

ANNUAL REPORT 2017



INSTITUTE OF WATER MODELLING

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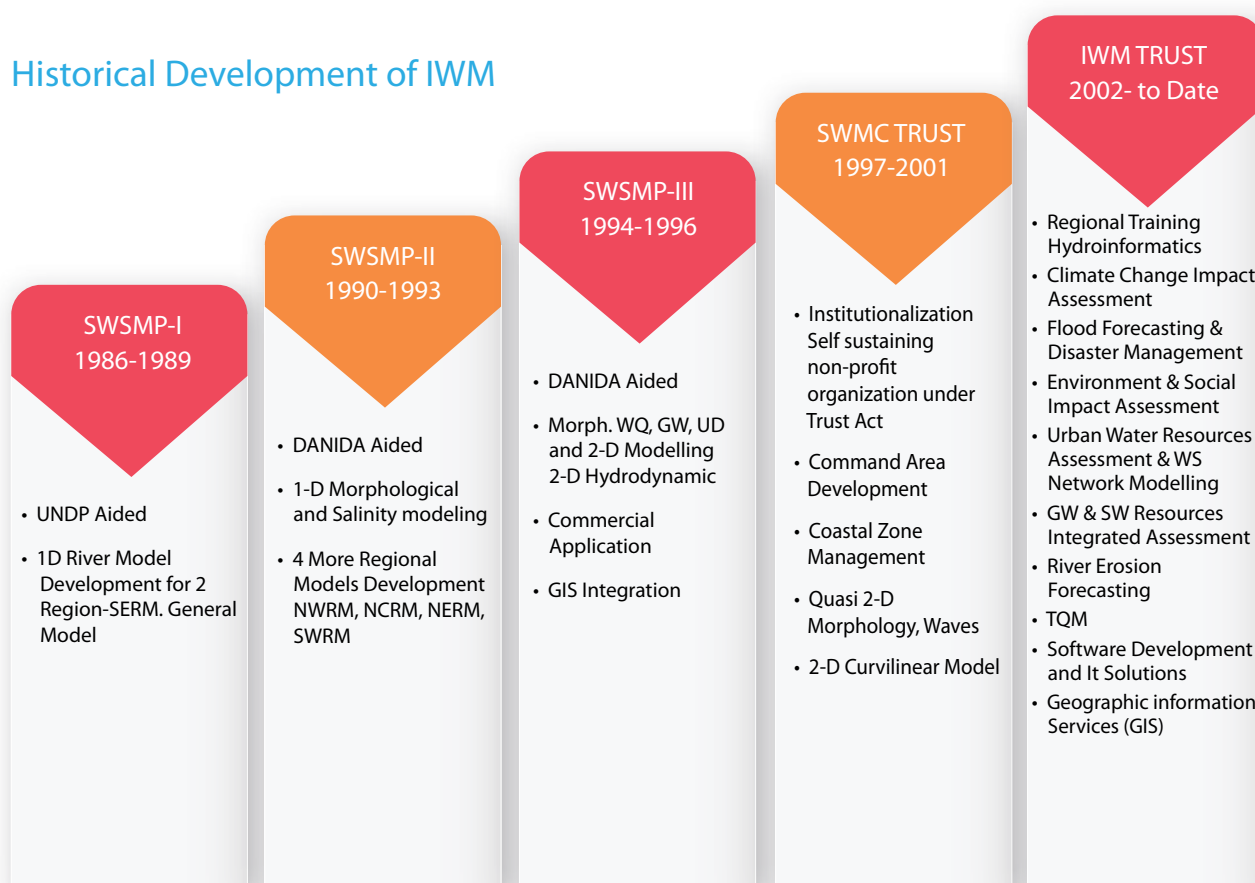
- Integrated Water Resource Management
- Climate Change Modelling
- Wetland and Lakes Management
- Irrigation Management
- Groundwater Management
- Urban Water Management
- Water Quality and Ecology
- Fluvial Hydraulics
- River Engineering
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- Estuary and Marine System Management
- Offshore Structure and Pipelines Design
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- Hydrogeological Investigations
- Topographic, Bathymetric & Hydrographic Survey
- Discharge Measurement
- Sediment Transport, Water Quality and Hydrological, Meteorological Field Measurements, Necessary Laboratory analysis, Data Management and Digital Mapping;
- Any other field or area which may be conveniently and beneficially done through the facilities of IWM.

About IWM

Institute of Water Modelling (IWM) is a Trust established by the Government of the People's Republic of Bangladesh in December 1996 to function as a Centre of Excellence and learning in the field of Computational Hydraulics, Water Modelling and Allied Sciences. IWM owes its genesis to the three phases of UNDP-DANIDA aided Surface Water Simulation Modelling Programme (SWSMP) carried out during 1986-1996. Since then IWM has developed numerical models of rivers, estuaries and Bay of Bengal covering entire Bangladesh and applied in national important projects.

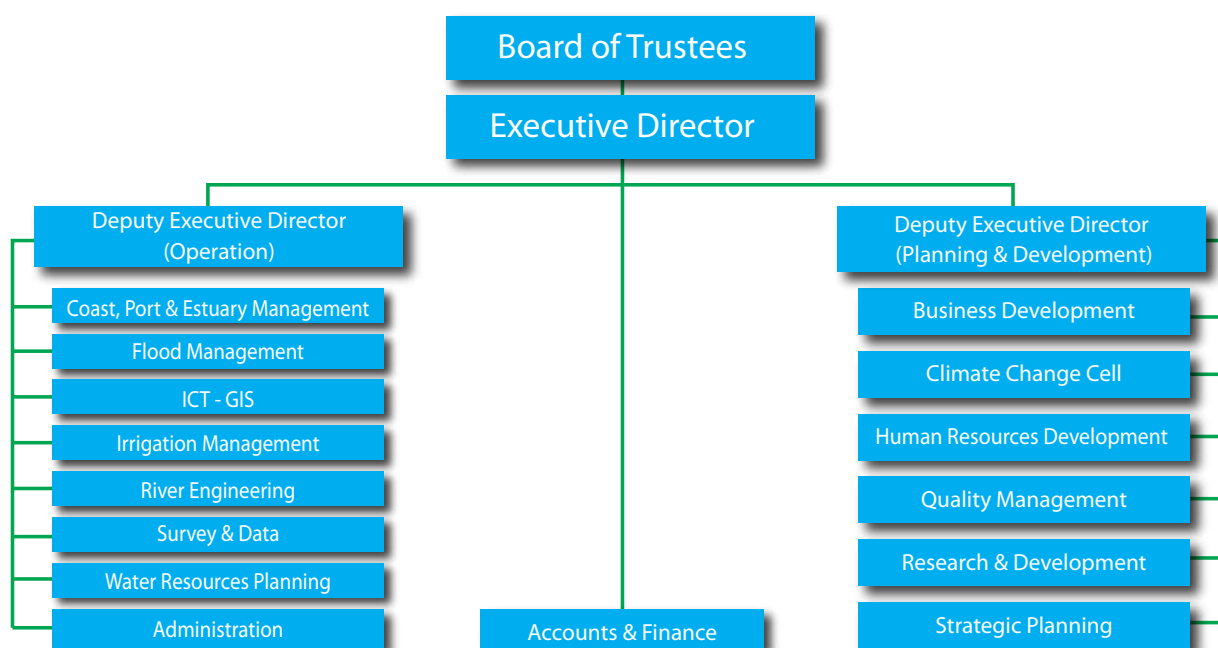
IWM offers a wide range of specialist services in the fields of water resources planning and management as well as hydrometric measurements, hydrographic, bathymetric & topographic surveys and monitoring.

Historical Development of IWM



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FROM CHAIRPERSON

Kabir Bin Anwar

Secretary
Ministry of Water Resources
Government of the People's Republic of Bangladesh

It gives me immense pleasure to convey my best wishes to Institute of Water Modelling (IWM) on publication of its **Annual Report 2017**. I am delighted to observe that IWM has come a long way in establishing its accomplishment as a Reference Centre in South Asia and a leader in the field of water management and modelling. I also appreciate that IWM is contributing in implementing of the Bangladesh Delta Plan 2100 in respect of water resource design, study and modelling.

The Institute is contributing in the prosperous journey of emerging Bangladesh by delivering world class solutions in water resources & environmental management with its excellent skills on state-of-the-art technology of mathematical modelling, computational hydraulics and allied sciences. It is addressing numerous water-related problems of the country and abroad. I am very happy to know that IWM has expanded its vision to Water, Environment & Climate with a special attention on ecological studies. This will definitely provide important insights regarding impact of development works on our ecosystem. IWM has become a centre of repute and is venturing into new opportunities with foreign Institutes and Universities. Previously we needed to hire expensive foreign consultant for different studies. But centres like IWM have come forward and successfully reduces the dependence on foreign experts, thus is saving millions of important foreign exchanges. This is a success story of Bangladesh.

I am happy to know that it is widely acknowledged that IWM's linkage with other educational and research institutions in the country and abroad has expanded in an exponential manner opening new frontiers of collaboration in South and East Asia, North America and Europe.

Finally, I would like to extend my heartfelt appreciation to the members of the Board of Trustees of IWM for their whole-hearted contributions and continuous support over the years. They provided continued support for the development of the Institute as a successful entity in addressing the challenging needs of the country. I also wish to extend my best wishes to the staffs of IWM for their tireless efforts in strengthening the Institute for their commitment and dedications, in enhancing the image of the country. I wish IWM a prosperous and bright future.

Kabir Bin Anwar

Secretary
Ministry of Water Resources
Government of the People's Republic of Bangladesh



MESSAGES

FROM Executive Director

It is my honor to present the year-round activity of IWM in the **Annual Report 2017**. It summarizes an overall status of IWM to our valued clients, well wishers, stakeholders and other fellow professionals on our activities. The year 2017 has been yet another year of continued success in the milestone of our accomplishments, depicting the completion of number of significant projects. This year we have provided our services to around 50 different clients and number of projects was around 95. Our emphasis was on new areas of knowledge generation through research and studies.

I would like to provide a very short glimpses of activities division-wise below:

CPE division has been involved with diversified projects in 2017. Some of them are: Formulation of Bangladesh Delta Plan 2100, Morphological Study, Design & Supervision and EIA/SIA of the Twelve Navigation Routes of BIWTA, Consultancy Services for detail design of extension of runway for Cox's bazar airport, Preparation of EIA and Implementation of RAP for CEIP-1 for BWDB, Techno-Economical Feasibility Study for Development of the Land at Moheshkhali for constructing L.N.G. Terminal, Techno-Economical Feasibility Study for Development of the Land at Payra Port, Feasibility Study for Improvement and Restoration of Navigability for Seven Navigation Routes, etc. The Division also carried out some international research collaboration projects with US fundings with US top ranking Universities. **FMG division** has been involved in Kalni-Kushiyara Dredging Modelling & Monitoring, Future plan study for West Gopalganj Integrated Water Management Project, Hydrological Study for a Water Reservoir Construction to Supply Water to the GPH Ispat Limited in Chittagong, EU-Global Earth Observation for Integrated Water Resources Assessment (Earth2Observe), research project with Yunnan University, China on water security and vulnerability in Brahmaputra Basin etc. **ICT-GIS Division** of IWM carried out projects such as BWDB's Scheme Information Management System (SIMS-Web), Development of HAOR MIS, Development of ICT Connectivity DSS through Interactive GIS Map for A2I, etc. **IRM division** continued the projects on National Water Balance Management System (NAWABS) bagi Lembangan Sungai Muda in Malaysia, Cropping System Intensification in the salt affected Coasted Coastal Zones of Bangladesh and West Bengal, Study of Interaction between Haor and River Ecosystem including Development of Wetland Inventory and Sustainable Wetland Management Framework, etc. **REN Division's** major projects are: Monitoring of Hydraulic and Morphological Conditions of Jamuna River for the Safety of the RTW of Bangabandhu Bridge during the year 2013-2017, Morphological Mathematical Modelling for Implementation Support to Maintenance Dredging of the Gorai River Phase II, Hydraulic and Morphological Study of the Ghorautra River around Mithamain Area for establishing Cantonment, Gumti River Dredging - Hydro-morphological Study and Feasibility Study of Re-excavation of Upper Bhairab River etc. **SDT division** has carried out survey works for numerous on-going projects. These include Bathymetric Survey for Gorai River Restoration Project, Services for Review of the Physical Condition and Functionality of Existing Hydraulic Structures of BWDB, Current, Wave and Salinity Measurement for the Matarbari Port Development, etc. **WRP division** worked on projects such as Preparation of Action Plan for Control of Pollution of Peripheral Rivers of Dhaka City, Design and Implementation of Water Supply Network in Chandrima Model Town, Improvement of drainage and road network in new areas of DNCC, Preparation of a Sanitation and Drainage Improvement Strategy and Master Plan for the city of Chittagong, Feasibility Study of Barapukuria Coal Mine Project 2, Design of water distribution system in Jhilmil project area, Consultancy Services for demarcation of RoW of raw water transmission pipeline of Saidabad WTP Phase III, etc.

IWM has participated in **Water Malaysia 2017** Exhibition and made a respectable appearance. The event facilitated a congregation of about 800 water professionals from around the world. IWM exhibited its key strengths and skill sets in providing solutions in Coastal Hydraulics, Ground Water Modelling, Flood Management etc. Besides providing services in Bangladesh, IWM is growing as a commendable institute in the Asian region and is currently delivering its services to India & Malaysia. Different international institutes are approaching IWM for making alliances. **BD & HRD** units of IWM organized several workshops, seminars, training programs both at home and abroad for IWM staffs as well as its valued clients. Local training for professionals from NAHRIM, BUET, BWP, WARPO, BIWTA, LGED, and DWASA, RWASA, SSC & BWDB were arranged. International trainings were arranged in Thailand, Germany, Malaysia & USA. All these workshops and seminars help a lot to disseminate the knowledge of IWM to different stakeholders of national and international arena.

