 3D. These simulations were carried out with and without climate change scenario. Also 50-year and 100-year morphological simulations have been carried out for different morphological factor using DELFT 3D. For long term morphological simulation, downstream boundary has been generated by input reduction technique using DELFT3D. Semi-diurnal M2 constituent and another artificial constituent C have been used for downstream boundary. Erosion-deposition pattern after 10 years has been studied by morphological factor of 10.42857 using DELFT3D which has been shown in the figure below.

Fig : Erosion-deposition pattern after 10 years
The Barind Multipurpose Development Authority (BMDA) engaged IWM in June 2013 to carry out a project titled “Survey and investigation of Water Resources Management by Mathematical Modelling of Panchagarh, Thakurgaon, Dinajpur and Joypurhat Integrated Agricultural Development Project Areas”. The project covers 28 Upazilas having a gross area of 7,61,800 ha and cultivable area of 6,16,265 ha. Total population of the area is approx 55.65 lakh and per capita land holding is about 0.10 ha. This low land-man ratio indicates that intensive agricultural use of land is essential to uplift the socio-economic condition of the local people in the project area.

The project area has favourable climatic conditions, and the soil is suitable for growing crops round the year. Thus the project was undertaken to bring potential cultivable areas under irrigation along with some other development activities.

For successful implementation of the project, groundwater resource was to be assessed for optimum utilization as well as to check the further deterioration of groundwater table for future developments. At the same time, it was felt necessary to assess the impact of surface water and groundwater since surface & groundwater are interlinked. BMDA engaged IWM for assessment of groundwater & surface water resources in the study area using modern technique of mathematical modelling tools.

The main objective of the study is to increase agricultural production through optimum utilization of available water resources. The study would specifically address irrigation planning based on model results for an efficient management of the potential groundwater & surface water resources.

The important specific objectives of the present study are as follows:

- Assessment of Upazila-wise groundwater resources and recharge potential based on different modes of withdrawals of ground water;
- Assessment of Upazila-wise tubewell requirements
- Assessment of surface water resources
- Development of Interactive Information System (IIS) to facilitate decision making process.
- Projection of 20 years ground water conditions for recommendations of effective ground water utilization.

To achieve the objectives, IWM is collecting various types of hydrological, hydro-geological and hydro-meteorological data both from secondary and primary sources. Among these, installation of 40 Nos. groundwater observation wells, 8 Nos. aquifer tests, 14 Nos. test drilling of 150 to 300 m depths, river cross sections, survey surface water levels and discharge measurements etc are being conducted in the field. The outputs of the on-going study will assist BMDA in planning their future projects to increase agriculture production of the study area in a coordinated and sustainable way.
Chittagong is the second largest city of Bangladesh with an estimated population of 4.2 million. Less than half the population of the city is currently connected to the water network, which endures interruptions to the supply sometimes, even for several days.

In order to improve the water supply condition of the City, Chittagong Water Supply and Sewerage Authority (CWASA) has taken up several major initiatives which would increase the water production from its current 180 MLD to over 550 MLD by 2020. Chittagong Water Supply Improvement and Sanitation Project (CWSISP) is a project funded by the World Bank to increase the production of safe water coupled with rehabilitation and expansion of its water distribution network. IWM is being engaged with DHI, Grontmij and Aqua in providing consultancy service to the project.

A critical element of CWSISP is the rationalization, improvement, expansion and operation of the City’s distribution and transmission network. It is anticipated that when water from the new plants will be brought online, CWASA may struggle considerably to operate the system with high pressure and, as a result, the amount of water losses in the distribution network will increase substantially. To avoid this, the project includes for the improvement of the network incorporating the hydraulic and pressure modeling of the existing system, its sectorization into district management areas (DMA) and the identification and prioritization of interventions.

The consultancy includes hydraulic modeling and detailed engineering design of the transmission mains and as well as the distribution system. The scope of work includes “study and design” in phase-1 and construction supervision, capacity building and development of an active leakage control program in phase-2. As part of the project a hydraulic model has been built and calibrated to determine the future improvements of the distribution and transmission system.
Bangladesh Army intends to develop an integrated plan for development of newly accreted Jahajer Char island which would include afforestation, grazing field, fish processing facilities, five camps, cyclone shelters and harbour. At present Jahajer Char is entirely in a state of natural development. The area has multiple opportunities and vulnerabilities. It has been experiencing cyclonic storm surge, tidal bore, erosion, accretion and drainage congestions. There are other development projects adjacent to this char which includes Char Development and Settlement Project (CDSP), Urir Char-Noakhali Cross Dam Project and Estuary Development Program.

A detail feasibility study will be carried out for integrated development of Jahajer Char considering technical, environmental and social issues. To support this feasibility study, Military Institute of Science and Technology (MIST) signed a contract agreement with Institute of Water Modelling (IWM) to carry out a massive data collection programme on urgent basis considering the limited suitable working period. The work includes bathymetric survey, topographic survey, discharge observations, water level measurements & sediment analysis. IWM has completed the dry season data collection campaign from February 2014 to mid of April 2014 and the report duly submitted. The 2nd phase of data collection will be initiated in monsoon in mid July 2014 to mid August, 2014.
The project is an innovative one being executed exclusively by the ICT unit of IWM for the national NGO-BRAC. The project area covers entire Bangladesh, where BRAC has its programs in approx 4,300 fixed structures around the country excluding all community-based activities that do not require buildings. Broadly the project is meant to be the first step in creating a central database by integrating geographical locations and photographs of BRAC’s presence using Smart Phone through interactive visualizations.

The specific objectives include (a) to design the data collection process and developing an Android Apps (b) to collect the latitude, longitude and other basic information (c) at least 4 images of every point during data collection using android apps using Smart Phone by 25 enumerators (d) cleaning and processing of collected field data, joining with other attributes and share the findings in BRAC’s internal seminar and incorporating feedbacks.

Surveyed data is instantly sent to the Google Server (Google App engine) having the internet connection. Monitoring and supervision of enumerators and quality assurance is ensured by downloading data from the server and checking outputs on daily basis as well as tracking enumerators’ presence at the survey location continuously on the Google maps.

Fig : Technical Approach Method
Regional Workshop on Sharing Lessons and Experiences on Current Water Management Issues in South Asia

Institute of Water Modelling in association with Bangladesh Water Partnership organized a workshop on ‘Regional Workshop on Sharing Lessons and Experiences on Current Water Management Issues, Opportunities and Challenges from Deltaic Regions in South Asia including Impending Climate Change Impacts’ on 28-29 March 2014 at BRAC Centre INN, Dhaka.

The purpose of the workshop was to share lessons, knowledge and experiences for best utilization of available water resources in the in South Asia delta region under impending climate impacts.

Barrister Anisul Islam Mahmud, Hon’ble Minister for Water Resources, Government of the People’s Republic of Bangladesh graced the occasion as Chief Guest. Dr. Zafar Ahmed Khan, Secretary, Ministry of Water Resources, Mr. Md Shahidur Rahman, Director General, BWDB and Ms. Priyanka Dissanayake, Regional Coordinator, GWP-SAS, Sri Lanka graced the occasion as Special Guests. Mr. Shahidul Hassan, President, Bangladesh Water Partnership presided over the inaugural session of the event while Prof. Dr. M. Monowar Hossain, Executive Director, IWM presented overview on the workshop.

Water Resource Secretary Dr. Zafar Ahmed Khan said, climate change had been triggering natural disasters. We can resolve many of the problems if we share our experience and knowledge.

Mr. Md. Shahidur Rahman, President, BWP, Ms. Priyanka Dissanayake, Regional Coordinator of GWP-SAS, Sri Lanka, Prof. Dr. M. Monowar Hossain, Executive Director, IWM also spoke on the occasion.

Experts from India, Pakistan, Sri Lanka and Nepal presented papers in the technical sessions of the workshop. The workshop was attended by high officials, experts and decision makers from the relevant ministries, development partners, representatives from different government and non-government organizations. Mr Abu Saleh Khan, Deputy Executive Director (Operations), IWM gave vote of thanks in the workshop.

Speaking as the chief guest, Barrister Anisul Islam Mahmud said no country can resolve the water problems alone. So, all countries should share their experience and knowledge.

With assistance from the European Union FP7 programme, Institute of Water Modelling (IWM) arranged a workshop on Dhaka Case Study for the research project ‘Collaborative Research on Flood Resilience in Urban areas (CORFU)’ on 02 June, 2014 at Spectra Convention Centre, Dhaka. Mr. Md. Nazrul Islam, Bir Protik, MP, Hon’ble State Minister, Ministry of Water Resources graced the occasion as Guest of Honour and Dr. Zafar Ahmed Khan, Secretary, Ministry of Water Resources attended the program as Special Guest. The workshop was chaired by Prof. Dr. M Monowar Hossain, Executive Director, IWM.
Dhaka experiences water logging in various parts of the City during intense rain in the monsoon. The workshop focused on the different aspects of drainage management for Dhaka City and discussed effective measures to mitigate the present water logging and flooding within the City. Special focuses were on economic growth, urban growth, hydraulic modelling and impact assessment and flood risk.

A number of presentations on Dhaka case study were delivered in the programme. Dr. Slobodan Djordjević, University of Exeter, UK and S M Mahbubur Rahman, Director, WRP, IWM presented briefs on the research and Dhaka case study, respectively. Prof. Dr. AK Enamul Haque, UIU, Dhaka presented on economic growth modeling, William Veerbeek, Dura Vermeer, the Netherlands presented on urban growth modeling. David M Khan, IWM delivered his presentation titled Hydraulic modeling & Impact Assessment while Dr. Michael Hammond, University of Exeter, UK presented on Flood risk perception in Dhaka. Group discussions on the presentations were held which was wrapped up by Prof. Dr. M Monowar Hossain, Executive Director, IWM.

The workshop was attended by high officials and experts from Ministries, donor agencies, representatives and decision makers from relevant government organizations. Mr. Abu Saleh Khan, Deputy Executive Director, IWM gave welcome speech on the occasion.