Prof. Dr. M. Monowar Hossain
Executive Director

IWM Success 2017: At a glance

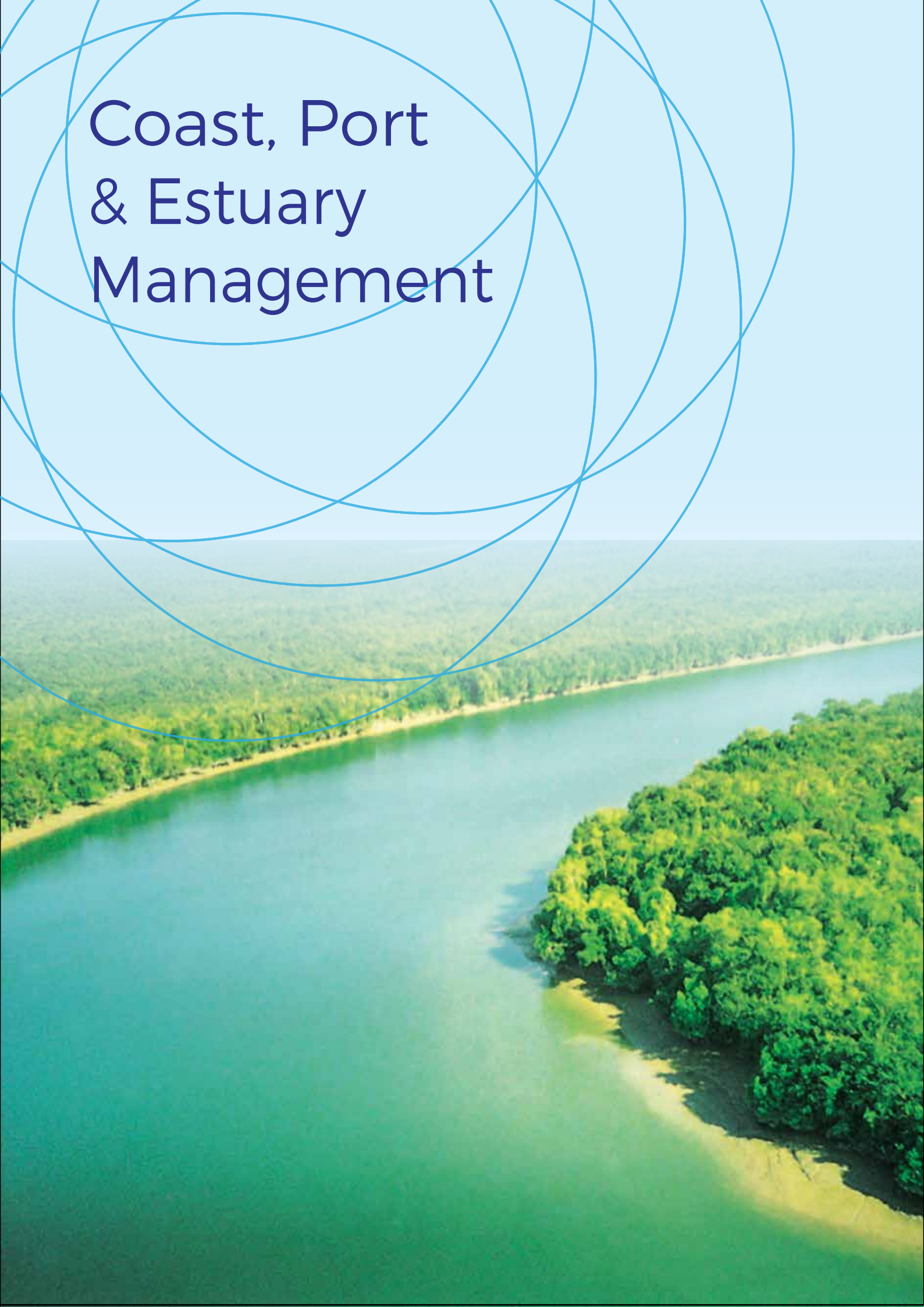
We are steadily growing to provide sustainable solutions to the water sector of not only in Bangladesh but also in the neighboring countries which extends upto the region of Asia and Europe, Since its inception in 1986, IWM continues to thrive in an exceptional manner and grow day by day. In 2017, IWM had taken several challenging projects of great national interest and experienced a steady growth. We have provided our services in around 95 projects and to more than 50 clients. Maintaining our strong pursuit in modelling, we are exploring some adjacent sectors to meet the pressing demand of our valuable clients. Services of IWM were requested from different international agencies from various countries and thus IWM is getting Recognition at a global scale.

Major Projects

1.	National Water Balance Management System (NAWABS) Bagi Lembangan Sungai Muda, JPS, Malaysia
2.	Study of Interaction between Haor and River Ecosystem including Development of Wetland Inventory and Sustainable Wetland Management Framework), DBHWD
3.	Feasibility Study (FS) of port facilities for Khulna, Narsingdi, Barguna, Galachipa, Mongla, Meghna, Sunamganj, Tekergat, Ghorashal, Kanchpur port, Mojuchowdhuryhat, Daudkandi-Bausia River Port, BIWTA
4.	Bhanga to Payra Port Rail Line Construction - Hydro-morphological Study, Bangladesh Railway
5.	Study for Investigation of GW Irrigation in Habiganj, Moulavibazar and Sylhet Districts, DBHWD
6.	Water Availability & Demand Assessment of Bangabandhu Sheikh Mujib Shilpa Nagar, BEZA
7.	Feasibility Study of Development of Safe Water Supply System in the newly added 16 unions of DNCC and DSCC
8.	Payra Port Capital Dredging - Technical Consultancy Support Services, Payra Port
9.	Technical Feasibility Study of Embankment-cum-road and Water Management Systems for Economic Zone-4 at Sonadia-Ghotibhanga Islands, Moheshkhali, Cox's Bazar, BWDB
10.	Consultancy Service for Implementation Support Services for Kalni-Kushiyara River Management Project by State-of-the Art Survey Technique, BWDB
11.	Management Support to the Mathematical Modelling Centre (MMC) for Water Resources Research & Development under Water Resources Department, Government of Bihar, India
12.	Water Resource Potential Assessment of Ukhia and Teknaf Upazila Area, Cox's Bazar, Bangladesh, DPHE
13.	Preparation of Environmental Impact Assessment (EIA) and Environmental Management Framework (EMF) for DSIP (Package No.: S-3), World Bank
14.	Integrated Water Resources Management for Baral Basin, BWDB
15.	Karnaphuli and Boalkhali Irrigation Project, BWDB
16.	Four Large Road Bridges in the SW Region of Bangladesh - Hydro-morphological Study, BBA
17.	Feasibility Study of Barapukuria Coal Mine Project 2, Barapukuria
18.	Flood Management Planning in Bangladesh: Cooperation on Mathematical Model of Hydrology and Sediment, BWDB
19.	Blue Gold: Innovation and Action Research - Water Management, Sticking Deltares

Among the major clients of IWM; BBA, BIWTA, BMDA, BWDB, CPA, PPA, MPA, CAAB, PDB, DBHWD, CWASA, KWASA, RWASA, DPHE, DWASA, LGED, RHD, WARPO, BR, DOE, DOF, Atomic Energy Commission, WB, ADB, UNICEF, etc. stand big to seek IWM services. These agencies play significant role regarding taking large projects which involve development of the country and the people. With IWM's services of modelling and survey our clients can ensure optimum performance and outcome of these projects and thus save resources of the country in terms of millions of dollars. The vision of IWM is aligned with the Perspective Plan of Bangladesh, Vision 2021. IWM is also relentlessly working with Delta Plan 2100 with other partners of the consortium.

Coast, Port & Estuary Management



Environmental and Social Impact Assessment of Bangladesh Regional Waterway Transport Project 1 (Chottogram-Dhaka-Ashuganj Corridor) of Bangladesh Inland Water Transport Authority (BIWTA)

River corridors between Dhaka and Chottogram; and between Dhaka and Ashuganj (with extensions to Narayanganj and Barisal) are high priority routes for Inland Water Transport (IWT) of Bangladesh and carries approximately 80 percent of IWT traffic including about 200,000 passengers per day. Inland river terminals at Dhaka, Narayanganj, Chandpur and Barisal and a number of landing stations along these routes play very important role in transporting and handling passenger and cargo. Realizing importance of this corridor and the need to fully utilize all transport modes to reduce demand on roads, the

The Project consists of three components as follows: Component 1: Improved Inland Waterway Navigation; Component 2: Improved Services at Priority Inland Waterway Terminals and Landing Ghats/Stations; and Component 3: Institutional Capacity Development and Sustainability. The Component 1 of Dhaka Chottogram Inland Water Transport Corridor Project intends to maintain the river routes between Dhaka-Chottogram and Dhaka-Ashuganj corridors and three ferry routes through annual maintenance dredging. The Environmental and Social Impact Assessment (ESIA) study has been carried out to identify any



Environmental Resources in the Project Area

Government has prioritized improved development and maintenance of the Class I routes and linked II and III routes along this corridor. The main trunk route is about 300km, of which it is initially estimated that about 40km currently require dredging and channelization to maintain the advertised depth for existing traffic. Another 110-130km of linked routes is part of this corridor, of which about 33-50km requires constant maintenance.

possible adverse impacts of the proposed project in advance and prepare a plan to avoid, minimize and mitigate these impacts to revive the stakeholder population and to improve or at least restore their pre project socio-economic condition.



Focus Group Discussion in Norsingdi



Focus Group Discussion with Local Community, Norsingdi

Baseline for physical, biological and social environment is established based on analysis of primary data collected from field as well as secondary data. Valued Environmental and Social Components (VESC) are selected which are likely to be impacted by the proposed dredging, lifting, transportation and placement of the dredged materials. Physical and social survey, analysis of available data and results of mathematical model simulations are used to identify the likely impacts of the proposed interventions on the identified VESCs. A comprehensive Environmental Management Plan is suggested in this study which includes impact mitigation and monitoring measures, institutional arrangement, EMP cost and reporting requirements.

The dredging works and associated activities are likely to increase suspended sediment in water and consequently affect aquatic and benthic flora and fauna; cause changes to bioavailability of contaminants in the sediment due to its re-suspension; impact temporarily to navigation, fishing and other river uses; disturb local communities and riverine species; initiate riverbank erosion; and so on. The suggested mitigation measures for maintaining suspended sediment concentration within 4,000 mg/l include use of dredging equipment with low risk of sediment dispersal; monitoring of dredging operation; and, if necessary, change the dredge location or the number of dredgers to minimise

the amount of material being dredged at any one time. Potential impacts during transportation are spillage and safety in relation to other transport users of the river. Dispersion of deposited material and release of sediment laden runoff are likely due to direct disposal of the dredged materials. For direct placement of sediment on land the area will be subdivided into compartments by dredged materials. Filling will be achieved by progressively pumping a slurry of sand

and water into the bunded areas, allowing the surplus water to drain away to artificial and natural waterways in a controlled manner through the pipeline, without affecting floodplains. Non-toxic dredged materials will be disposed at designated scour holes on riverbeds but the contractor is recommended to use diffusers at the outlets of the hydraulic pipes to minimize sediment dispersion. Management of contaminated materials, bio-diversity management plan and social management and resettlement plan are also integral parts of the EMP.

The benefits and disadvantages of the project, various environmental and social issue, impacts, mitigation measures during the dredging period were disclosed to stakeholders through extensive consultation and disclosure procedure. A total of 32 public consultations and 29 Focus Group Discussions (FGD) were conducted at 60 different locations which were within the project influence area along the proposed river routes in addition of two national workshops and a few regional workshops. In the consultation and disclosure process, participation of female, disabled and vulnerable stakeholders was ensured. The main focus was to investigate

how dredging and maintenance work of the project can impact the surrounding environment and people's perception about this project. The participant's opinions and comments were

spontaneous and the facilitators had the full cooperation of participants. The EIA report and Bengali translation of its executive summary were disclosed to the public; made available on the official website of the BIWTA and sent to the WB InfoShop.



National Stakeholder Consultation Workshop

Planning, Design and Monitoring of Dredging in Kajal-Tetulia River Route of Payra Port

Payra Sea Port, the 3rd sea port of Bangladesh, is situated on the bank of Rabnabad Channel in Kalapara upazilla under Patuakhali district. The port has begun its operational activities in August 2016 and further development works of the port infrastructure and facilities are being carried out in order to enable the port fully operational by the year 2023. As a part of the development activities, navigability of the Kajal-Tetulia river route (from Payra Port to Dhaka-Chottogram waterway near Kaliganj) are improved by dredging in order to allow 5m draft vessels and maintain good river communication with Dhaka and Chottogram. Payra Port Authority (PPA) entrusted Institute of Water Modelling (IWM) for planning and design of dredging works, developing dredge materials disposal plan, monitoring the dredging activities and quantification of the dredging volume.

The shallow river stretches are identified for dredging on the basis of recent check survey data in order to maintain an overall navigability of 5m draft vessels through the Rabnabad-Kaliganj river route.



Route of the dredging in Kajal-Tetulia River navigation route and the minimum requirement of maintenance dredging. Analysis of satellite images is also carried out for assessment of the historical



Dredger in operation in Kajal River

Then the final dredging alignments are selected considering deeper channel, current speed, flow direction, erosion vulnerability and setback distance from riverbanks to ensure an effective

erosion-deposition pattern in the area to design a proper alignment of the navigation channel. The dredging channel section is designed following Permanent International Association of Navigation Congresses (PIANC) guidelines for Inner Channel

and design vessel. The dredged materials disposal locations are selected in a way that there is no scope of re-suspension of the dredged sediments into the



Visiting PPA Land proposed for development using dredged materials

dredged channel and does not affect the natural environment of the disposal location. The dredged materials have been utilized for land reclamation, erosion protection and development of land acquired for Payra Port facilities and a base of Bangladesh Navy on the banks of Andharmanik River. IWM also designed earthen dykes for retaining dredged materials inside the land development sites and estimated the

designated river stretch as well as immediately after dredging. The cross-sections derived from the post dredging hydrographic surveys are compared with the design cross sections and IWM team informs the port authority whether the design depths have been achieved or not in the dredged river stretches based on hydrographic survey. If the design depths are not achieved after dredging, then Payra Port Authority is notified and contractor has to repeat the dredging works in order to meet the requirements. The volume of capital dredging is estimated based on the pre and post dredging survey data. After processing the raw data

collected from the surveys, a Triangulated Irregular Network (TIN) model is generated using all the surveyed data and the dredged cross-sections are presented at 25m intervals. The allowable vertical tolerance is 0.5m and the allowable horizontal tolerance is considered as 4m at both sides of the design channel. Any dredging volume upto these tolerance limits are accepted.



Stakeholder consultations for disposal of dredged materials



earthwork volume for construction of dykes.

The pre and post dredging surveys were carried out by the dredging contractor, under the supervision of the Payra Port Authority, Bangladesh Navy and IWM. IWM monitors the performance of the dredging works comparing post dredging cross-sections with targets and identifying shortfalls. Hydrographic survey campaigns are carried out immediately before starting the dredging works in a

The river is morphologically very dynamic since tremendous water flow and sediment load is brought into the system from the upstream to the Bay of Bengal at the downstream of the Rabnabad Channel. It is found that the re-siltation rate is about 71% at the Kajal-4 dredged channel over a period of 10 months. The dredged stretches are very likely to be silted up if any maintenance dredging is not performed.

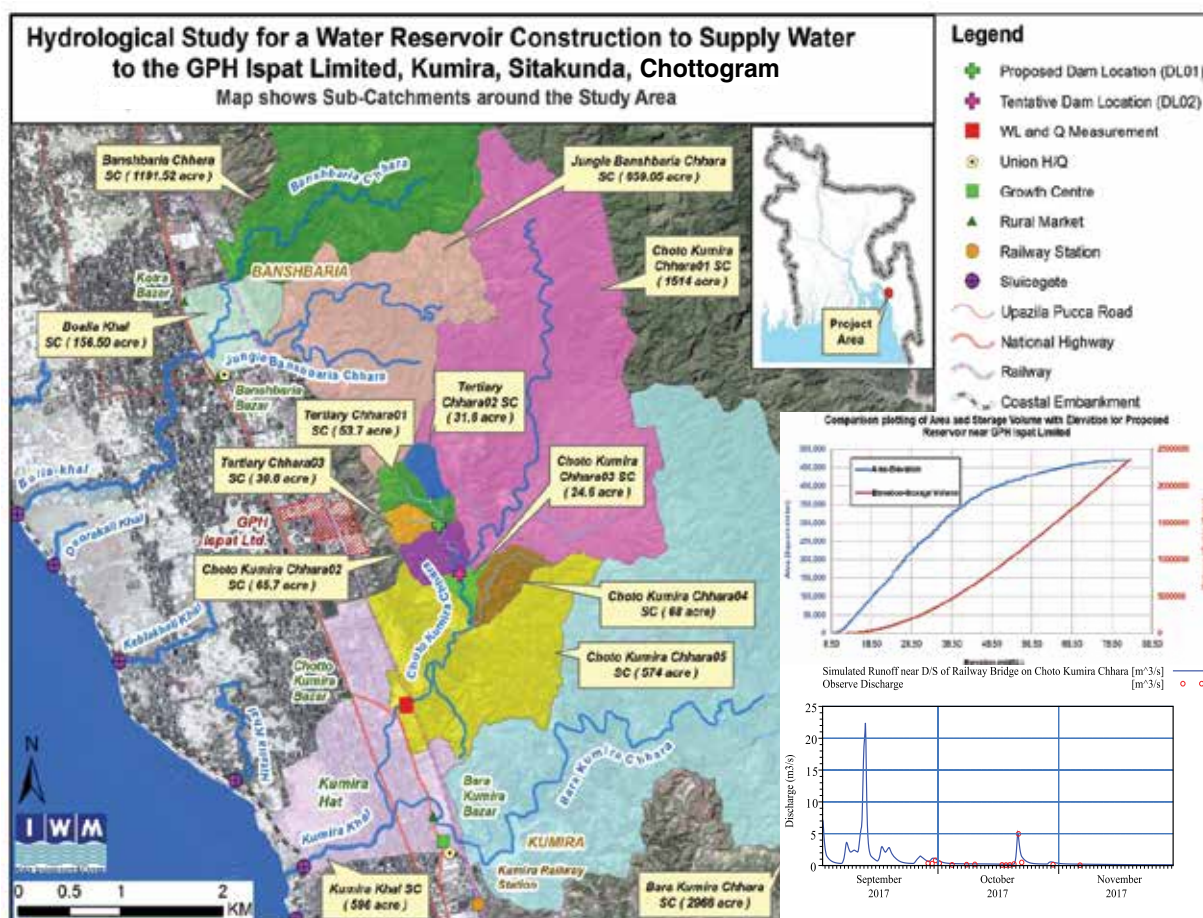
Flood Management



Hydrological Study for a Water Reservoir Construction to Supply Water to the GPH Ispat Limited, Kumira, Sitakunda, Chottogram

Sitakunda is an important industrial zone in our country which contributes a lot to the national economy. GPH Ispat Limited is one of the group of industries located near Sitakunda, recently has signed a contract with Austria Primetal Technologies GMBH for the construction of new plant. Water shortage persists along the entire industrial belt along Sitakunda for long and it is important to note that availability of groundwater in this area is fragile.

The main objective of the study is to identify potential location of water storage dam, assessment of water availability for the GPH Ispat limited new plant, establish operation rule for the reservoir, provide outline design of dam & associated structures and hydrological impact assessment of the project on surrounding areas. According to the methodology, both primary and secondary data collection program has been conducted which

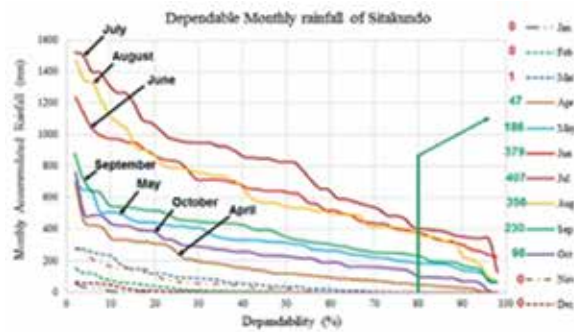


GPH Ispat Limited, for its own requirement has decided to develop the water reservoir to harness the huge quantity of rain water which is flowing down to the Bay with very little of the amount being utilized for agricultural or industrial use. For this purposes, they have requested IWM to conduct a detailed hydrological study to construct a water reservoir which will serve 6 MLD (million litre per day) of water for the new along with existing plant.

includes rigorous field visits, hydro-meteorological data collection, geo-spatial data collection, topographical data collection, etc. Collected data has been analyzed for the consistency checking, statistical analysis for the average year selection and water availability analyses, etc. Detail level hydrological model, basin model and hydraulic model has been developed for the study area. Developed model has been applied to optimize the reservoir spilling level & maximum storage level,

to assess the required time to fill the reservoir initially, to assess the flow availability by surplus-deficit analysis, to fix different characteristics level of the dams & reservoirs and to establish operation

rule. Finally, the outcome of the hydrological study has been applied for the outline design of dam and associated structures.



Optimization of Dam Spilling Level

Proposed Dam Location for GPHL

Withdrawal round the year

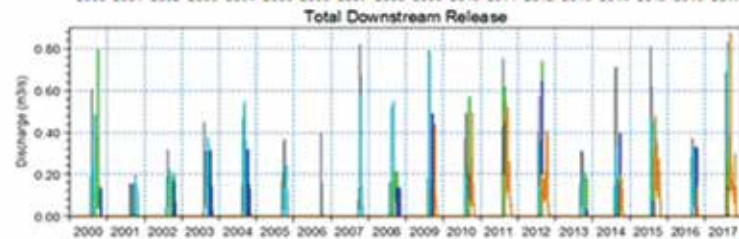
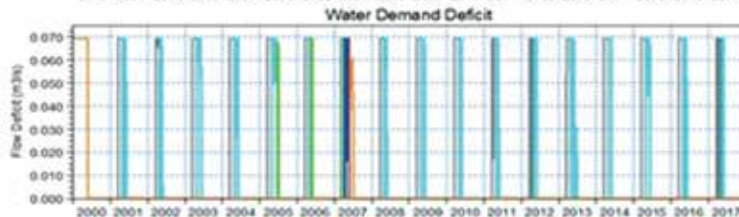
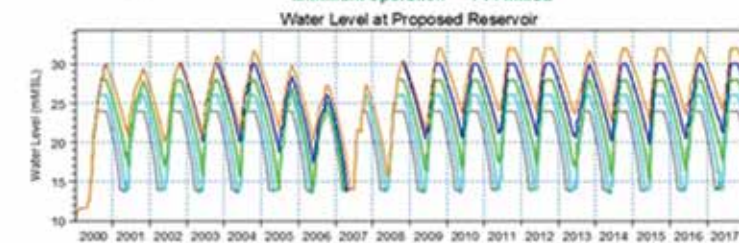
WL profile is varying with storage level and max WL is equal to the storage level

No deficit prevailed for ≥ 28 mMSL storage level (except in dry year 2005-07)

Spilling occurs for ≥ 24 mMSL storage level

Reservoir Characteristics Level
Bottom : 10 mMSL
Dead Storage : 14 mMSL
Minimum Operation : 14 mMSL

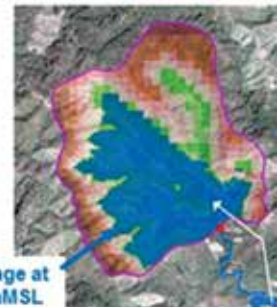
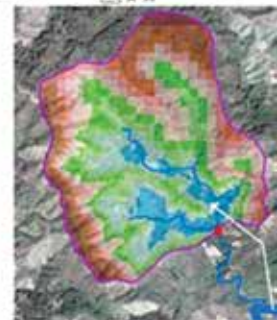
Operation of 6 MLD (0.07 CMS) withdrawal
(Source: Local Catchment Rainfall + 0.2 CMS from Choto Kumira Chhara during June to October)



Comparison plot of output variables

Spill Level

24mMSL
26mMSL
28mMSL
30mMSL
32mMSL



Location of the Proposed Reservoir and Dam

Scaling up of Satellite Assisted Flood Forecasting System in South and South East Asian Nations

The Flood Forecasting & Warning Center (FFWC) under BWDB, MoWR of the Government of Bangladesh in coordination with the Institute of Water Modelling (IWM), a trustee under the Ministry of Water Resources (MoWR) have successfully organized two regional training workshops in two consecutive years during 24-28 July 2016 and 9-13 July 2017 funded by USAID.



Chief Engineer, Hydrology, BWDB greets the Participant at inaugural program

This project is supported by National Academy of Science (NAS) of USA and US facilitator Dr. Faisal Hossain, University of Washington to transfer the knowledge and know how of satellite-assisted flood forecasting system to other flood management agencies of the South Asian Region.



Field visits to Bhagyakul during 2017

In connection to the project "Scaling up of Satellite-Assisted Flood Forecasting System in the South and South East Asian Nations", participants

from regional flood agencies like Department of Hydrology & Meteorology (Hydro-Met), Vietnam; Department of Hydrology & Meteorology (Hydro-Met), Nepal; Institute of Environmental Science and Engineering (IESE), Vietnam; Royal Irrigation Department, Thailand; Department of Meteorology and Hydrology, Myanmar; Lao National Mekong Committee Secretariat, Lao PDR; Asian Disaster Preparedness Center (ADPC), Thailand & local agencies FFWC, BMD, DDM, IWFM, LGED, Bangladesh have attended these training workshops.

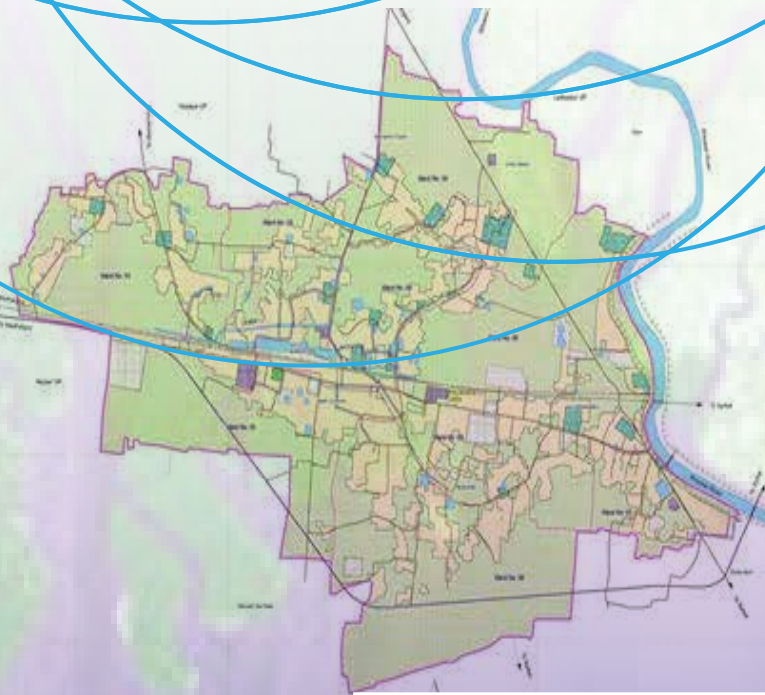


DG, BWDB inaugurates the 2nd year training program during July, 2017

Furthermore, to get extensive training on state-of-the-art satellite technologies for flood forecasting, two weeks long training program at University of Washington, USA has been conducted in the Project. One participant from IWM and 03 nos. of BWDB professional have made their trip to join the training program during April and November 2017 respectively.

Later, a follow up training program has been implemented to disseminate the knowhow gathered from training programs at University of Washington to further downstream (BWDB professionals). This follow up training helped the FFWC/BWDB professionals to master the state of the art techniques of satellite based flood forecasting.

ICT-GIS



Developing ICT Connectivity Decision Support System Through Interactive GIS Map for BTRC

The Government of the People's Republic of Bangladesh has declared 'Vision 2021' with a target to make Bangladesh as a middle income country where one major driving force would be the Information and Communications Technology (ICT) and development of favorable business environment for innovative companies. Also, the ICT has been considered as a thrust sector.