Final Workshop on Bangladesh Integrated Water Resource Assessment

Final workshop on Bangladesh Integrated Water Resource Assessment was held on 7 May 2014 at Brac Centre Inn, Mohakhali, Dhaka. The workshop was organised by Institute of Water Modelling (IWM) and Commonwealth Scientific and Industrial Research Organization (CSIRO), Australia in collaboration with the Bangladesh Water Development Board, Water Resources Planning Organization, Bangladesh Institute of Development Studies and the Centre for Environmental and Geographical Information Services. The workshop presented the conclusions of the three year study, the Bangladesh Integrated Water Resources Assessment. The study was funded by Australian Aid.

The lead researcher for the study, Dr Mac Kirby, from Australia’s national science agency, the CSIRO presented findings of the study. In his presentation he informed the audience about the challenges of climate change in water resource management in the perspective of growing population of Bangladesh. He also mentioned about other natural disasters including floods, droughts, cyclones which the country people will face more frequently in future resulting in salinity intrusion and threats to food security.

The workshop was attended by officials and experts from Ministries, donor agencies, representatives and decision makers from relevant government organizations. Mr. Abu Saleh Khan, Deputy Executive Director, IWM gave welcome speech on the occasion.
CAREER PROFILE

Mustafa Tanveer Hasan is a Junior Engineer of Water Resources Planning Division in IWM. He completed B.Sc. in Civil Engineering from Bangladesh University of Engineering & Technology in 2009. He started his career at IWM in the year 2009. He completed Masters in Water Resources Engineering from University of Alberta, Canada in December, 2013.

Mr. Hasan has more than two years experience in the field of water resources. His expertise areas are water distribution network modeling, urban drainage scheme planning & designing of drainage networks, water consumption measurement, statistical analysis of rainfall data, and analysis of tidal water level, discharge, and salinity data.

Mr. Hasan participated in number of training programs both as trainer as well as trainee on water distribution network and groundwater management. He has number of national and international publications.

M. Samiun Nabi is an Associate Specialist in Strategic Planning Unit working as Manager (in-charge), Business Development of IWM. He joined IWM in January 2012. He graduated in Urban & Regional Planning from BUET in 2004. Later he completed MBA from Institute of Business Administration (IBA), Dhaka University in 2009.

Mr Nabi possesses more than 10 years experience in different projects of LGED, DPHE & DWASA in urban planning & urban hydrology, drainage master plan, water supply, sanitation & utility network planning, traffic & transportation planning, pro-poor & poverty reduction & economic activity analysis, etc. He received comprehensive trainings on water resources planning using satellite imagery analysis & remote sensing from IWM, BUET; He received training on RTK-GPS & GIS data analysis using GNSS from Singapore. Besides, he also has specialized training in “Business Outreach and Procurement” in World Bank financed projects from WB Dhaka office and training on “Implementing ISO 9001 Quality Management System” from BIM.

His current job includes developing Strategic Plan for business augmentation, coordination with liaising different local and international donor and government agencies, Preparing Annual Budget with periodical updating, prepare monthly business report, networking activities, etc. Mr. Nabi also provides inputs in different projects of IWM as an Urban Development Specialist. He has profound experience in software ARCGIS, GNSS, ILWIS, ERDAS IMAGINE, SPSS, HTML, MS OFFICE, VBSCRIPT, ASP, .NET, C++. He is a widely travelled person and has number of national & international publications. He is a RAJUK certified Professional.

Md. Esraz-Ul-Zannat is a Junior GIS/RS Specialist in GIS and Remote Sensing Section under Information and Communication Technology (ICT) unit in IWM. He graduated in Bachelor of Urban and Regional Planning (BURP) from BUET in 2007. He joined IWM in 2009 as a Junior GIS Specialist. He completed Master of Urban & Regional Planning (MURP) from BUET, Dhaka in 2012.

Mr. Esraz has more than 7 years of experience in the field of Urban Planning, GIS & Remote Sensing (RS) applications in water sector that includes water resources planning and management, disaster management, etc. He started his career as GIS analyst at Golden Harvest Scankort GIS Ltd. in 2007 and later joined Autodesk Bangladesh: Win-Win Infosys Ltd. in the same year as instructor of geospatial technology. Later, he switched to Data Experts (Pvt.) Limited (datEx) in 2008 as a urban planner and GIS specialist. He has wide range of experiences in urban growth modelling, land use planning, geospatial analysis, mapping, coordinating and supervising of data processing and collections, remote sensing, etc.

Mr. Esraz participated in number of training programs both as a trainer as well as trainee in GIS & Remote Sensing and its application, disaster management, etc. He is a professional Urban Planner under Bangladesh Institute of Planners (BIP) and a registered town planner of Rajdhani Unnayan Kartipakkha (RAJUK). He has several national and international publications.

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- Md. Hazrat Ali
- David Mohammed Khan
- Pankaj Kumar Maitra
- Tanvir Ahmed
- Dr. Muhammad Enamul Quadir
- Md. Esraz-Ul-Zannat

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