Telecommunication has a vital role to achieve the targets of 'Vision 2021'. Access to Information (a2i), Prime Minister's Office, had taken an initiative to develop a decision support system to monitor

Key Features

- Can create a zone map related to fiber lines/ union digital centers (with buffer distance)
- Can select Union Digital Centers, High Schools, Primary Schools, Health centers within certain distance from selected Fiber Optic lines
- Can find Fiber lines within certain proximity of selected school/union center/GoB office/any other custom location
- Can find which Unions/Mouzas passed by Fiber optic networks and generate the statistics of area and population under connection coverage



Interactive Web GIS Application

the telecommunication network activities all over Bangladesh through an online interactive GIS based system. a2i assigned IWM to develop a GIS based interactive web application for National Network considering scalability and interoperability using Open Source development tools. Mr. Sajeed Wazed Joy, the ICT adviser to Honorable Prime minister has closely monitored the development and advised accordingly. Bangladesh Telecommunication Regulatory Commission (BTRC) is the authority to monitor the telecommunication network of Bangladesh. Therefore, as per decision of DNCC (Domestic Network Coordination Committee) meeting BTRC Server the developed system was transferred to BTRC (tiis.btrc.gov.bd). Only authorized user of BTRC can access the system.

- Can find populations of connected Unions/Mouzas of entire Bangladesh
- Interactively visualize more than 100 data layers with valuable information
- Can show connected and unconnected endpoints mapping
- Attribute data can be updated online
- Can prepare different types of dynamic reporting including custom query on telecommunication layers
- Advance search can be made by administrative unit and by telecommunication operator

Google Streets, Google Satellite can be viewed as background. Distance and area can be calculated interactively from the Web Map. Direct print to printers and PDF files are made possible.

Irrigation Management



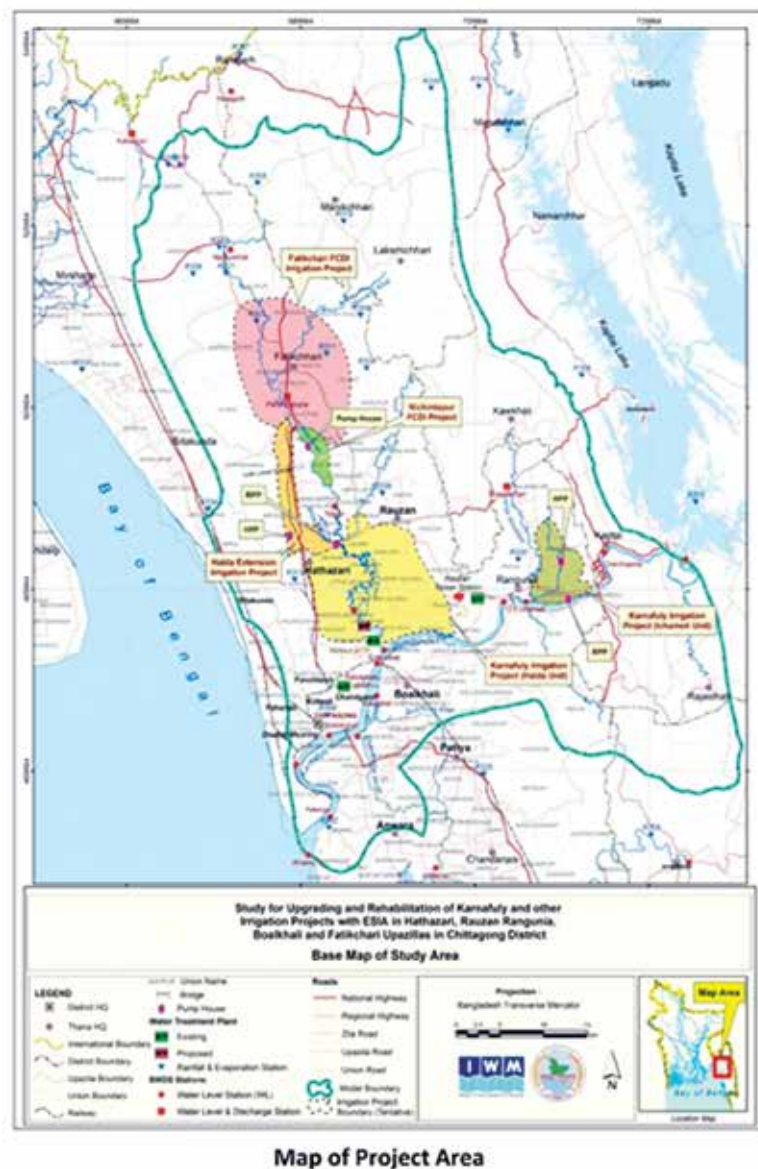
Karnaphuli Irrigation Project (Halda & Ichamoti Unit)

Since its inception, Irrigation Management (IRM) division has achieved a leading position within the field of integrated management of land and water resources through mathematical modeling study, wetlands management and detailed hydrological and hydrogeological investigations for Bangladesh and abroad. IRM plays an important role in agricultural productivity through improved irrigation by sustainable water resources management as well as wetland restoration and protection for achieving the Sustainable Development Goal (SDG). Using mathematical modeling, IRM supports water managers in home and abroad in structuring complex decision-making processes and provide technical know-how for effective evaluation of planning alternatives. Information management systems, decision support systems and simulation models are important tools in this respect. IRM provides technical support in different stages of project cycle i.e pre-feasibility stage, feasibility and planning stage, implementation stage, operation and maintenance stages using the diversified tools such as MIKE SHE, MIKE-11, MIKEGIS, MODFLOW, FEFLOW, HYMOS, CROPWAT etc., supported by ICT and sophisticated data collection system. Recently IRM has taken up a project in the field of wetland management which includes delineation and classifications of wetlands, establishment of connectivity between wetlands and rivers ecosystems and cluster wise best management practices for wetland restoration and protections.

Bangladesh Water Development Board (BWDB) has undertaken the upgradation and rehabilitation of Karnaphuli Irrigation Project (KIP) (Halda & Ichamoti Unit), Fatikchari FCDI Project, Halda Extension Irrigation Project and Nishchintapur FCDI Projects with a view to restoring agricultural production and Command Area Development. All these irrigation projects were commissioned long before. During this long service period, the structural components faced lack of proper maintenance concerns. The flood embankments are now in almost dilapidated condition to fight against high stage of water during flash flood.

Internal Irrigation and Drainage Channels have become badly silted up and lost serviceability up to the mark. Irrigation Project Operating Structures have also become weak and some of those have received the fate of non-functioning state. Such kind of disqualification has pushed the whole irrigation system of the above mentioned projects into jeopardy.

The Halda and Ichamoti units of KIP are located in the River Valleys of Halda and Ichamoti, two tributaries of the Karnaphuli River as shown in Figure 1. The project is about 15km away from the city of Chittogram. The Halda unit is located in Hathazari and Rauzan Upazillas while Ichamoti unit is located in Rangunia Upazilla in the district of Chittogram. The area covered by KIP is about 18,624ha (Halda Unit- 15,386ha and Ichamoti Unit-



3,238ha) out of which irrigable area is 14,380ha (Halda Unit- 12,550ha and Ichamoti Unit- 2,280ha). The Halda unit is lying north of the Karnaphuli in the Halda river valley where as the Ichamoti unit is lying in the lower valley of Ichamoti khal, also lying north of the Karnaphuli and east of the Halda unit. Halda Extension Irrigation Project is situated at both sides of the Chottogram-Khagrachari Highway some 25km away from Chottogram City. The project is about 25km in the North-South and approximately 03km in East-West direction. Sitakunda Hills are at the West, Halda Unit of KIP is at the East of the Project Area. It has a command area of 1820ha. Irrigating lands in dry season and protecting those from flood in wet season were the prime objectives of the Project. Nishchintapur irrigation project is about 50km north from the city of Chottogram. This project is located in Roshangiri, Nishchintapur and Samitirhat union of Fatikchari Upazilla. The area is bounded by Dhurang khal on the north, Halda River on the west, and Telpari khal on the east. The total project area is about 640ha and the irrigable area is about 500ha. Fatikchari Flood Control, Drainage and Irrigation Project (FCDI) is situated at Abdullahpur, Dharmapur, Nanupur, Lelang, Kanchannagar, Suabil, Haryalchari, Paindong, Bhujpur, Narayanhat, Datmara Unions under Fatikchari Upazilla. Project Command Area is around 11,000ha.

The activities that have been undertaken to fulfill the study objectives of the project can be broadly categorized under the following major groups:

- Collection of reports and review of past studies.
- Topographic survey, mapping, data collection and analysis.
- Computation of Crop Water Requirements (CWR).
- Development of mathematical models and its application.
- Layout planning of irrigation system for Halda Extension Irrigation Project.
- Detail design of Irrigation Canal, allied structures and pumping plant.
- Fisheries, Agro - Socio-Economic and Environmental study.
- Base line survey, Focus Group Discussions (FGD) and Key Informant Interviews (KII) with stakeholders.

Topographic survey has been conducted in 409,00ha areas with in the study area out of which 5,000ha area for Halda Extension project, 600ha for Nishchintapur project, 15,800ha for Fatikchari FCDI project, 14,400ha for Halda KIP and 5100ha for Ichamoti KIP.

Four types of models have been developed and calibrated for the study namely rainfall - runoff model (hydrological model), surface water model (1D-hydrodynamic model), morphological model (2D model) and irrigation model. Rainfall-runoff model is used to determine the runoff generated from rainfall and this generated data of runoff has been used to define the boundary conditions for the surface water model. Surface water model has been used for surface water resources assessment and to examining the drainage capacity of the existing drainage canals as well as the rivers. On the other hand, 2D morphological models have been used for the major rivers in the study area to investigate the morphological behavior of the proposed intake points in the Karnaphuli and Halda rivers.

Major Recommendations:

- Dredging of intake channel in each year for the Sattarghat Pump House is highly recommended to ensure the necessary flow in the pump.
- Dredging of all the connecting channel of sluice gates are highly recommended for ensuring flow of water without any interruption.
- The gradual shifting of the Halda River to the south should be taken care of by protecting the left bank of Halda River adjacent to the road and to ensure the Halda River to flow along the existing pump house avoiding any possible loop cut in future at the upstream.
- Continuous monitoring of river bank at Sattarghat pump house location is required to ensure the stability of the bank. The right bank should be examined after each flash flood so that any breach or weak point on the bank can be identified and immediate protection works can be undertaken.
- During and after implementation, monitoring of suggested parameters is necessary to assess the performance of the system and device necessary remedial measures.
- Polluted water released from different sources should be treated before disposed into the Halda River.
- Security wall/fence, store shed, operator shed is necessary for smooth operation and management of the project.
- Logistics support and skilled manpower is highly recommended for proper maintenance of canal, structures and pumping unit for the smooth operations of the proposed irrigation systems.

Study on Interaction between Haor and River Ecosystem including Development of Wetland Inventory and Sustainable Wetland Management Framework

Department of Bangladesh Haor and Wetland Development (DBHWD) is formulated this study project with a view to establish a national wetland inventory and wetland management framework emphasizing interaction between haor and river ecosystem to identify wetlands all over the country, to formulate national wetland policy,

GIS software and ground truthing by field survey to validate the different features of wetlands (absolute and relative locations, area etc.) from the satellite images compared with the real world.

- Classification of the satellite images using Remote Sensing software and characterizing connectivity status with other channels.



Contract Signing Ceremony between DBHWD and JV of Megatech - IWM

for identifying wetland suitable for restoration, to reserve and conserve biodiversity of wetland areas, to assess its status and trends considering climate variability, impact as well as for sustainable wetland management. As a result, a study for the whole country as is proposed to delineate and classify the wetlands for establishment of inventory and identifications of interaction between haor and river ecosystem. Accordingly, the contract agreement between DBHWD and JV of Megatech - IWM was signed on May 14, 2017.

The main objective of the proposed study is to prepare an inventory of the wetlands and assess the best wetland management practices for developing a cluster-wise national wetland management framework. The study is formulated with a view to study the interaction between Haor and River ecosystem. The study also aims to identify the different types of wetlands in the different hydrological regions of Bangladesh and preparation of detail map.

The major activities to accomplish the study objectives are

- Finalization of the proposed inventory methods to fulfill the specific objectives following the Ramsar Convention along with other international standards.
- Procurement of currently available remotely sensed images of recent years to identify the exact locations and boundaries of wetland, calculate their area and also determine their types, status and characteristics.
- Geo-referencing of the satellite images using

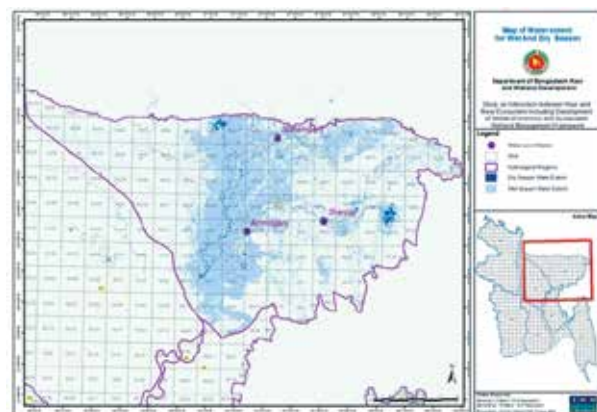
- Delineation of wetlands from classified images to categorize wetlands according to their habitat characteristics that suits the purpose of wetland management framework.

- LiDAR survey of Tanguar haor for an area of approximately 120 sq. km. for

empirical data collection.

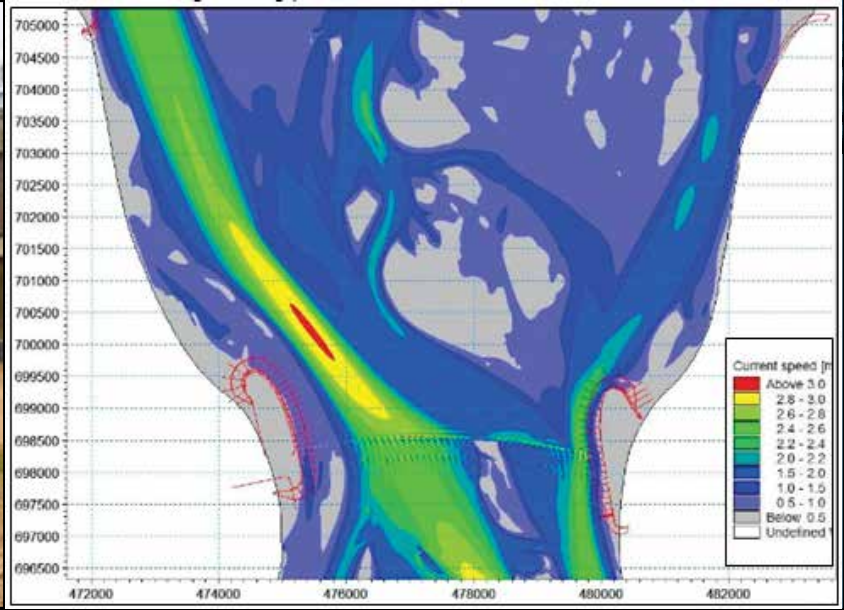
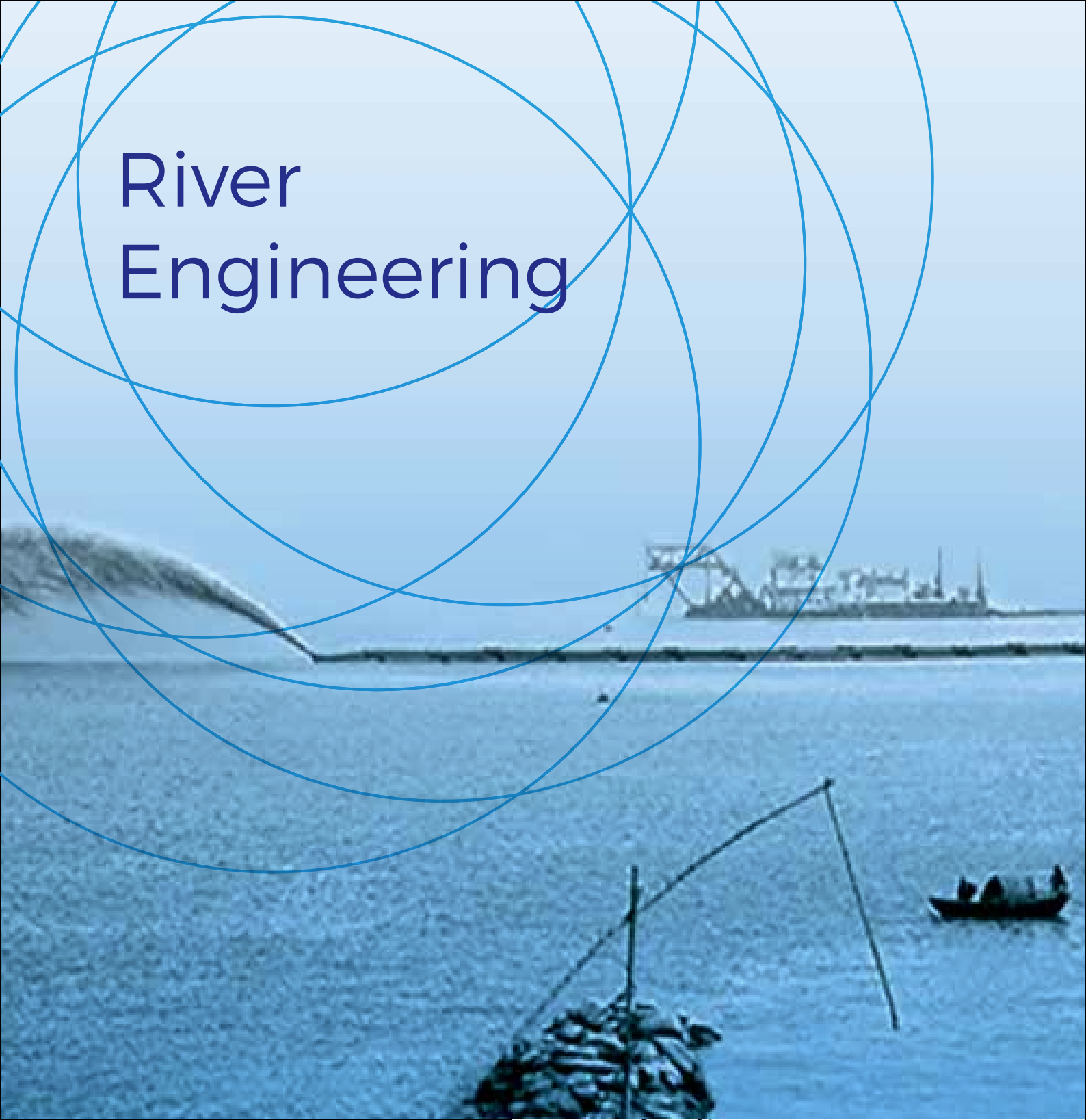
- Development of an inventory of wetland along with different categorical contour map through collection of data on their functions, geomorphological data, physiographic features, flora and fauna species and conducting hydrological assessment of different wetlands through physical surveys.
- Assessment of the vulnerability of wetland considering their importance in ecosystem and resource conservation.

The collected satellite images have been classified using unsupervised, index base and threshold classification techniques for delineation of wetland. A sample map of wetlands for North – east region of Bangladesh is shown in figure below.



Map Showing Combined Water Extents of Dry and Wet Seasons in NE Region

River Engineering



Morphological Mathematical Modelling for Implementation Support to Maintenance Dredging of the Gorai River for the Time Period of FY 2014-15 to 2016-17 for BWDB

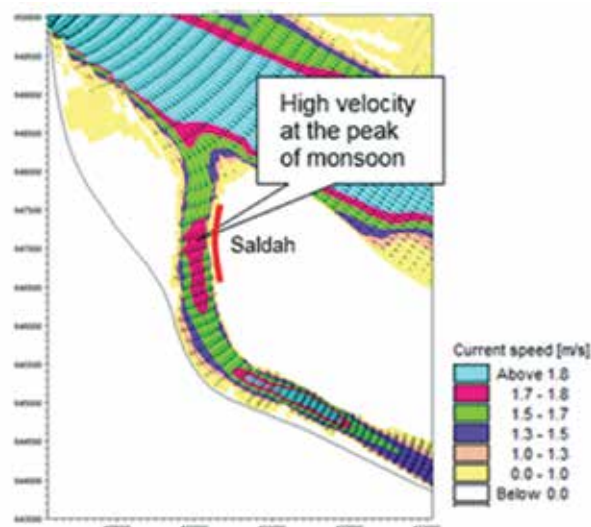
One of the major sources of fresh water flow in the south west region of Bangladesh is the flow from the Gorai that takes off from its parent river, the Ganges. During more than a decade the Gorai flow is interrupted during lean flow season, causing a lot of harm to the environmental and socio-economic conditions along the river. Due to implementation of the Barrage in Farakka in the year of 1975, the dry season flow of the Ganges River started to decline subsequently. As a result of the reduction of flow in the Ganges, the conveyance of flow through the Gorai started to reduce and the offtake got deposited hindering safe passage of flow from the Ganges to the Gorai River. Continuous siltation at the offtake area ultimately closes the flow to the Gorai totally during five months of the dry period. Due to drying out of the Gorai during the dry period, intensity and spatial extent of salinity intrusion to the south west region has increased, that is affecting the groundwater and irrigation within this area.

The Government of Bangladesh undertook the Gorai River Restoration Project (GRRP) with assistance from the Netherlands and Belgium. The Gorai was dredged starting from the off-take to 20km downstream during the three successive years from 1998 to 2000 under a Pilot Priority Works (PPW). The maintenance dredging was discontinued just after completion of the project in 2000.

In order to restore the Gorai River off-take and to ensure freshwater flow towards the south west region of the country, Bangladesh Water Development Board (BWDB) again took up steps to carry out dredging from the off-take, for a length of 30 km of the river, under Gorai River Restoration Project Phase-II (GRRP-II). To understand the dynamics of flow of water and sediment through a natural alluvial channel like the Gorai River, especially at the Ganges-Gorai offtake, and to devise suitable option for dredging in the Gorai, state-of-the-art mathematical modelling technique had been used since the beginning of the Project. BWDB accomplished the capital dredging during the dry season of 2010-11, then subsequent maintenance dredging continued during the dry seasons of 2011-12 to 2016-17. During implementation of the dredging works for this period (2010 - 2017), BWDB received technical support from Institute of Water Modelling (IWM) through studies having different titles, and the last in the series of the studies is the present study.

The objectives of the mathematical modelling study were to support the Project during the dredging operations, and to study hydrodynamic, morphological and salinity intrusion phenomena of the river systems, situated at the downstream of the Gorai River.

Mathematical modelling was carried out to establish suitable strategy for dredging operations as well as to assess backfilling rate and required dredging volume for maintenance dredging, and to test alternative interventions, which may be required to keep the Gorai flow uninterrupted throughout the year. The modelling was also used to study the impacts of augmented flow through the Gorai on the hydro-morphological aspects of the Gorai river system. Very advanced one- and two-dimensional river modelling systems, namely MIKE 11 and MIKE 21C of DHI Denmark, were used to accomplish the modelling activities.



Simulated velocity near Saldah during the peak of monsoon 2017 (forecast)

The model results have been found truly useful in devising appropriate dredging alignments for the dredging operations, predicting changes in river morphology after the monsoon subsequent to dredging, identification of critical sites of the Gorai with respect to river bank erosion and sedimentation on the river bed, and demarcation of proper sites for dumping of dredged spoil.

Numerical Morphological Modelling and Field Data Collection for Designing of Proposed Bangabandhu Railway Bridge for Bangladesh Railway (BR)

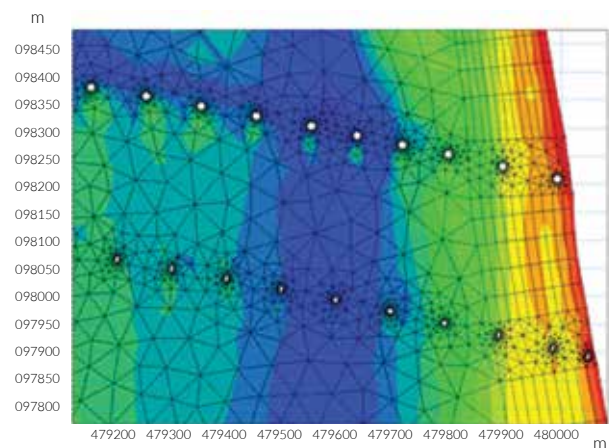
The Bangabandhu Bridge, over the Jamuna river, was constructed for multipurpose uses such as road, rail, gas, etc. to establish linkage between the two banks of the Jamuna river. The road and rail bridges were constructed together that have been serving since the opening of the bridge in 1998. However, the existing rail bridge, mounted up on the Bangabandhu Bridge, cannot carry freight trains, and also passenger trains can run mostly at 10km per hour through the bridge. As such, speed limitations have become major hindrances to the Bangladesh Railway network.

To meet the increasing demand and to have smooth communication, Bangladesh Railway (BR) has planned to build a 4.8-Km separate rail bridge over the Jamuna river in parallel with Bangabandhu Bridge that would rely on the continued functionality of the present system of RTW to provide protection against possible outflanking and scour at the abutments.

A feasibility study in connection with the new rail bridge construction was conducted in 2014 (CANARAIL 2014). This study provided feasibility overview of the issues that would face the operation of the new rail bridge and rail approaches with respect to the existing RTW. As per the feasibility report (2014), it has been decided that the location of new bridge would be at 300m upstream of the existing Bangabandhu Bridge. The proposed bridge piers would obstruct the approaching flow towards the existing bridge piers. The establishment of new bridge piers may, thus, increase the river bed and bank erosion, which may exceed the existing RTW design values as well as possibilities of outflanking of the RTW may appear. These changes in the flow regime of the Jamuna river underneath the existing bridge and between the RTWs need to be investigated under different flow conditions with advanced mathematical modelling tools.

Following the suggestions made in the feasibility study report (2014), detail design study is required prior to implementation of the proposed rail bridge. The joint venture (JV) of OCG-CHODAI-DDC in association with ACE had been engaged by the BR to conduct consultancy services for detailed design and construction supervision of the whole task. Institute

of Water Modelling (IWM) was engaged by DDC Ltd. (Contract Agreement was signed between DDC Ltd. and IWM on 28 May 2017) to assist the JV with survey works and numerical modelling to finalize the detailed design task of the proposed bridge along with the RTW.

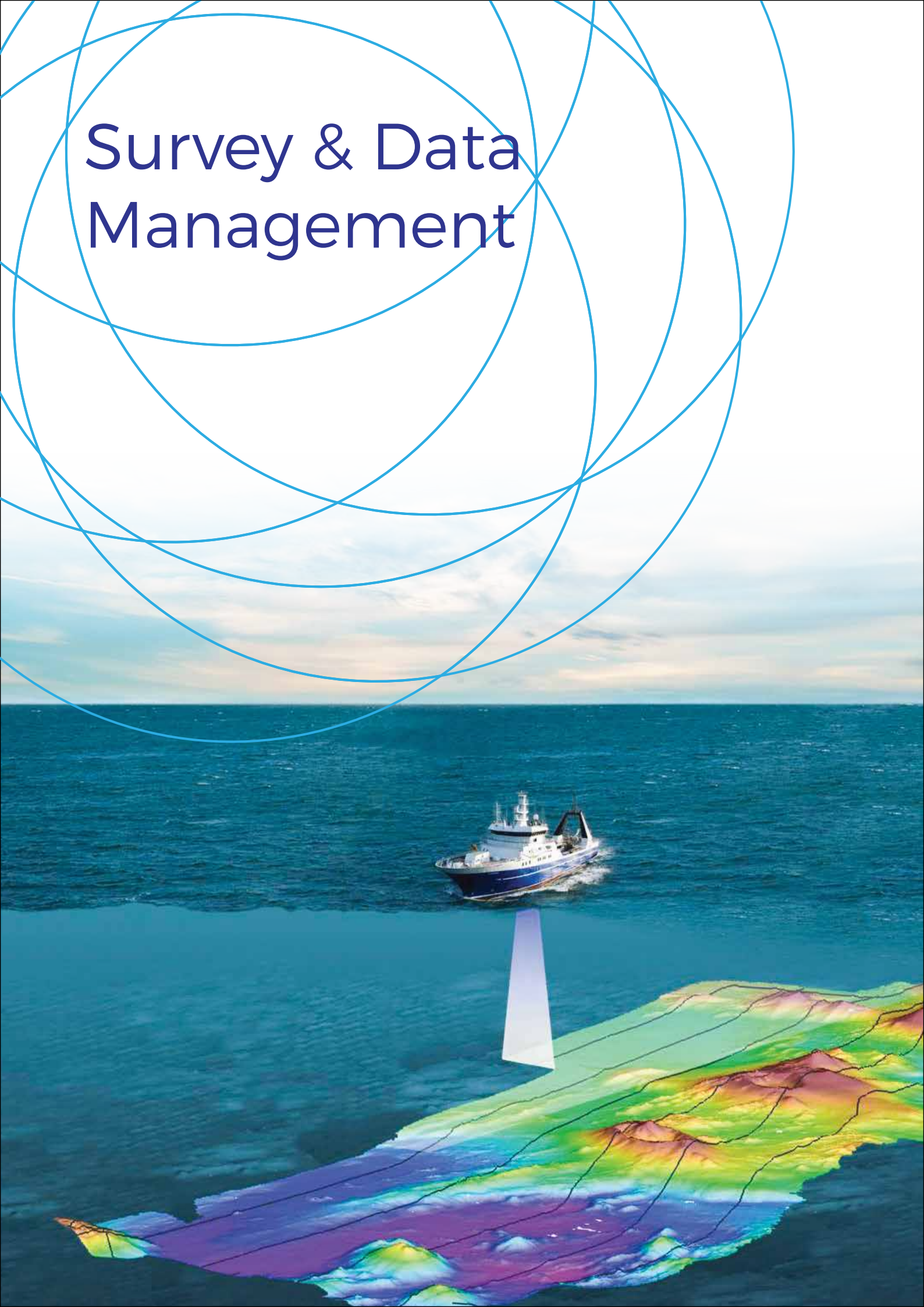


Grid and bathymetry of a reach of the Jamuna (including piers of existing Bangabandhu Bridge and proposed Rail Bridge) prepared using MIKE 21FM Modelling System

The outputs of the study are as follows:

- Magnitude and probable pattern of different hydrological events;
- Report on the performance of SHP, BHP, EGB and WGB;
- Outline hydraulic design parameters based on model results of different scenarios;
- Expected deepest scour at the proposed and existing bridge piers and RTWs;
- Suggestion in case of possibility of outflanking of the guide bunds;
- Flow pattern around the existing and proposed bridge piers;
- Backwater due to Bangabandhu Bridge in combination with the proposed rail bridge.

Survey & Data Management



State-of-the Art Survey Equipment Procured for Enhancing Capacity of IWM

Institute of Water Modelling (IWM) is engaged in survey activities for more than 20 years and has developed skills in various disciplines like Topographic Survey and Mapping, Hydrographic Survey, Hydro-meteorological Measurements, Water Quality Investigation and Laboratory Analysis of Sediment Samples. To remain update with international standard, it is continuously procuring latest equipment and using those for diversified project works. Survey & Data Division is supporting all the modelling division by rapid acquisition of quality data. It has acquired reputation from Government Organizations as well as Non-Government or Private enterprises for quality data collection. IWM is now capable of conducting survey work in all disciplines to fulfill clients' requirement. Some of the special instruments procured and used by IWM are described below:

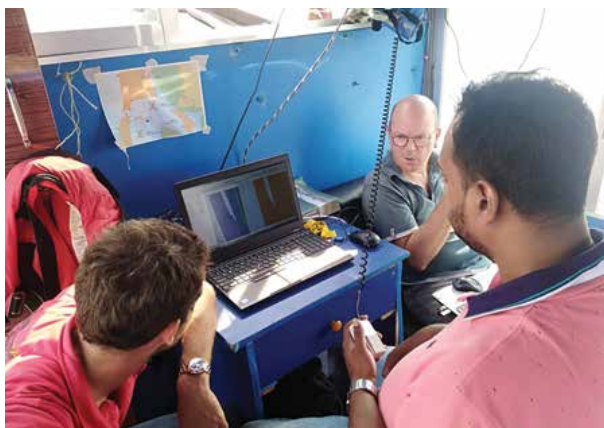
Multibeam Echosounder System

Multibeam Echosounder System is used for the bathymetric survey where total coverage of the sea bed is needed. IWM has acquired one of the newest models of multibeam echosounder alongwith high quality supporting instruments. MB2 features a dedicated cylindrical transmit array and broad range of sounding frequencies improving on the performance of the MB1 by offering a wider coverage and narrower acoustic beam. Using both amplitude and phase bottom detection, the MB2 is capable of sounding a swath of up to 140° in up to 110m water depth. With 24 bit raw data, both water column and seabed information can be collected within the controller software. The Real Time Appliance (RTA) synchronizes all of the sensors with accuracy better

water depth Valeport Monitor CTD Sound Velocity Profiler (SVP) is used. The data of SVP is used to correct depth data real time during survey.

Salient feature of the system is described below:

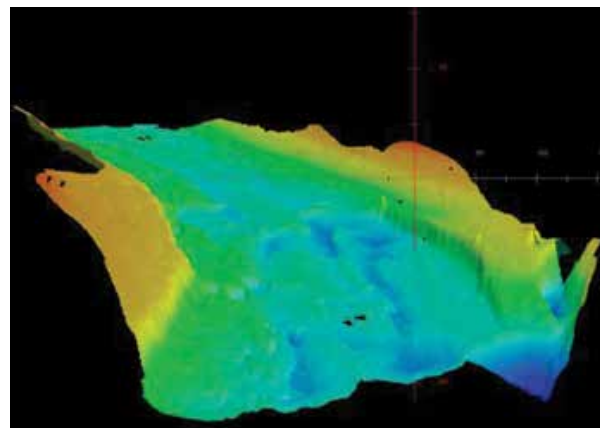
- 1.8° x 1.8° beam width
- Selectable swath width up to 140 degrees
- User selectable frequency range from 200 to 460 kHz
- 24 Bit Resolution, No Analogue TVG
- User selectable number of beams 10 to 256
- Water column backscatter data
- Sidescan and snippets included as standard features
- Raw data logging for post processing, beam forming, bottom detection



Multibeam Echosounder data collection at Kutubdia

than 0.1 millisecond.

MB2 is integrated with Hemisphere GPS for positioning and heading system as well as an integrated real-time sound velocity sensor to simplify installation and calibration to make it perfect for use on vessels of opportunity, small survey boat and country boat. The system also includes Heave, Pitch and Roll sensor for compensation of heave, pitch and roll. To measure sound velocity across the



River bed geometry of the Andhermanik River surveyed by Multibeam Echosounder

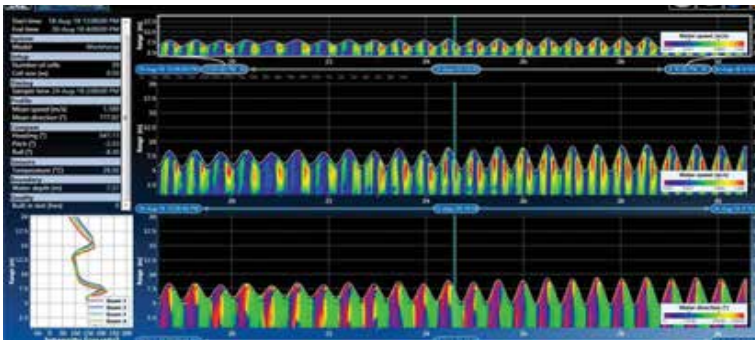
IWM staffs have been trained in the operation of the system from the experienced trainer from Singapore. The equipment has been tested in Andharmanik River and Jamuna River. The equipment has been used in the Jamuna river at Sirajganj for measuring Scours surrounding bridge piers and guide bunds during monsoon 2018.

Acoustic Doppler Current Profiler (ADCP)

Acoustic Doppler Current Profiler (ADCP) is used for flow measurement in the large (deep or wide) rivers within shortest possible time. IWM procured a 600 KHz Rio-Grande ADCP from Teledyne RD Instruments (TRDI) during 2004. It has the versatility and capacity of recording three dimensional velocity data and sediment backscatter (indicator of concentration) along the entire column of water. Since procurement, the instrument has been successfully used in innumerable project. Later on, more portable ADCP namely River Ray was procured during 2010. The instrument can be deployed on a Tri Maran and towed by a boat making

it more versatile for use in the smaller rivers and streams.

IWM procured Workhorse Sentinel 600 KHz ADCP from TRDI during 2011 for measuring current and wave in the sea. Later on, it has been upgraded with bottom tracking option to conduct discharge measurement/velocity profiling in the river and estuaries. To fulfill demand of the instrument, IWM procured Sentinel V ADCP during 2015 and 2018 to measure current and wave in the estuary. Currently, IWM has 6 ADCPs of which 2 units used for discharge measurement in the river and 4 units used to measure current and wave in the sea.



Recorded Wave height, Current Speed and Direction at Kutubdia



Downloading Sentinel V ADCP Data

Terrestrial Laser Scanner

Terrestrial Laser Scanner is the latest technology to measure the 3D Point cloud by using laser scanning technology. IWM procured a latest model of Terrestrial Laser Scanner "Polaris" from Teledyne Optech, Canada during 2018. The instrument has built-in internal GPS, camera and inclinometer. The Polaris Terrestrial Laser Scanner (TLS) meets the needs of topographic survey by delivering dense lidar data at high speed without sacrificing accuracy. The Polaris Terrestrial Laser Scanner (TLS) delivers accurate, precise data faster than ever before, bridging the gap between small, light-weight, short-range sensors and large, long-range, pulsed time-of-flight scanners. Polaris has a user-friendly on-board operator interface with menu-driven operations for quickly collecting and referencing data. With an integrated high-resolution camera, inclinometers, a compass, a L1 GNSS receiver, and weather-proof housing, it can be deployed in many environments and orientations. It can be mounted on a tripod, vehicle, or moving platform to make it the most versatile terrestrial laser scanner on

the market. Atlascan Software is used to control the Polaris scanner, processes and generates geo-referenced point clouds. It also provides higher-level deliverables such as feature extraction, meshing, and modeling from point cloud.

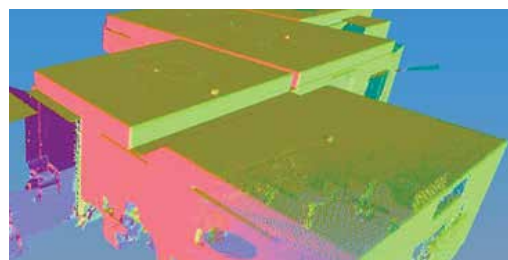
Saline feature of the system is given below:

- Laser repetition rate (peak and effective, kHz): 50 to 500 depending on range
- Max range capability @90% reflectivity (m): >2000m to
- Max range capability @20% reflectivity (m): 976m
- Sunlight-visible, ~ Resistive single touch, ~ 640 x 480 pixels, Color TFT LCD

The instrument enhanced efficiency and quality of topographic data collection by IWM. The instrument will be used for as-built survey/postwork survey, survey of stock pile, river banks and sand bars, road network, monitoring construction work, land development work, beach area monitoring and survey of urban area.

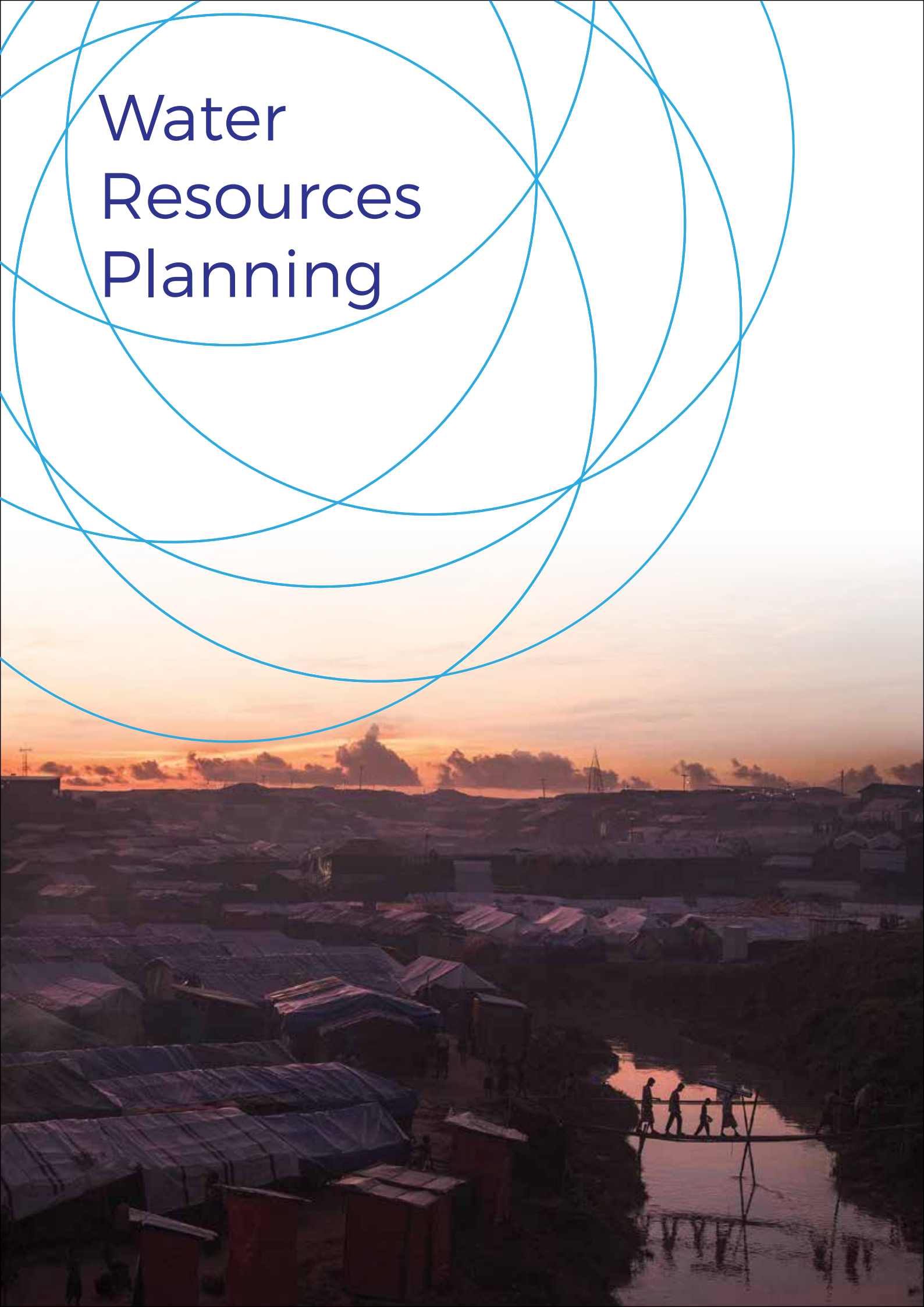


Field data collection using 3D Scanner



Sample of Processed Scan Data (Office Room)

Water Resources Planning



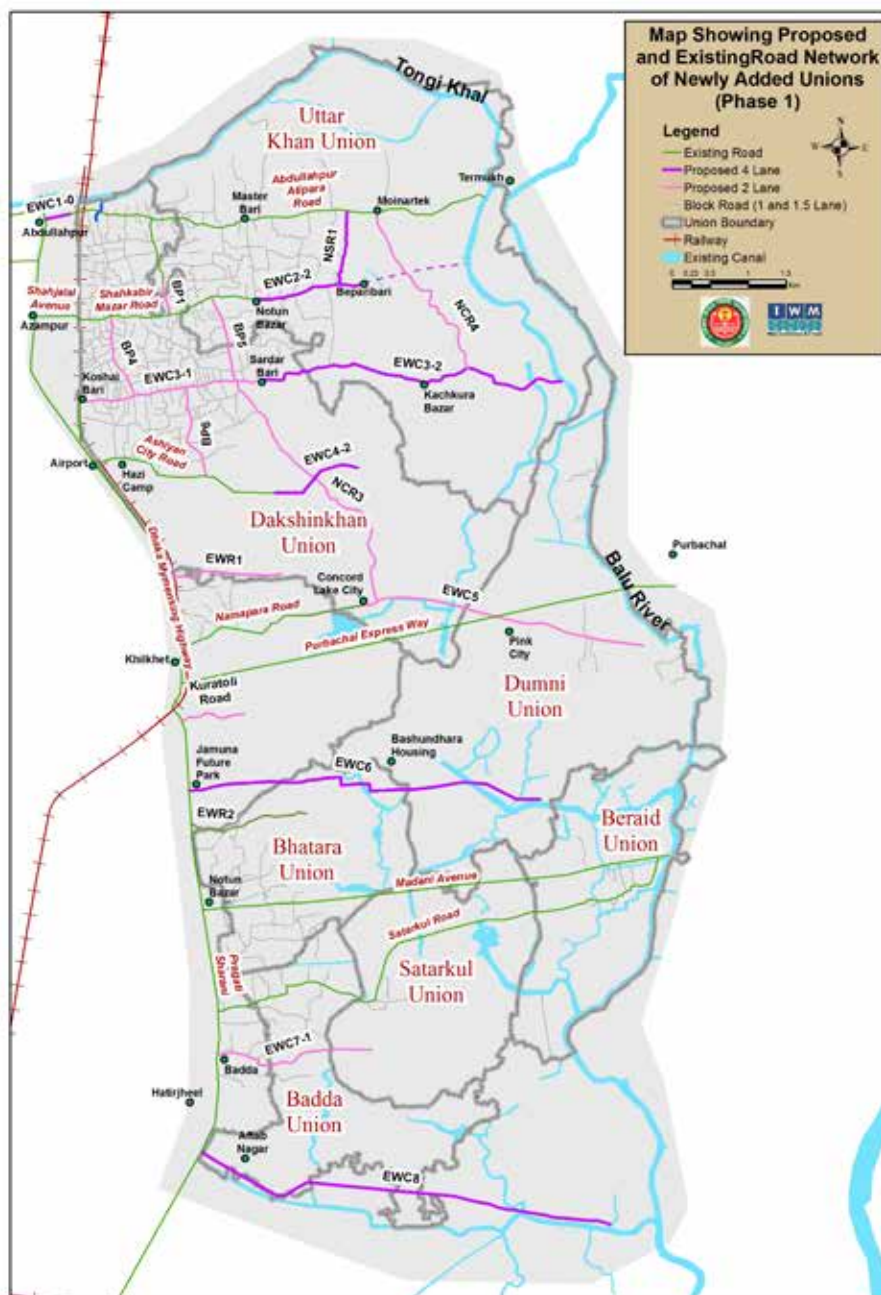
Road and Drainage Network Improvement Plan in Extended DNCC Area

Dhaka City Corporation (DCC) was divided into two parts as Dhaka South City Corporation (DSCC) and Dhaka North City Corporation (DNCC) on 4th December, 2011. As part of efforts to provide better civic amenities to the people of adjacent Union Parishads, eight Union Parishads have been included in the DNCC on 8th May, 2016. The eight Union Parishads included with DNCC are Beraid, Badda, Bhatara, Satarkul, Harirampur, Uttarkhan, Dakshinkhan and Dumni. The inclusion has increased the DNCC's area from the previous 82.63 sq. km by 114.56 sq. km, almost 1.4 times the previous area.

Roads and storm water drains are essential element of civic life. In the extended DNCC areas, roads and storm water drains are inadequate and mostly unplanned. Most of the area remains rural or semi-urban in nature except the fringe areas along Dhaka-Mymensingh Highway and Progoti Sarani.

DNCC has taken the initiative of developing road infrastructure keeping room for smooth drainage. It has been observed that various other agencies are also taking initiatives to develop roads and land development projects. This study has identified that any development works need to be carefully devised so that they match well with the overall development initiatives as proposed in strategies and plans of different agencies. In this study, designs of storm water drains, utility ducts and road network have been integrated.

IWM has been entrusted to conduct the feasibility study covering a wide range of issues pertaining to road and storm water drainage improvement and expansion in the eight unions newly incorporated to the DNCC. The development Strategy has been recommended into three Phases. Phase I is from 2017 to 2020 which includes the priority works. Phase II will also start from 2018 but will finish in 2025. Phase III will start from 2021 and finish in 2030.



Map Showing Proposed & Existing Road Network of Newly Added Unions (Phase 1)

Water Resources Assessment for Water Supply to Rohingya Camps and Host Communities of Teknaf and Ukhiya Upazila

Rohingya people have been compelled to flee from their homeland, cross the border and take shelter in various camps of the Teknaf and Ukhiya Upazila under Cox's Bazar district of Bangladesh. In spite of all support, providing safe water is very crucial issue for this area not only for current circumstances but for future water need of the inhabitants of Teknaf and Ukhiya upazila. Considering the situation, a two-phase study on Water Resource Potential Assessment of Ukhiya and Teknaf Upazila has been undertaken. Institute of Water Modelling has been engaged to carryout the study in partnership with G & NGO. The study is coordinating by Department of Public Health Engineering (DPHE) with concurrence from the Local Government Division of MoLGRD&C.



Kutupalong Rohingya Camp, Ukhiya



Groundwater pumped at Kutupalong Rohingya Camp, Ukhiya

The overall objective of the study is to carry out a comprehensive assessment of the groundwater and surface water resources to ensure safe, sustainable and affordable water supply to the Rohingya camps including local host community. The study will also assess impacts on groundwater resources of Cox's Bazar area. The project area lies on western quite zone along the eastern coast of the Bay of Bengal and includes Dakshin Nhila and Inani anticlines. The current study area is geologically situated in the Chittagong Tripura Fold Belt (CTFB).

In addition to, reconnaissance survey for detail investigation 22 exploratory wells have been drilled in the study area. Lithological information have been collected upto depth ranging between 180-

304 m.

The study area has very complex situation and aquifer layers . There are low yield aquifer layers in the study area Groundwater potentiality is higher in Ukhiya area than Teknaf area Aquifer layers are mostly in Tipam formation upto depth of 300 m. In the study area there are single to several aquifer layers with variable thickness and properties. There are artesian flow wells in number of places of the study area.

In the study area 50mm dia Test Tubewell's discharge rate varies from 90 lit/min to 96 lit/min. Available groundwater resource in the study area confirmed after obtaining dry season groundwater monitoring and aquifer test.



Artesian Well at Jaliapalong

Groundwater quality survey on existing private wells shows that maximum electrical conductance (EC) value is 12510.0 uS/cm at Royel Tulip, Inani and minimum is 37.1 uS/cm at Raja palong. Maximum values of Iron (Fe) found 7.0 mg/l at Sonarpara, Jaliapalong and minimum found 0.5 mg/l at Whykong. No Arsenic (As) IWM detected in tested groundwater during survey.

Six locations have been identified in Ukhiya and Teknaf area, where flowing surface water is available. During rainy season maximum 44 to 215 m³/sec flow has been measured. Dry season data is required to confirm the availability and quantity. Topographic survey results show prospect and merit for constructing two fresh water reservoirs for water supply, one at Shamlapur, Teknaf and another one at Finizi Area, Ukhiya. For optimum utilization of resources is required an efficient groundwater management strategy. Possible alternative water supply sources and rainwater harvesting techniques will also be explored, e.g, Rainwater harvesting and construction of in this study.

Research & Development

IWM owes its genesis to the Surface Water Simulation Modelling Programme (SWSMP) launched in 1986 by the Ministry of Water Resources under the Master Planning Organization to develop a high level of analytical capabilities by use of state-of-the-art mathematical water modelling with the technical guidance of DHI. IWM has 7 units and R&D unit is one of them.

IWM undertakes two types of research:

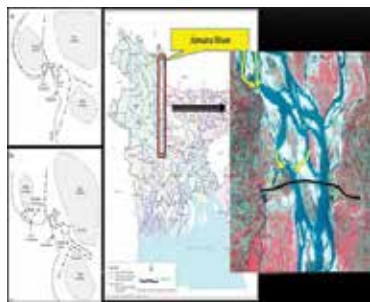
- i) One is sponsored research; this is meant for devising solution to problems of national/international importance for its clients.
- ii) The other is for development of new tools and methods or for adaptation of some new technology or tools for future useful purposes. The second kind of research may be sponsored by IWM itself or be collaborative with other national or international educational and scientific institutions.

Research projects are well-defined projects executed in the same manner in which other projects are managed with quality procedures followed. IWM conducts research to further of the objectives of the Trust.

Recently Completed R&D Projects are Briefly Described Here:

Study on Effect of Oblique Flow & Char Movement in Rivers & Bank Protection Works

The objective of the study is to analyze the hydro-morphological behavior of main channel (Prototype) in relation with the characteristics of Jamuna river (braided) due to oblique flow by using Mathematical Model and to observe the bank erosion pattern and compare the results of Mathematical Modelling



Hydro-morphological behavior and erosion of main channel due to oblique flow

with Physical Modelling. The physical model was developed in a scale ratio of 1:50 for a straight bank with variable oblique channel angles and different discharge ratios. Mathematical modeling was carried out using

different data such as initial and final bed level of cross-sections, velocity, water surface slope, flow line, scour pattern and flow on bank lines as obtained from physical model.

It was a collaborative research project of IWM, WRE BUET & RRI. Physical modeling was carried out in RRI along with the Mathematical modeling by using MIKE 21C at IWM is a better way to perceive the nature of rivers due to flow and sediment interactions.

Determination of Hydro-geological Parameters of Different Regions of Bangladesh: Phase-II: South East & South West Region

In this study, hydro-geological parameters of GW have been collected, systematically processed and stored as a database for future use. The main objective of this study is to assess hydro-geological parameters and groundwater quality for the South-East (SE) & South-West (SW) regions of Bangladesh for efficient planning and management of groundwater resources. By using secondary data this study was



Study area: South East & South West Region

performed to assess hydro-geological parameters in selected regions. The study will provide support to the planners and decision makers for groundwater development. The result demonstrates that SW region is more vulnerable to Arsenic & Salinity than SE region.

Based on this study an important tool "Interactive Information System (IIS)" is developed and effective training has been provided to the required professionals from all the collaborative agencies (BWDB, WARPO and DPHE).

Ongoing R&D Projects are Briefly Described Here:

Determination of Hydro-geological Parameters of Different Regions of Bangladesh: Phase-III: North Central & North East Region

This is the continuation and final phase of "Determination of Hydro-geological Parameters of Different Regions of Bangladesh" project. This project will be completed within March, 2019. Based on this study an important tool "Interactive Information System (IIS)" will be developed and effective training will be provided to the required professionals from all the collaborative agencies (BWDB, WARPO and DPHE).



Study area: North Central & North East Region

Data Collection and Updating of General & Regional Models

The main objectives of the project are to identify gaps in data collection under BWDB regular program, install gauges at such critical boundary stations and carry out updating of the regional models up to the hydrological years 2016 utilizing collected and secondary data. This is the major ongoing R&D project of IWM.

Training & Capacity Development

Certificate Awarding Ceremony



1	2	3	4	5	6
JAN	FEB	MAR	APR	MAY	JUN
<p>Internship programme for students from Civil Department , MIST</p> <p>Workshop on Participatory Scenario Development & Conflict Resolution for Strategic Delta Planning</p>	<p>Metasploit Training for Penetration Testing</p> <p>Training on Application of GIS -RS in Integrated Water Resources Planning</p> <p>Leadership Certificates in Managerial Communication (LCMC)</p>	<p>Training course on Oceanography: Principles and Applications</p> <p>Training workshop on Preparation & Monitoring of Medium Term Development Plans (7th 5 year plan)</p> <p>Training of Trainers and Technology Validation on the Global Nutrient Management Toolbox</p> <p>Training on Application of Hydrological, Hydrodynamic and TRM modelling for Solution of Long Standing Drainage Problem of Bhabodah Area</p>	<p>Training workshop under USAID PEER project</p> <p>Training on Advanced Arc-GIS</p> <p>ToT course on 'Concept & Practice of Integrated Water Resources Management'</p> <p>Training Course on 'Geospatial Technology based Water Quality Monitoring</p> <p>National Workshop on 'Gender Consideration in IWRM'</p>	<p>Training for Building Capacity on Coping with Climate Vulnerability & Climate Change through Partnership</p> <p>Training Program under Sylhet City Drainage Study</p>	<p>Training for BWDB officials in connection with Dhaka Eastern Bypass Project</p>



JUL	AUG	SEP	OCT	NOV	DEC
<p>APSCO Data Sharing Service Platform</p> <p>Regional Training Workshop on Scaling up of Satellite-assisted Flood Forecasting Systems in South and Southeast Asian Nations</p> <p>Crash course on GIS and GIS based application development</p> <p>Training on Bathymetric survey using HYPAC software RTK-GPS</p> <p>Training on Establishment of Groundwater Monitoring System in Dhaka City for Aquifer System and DWASA Production Wells project"</p> <p>Training and Technology Transfer Program under Haor Flood Management and Livelihood Improvement Project</p>	<p>Land Subsidence at Chittagong, Cox's Bazar, Hatia and Khulna and computation of Relative Mean Sea Level Based on Subsidence and Absolute Sea level Rise</p> <p>Training workshop on "Google Earth Engine"</p> <p>Training on Urban Rain Water Harvesting System</p> <p>Training on Environmental Noise Prediction Models</p>	<p>Training Programme on Hydraulic Structure for BWDB staff</p> <p>Technical training on Moodle under DeltaCap Project</p> <p>Adaptive Delta Management: Longer term Planning and integrates assessment in Deltas</p> <p>Training on Water Quality</p>	<p>Training on Development of Groundwater Model for Linggi River Basin using MIKE SHE</p> <p>Workshop on "Extracting geospatial data from Google Earth: identification of communities and labelling features."</p> <p>Preparatory training on WRF Model</p>	<p>Training on WRF Modelling</p> <p>Training on Faecal Sludge and Septage Management</p> <p>SIMS- Smart User Operational</p> <p>Internship of the Students of Civil Engineering Department, MIST-2017</p>	<p>Workshop on Water Governance and Diplomacy</p> <p>Survey & Data collection, GIS and Mathematical Modelling for BWDB staff</p>

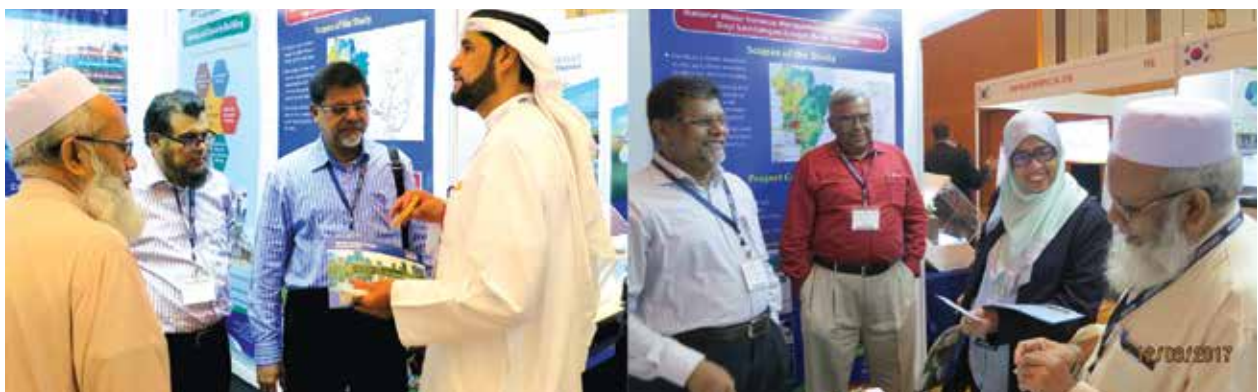
IWM Major Events

IWM attends International Water Exhibition Malaysia 2017



IWM Attends Water Malaysia 2017

Institute of Water Modelling (Malaysia) Sdn Bhd has successfully participated in the International Exhibition Water Malaysia 2017, jointly organized by International Water Association (IWA), Asia Pacific Group (ASPIRE) and Malaysian Water Association (MWA) at Kuala Lumpur Convention Centre, Kuala Lumpur, Malaysia from 11-14 September 2017. Water Malaysia 2017 (WM2017) is the biennial, international exhibition and conference that encompasses all across the entire water cycle, covering integrated water management, water supply management, wastewater management, NRW Management, Flood Mitigation & Drainage, Monitoring, Testing and Measuring, and many other areas. In 2017, Water Malaysia took place concurrently with the 7th International Water Association (IWA)– Asia Pacific Regional Group (ASPIRE) Conference & Exhibition and hosted over 800 international and local delegates and over 200 technology and solution providers. As the biggest water event in the Asia Pacific region. Jointly organized by the Malaysian Water Association, the International Water Association – Asia Pacific Regional Group and PROTEMP Group, this unprecedented combination of two influential water industry events drew an estimated 150 exhibitors and 6,000 visitors. IWM decided to be a part of the solution to Asia's water issues. The exhibition was inaugurated by Y.B. Datuk Seri Panglima Dr. Maximus Johnity Ongkili, Minister of Energy, Green Technology and Water, Malaysia and was accompanied by a number of senior government officials of Government of Malaysia and some other countries like UAE, India, China etc



Executive Director, IWM is briefing H. E. Dr. Rashid Alleem, Chairman of Sarjah Electricity & Water Authority (SEWA), UAE.

DED (P&D) is briefing about IWM Malaysia Projects to Senior Officials of Government of Malaysia

IWM Participants in Water Bangladesh International Expo 2017



IWM jointly organized a seminar on “Water & Climate Challenges, 2030” at Water Bangladesh International Expo 2017 with CEMS Global.

Institute of Water Modelling in collaboration with CEMS Global arranged a seminar on Water and Climate Challenges 2030 on 28 October 2017 at the Bashundhara International Convention Center, Dhaka. Dr. Zafar Ahmed Khan, Senior Secretary, Ministry of Water Resources graced the occasion as the Chief Guest while Mr. Md. Mahfuzur Rahman, Director General, Bangladesh Water Development Board graced the occasion as Special Guest. The seminar was chaired by Prof. Dr. M. Monowar Hossain, Executive Director, IWM.

Mr. S. M. Mahbubur Rahman, Director, Water Resource Planning Division of IWM made a presentation on Urban Water and Waste Water Management in Bangladesh. Another presentation was made by Mr. Md. Rubayat Alam, Principal Specialist, Coast, Port and Estuary Management Division of IWM on Coastal vulnerability due to climate change and adaptation in BD delta. An open discussion was followed by the presentations moderated by the Chair. Ms. Meherun N. Islam, Managing Director of CEMS Global gave vote of thanks to the audience attending the seminar.



Executive Director, IWM described IWM services to different foreign delegates in IWM Stall



Managing Director of CEMS Global is handing over the Crest to Prof. Dr. M. Monowar Hossain, Executive Director, IWM

IWM Major Conference, Seminars & Contract Signing,

IWM Malaysia Activities



A meeting with Faculty members of Civil Engineering Department of University Kebangsaan Malaysia for future collaboration.



An MOU was signed between IWM and JPZ, Malaysia on 16 January, 2017 in presence of honorable BoT Chairman, Dr. Zafar Ahmed Khan, Senior Secretary, Ministry of Water Resources, Bangladesh.

IWM signed MoU with Bangabandhu Sheikh Mujibur Rahman Maritime University, Bangladesh



A Memorandum of Understanding (MOU) was signed between Institute of Water Modelling (IWM) and Bangabandhu Sheikh Mujibur Rahman Maritime University, Bangladesh (BSMRMU) on 19 April, 2017 at the Conference Room of BSMRMU, Dhaka. Prof. Dr. M. Monowar Hossain, Executive Director, IWM and Commodore M Abidur Rahman, Registrar, BSMRMU signed the MOU on behalf of their respective organizations. The Vice-Chancellor of the university, Rear Admiral A S M Abdul Baten graced the ceremony as the chief guest. From IWM side, Dr. A F M Afzal Hossain, Deputy Executive Director (P&D) and Mr. M. Samiun Nabi, Manager, Business & Strategy was present in the MOU Signing Ceremony. From BSMRMU side the Treasurer, Deans, Faculty Members and other Senior Officers attended the program as well.

IWM attends 8th International Bangladesh Infrastructure Innovation & Development (BIID) Expo 2017



Executive Director of IWM with others in the Dialogue



Expert Panelist in the Opening Session of BIID Expo 2017

DeltaCap Inception Workshop 2017



DeltaCap Inception Workshop

DeltaCap project is to help the Bangladesh Delta Plan 2100 to meet the demand for skilled water professionals who are able to respond to the complexity of current water challenges, developing capacity through an emphasis on training and knowledge transfer, as well as increasing transparency of efforts, making longer terms plans and implementing them while involving various stakeholders at multiple level. The DeltaCap project is funded by the Dutch organization the "Netherland Initiative for Capacity development in Higher Education" (NICHE) to promote partnership with Bangladesh and Netherlands in water sector. The partners in this project are IHE-Delft, Alterra, Wageningen UR, Delta Alliance Bangladesh wing (DABW), mpower and Climate Adaptation Services Foundation.

Honourable Ambassador of the Kingdom of Denmark Visits IWM



Honorable Ambassador of The Kingdom of Denmark H. E. Mr. Mikael Hemniti Winther visited Institute of Water Modelling (IWM) on 7th May 2017. He was welcomed by the Executive Director of IWM. Two short presentations, one is "Brief on IWM and its Role in Water Resources Management of Bangladesh" by the Executive Director and the other one is "Flood Risk Management and Climate Change Research and Investigations in Bangladesh" was presented by Director of FMG Division.

Prof. Dr. M. Monowar Hossain presented Souvenirs and Crest from IWM to Honorable Ambassador and his team.

IWM has initiated a joint research project with Yunnan University, China on “Water Resources Vulnerability and Security Assessment of Yarlung Tsangpo – Brahmaputra Transboundary River Basin”



Visit of IWM research team headed by Dr. M Monowar Hossain, Executive Director, IWM to Yunnan University, Kunming, China

THE BRAHMAPUTRA RIVER SYMPOSIUM: “KNOWLEDGE BEYOND BOUNDARIES”



Executive Director, IWM with Prof. Dr. Eddy Moors, Rector, IHE Delft in the Brahmaputra River Symposium

Professor Dr. M. Monowar Hossain, Executive Director, IWM participated in the Brahmaputra River Symposium: “Knowledge Beyond Boundaries” Conference held at Shangri-La’s Eros Hotel in New Delhi during September 25-26, 2017. The Symposium was organized by that Department of Humanities and Social Sciences, Indian Institute of Technology, Guwahati (IIT-G) in collaboration with The Energy and Resources Institute (TERI), New Delhi and SaciWATERS.

IWM Participates in Digital World 2017



Contract signing between BEZA & IWM



The contract agreement paper is exchanged between Md. Mostaque Hassan, Addl. Secretary & General Manager (P&D), BEZA and Prof. Dr. M. Monowar Hossain, Executive Director, IWM

Contract signing between RPGCL & IWM



Environmental & Morphological Study For Development of the land at Moheshkhali Island by Dredging Chars, Shoals for land based LNG Terminal

Cultural Events & Sports



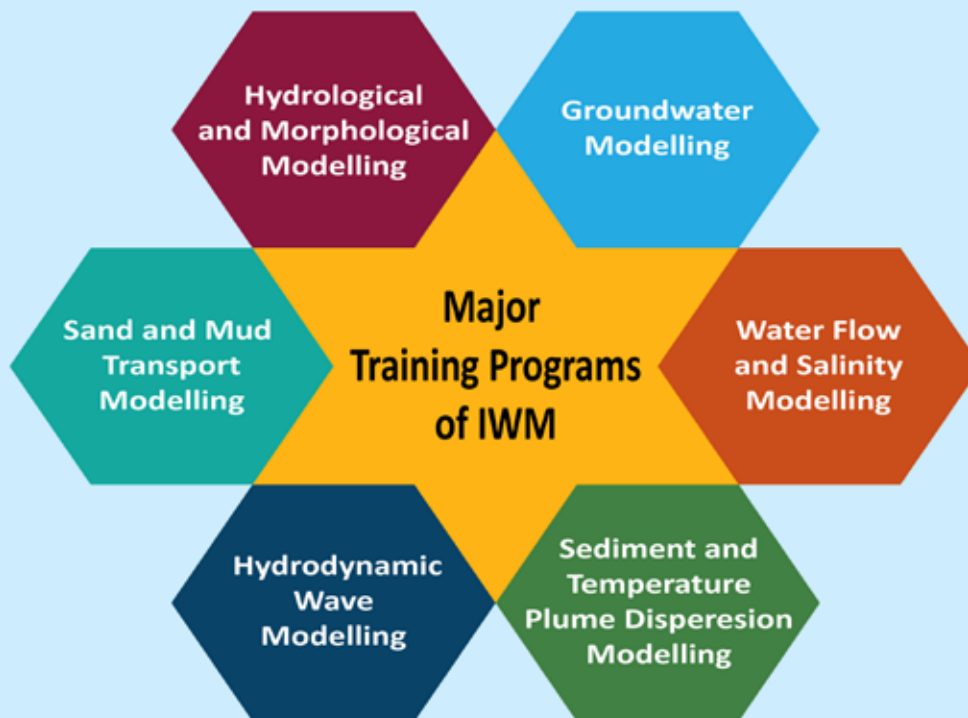
IWM Celebrates International Women's Day 2017



IWM Sports Day 2017: Cricket Tournament Champion: Team Teesta

Training and Capacity Building

IWM Provides Training on following Technologies



OUR STRATEGIC PARTNERS



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