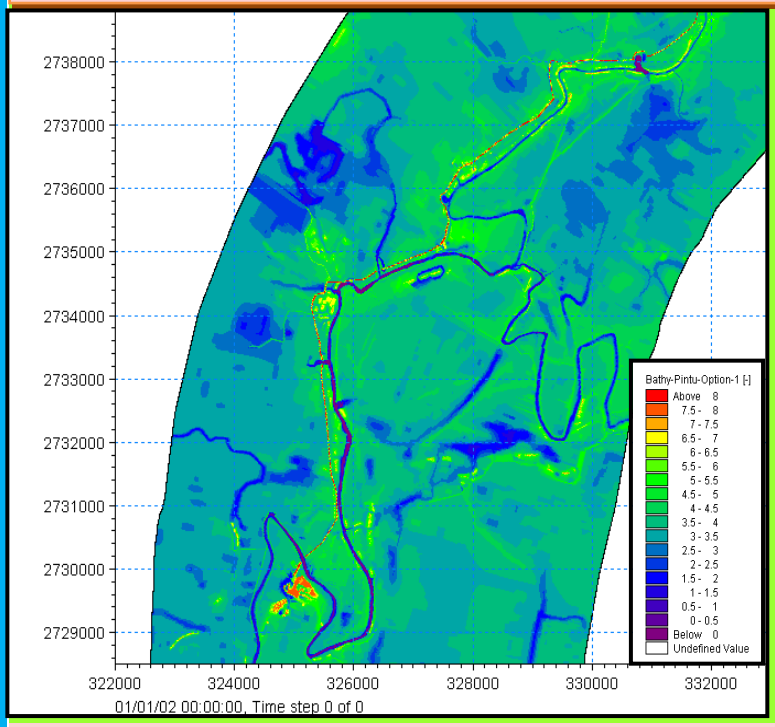
Annual Report

2018-2019 Serial No. 46/18-19



J U L Y 2018 - J U N E 2019

River Research Institute

RIVER RESEARCH INSTITUTE, FARIDPUR
Ministry of Water Resources
Government of the People's Republic of Bangladesh

A view of a meeting Chaired by Water Resources State Minister attended Secretary MoWR, DG RRI & BWDB and other high Officials at MoWR Conference room

DG, RRI congratulates to Mr. Md. Lokman Hossain Mridha, BOG member of RRI in a seminar at RRI

River Research Institute

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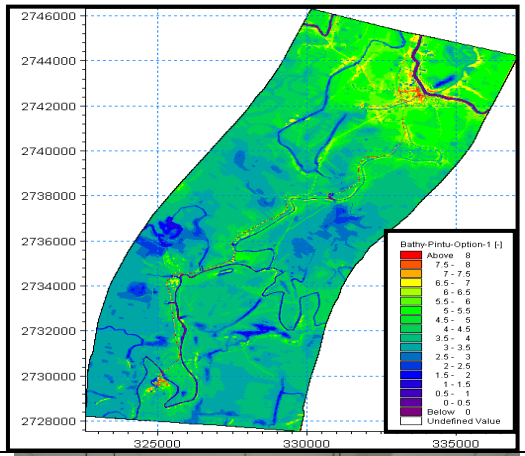
Published in October 2019

RIVER RESEARCH INSTITUTE
FARIDPUR, BANGLADESH

Contents



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Chief Scientific Officer
RRI, Faridpur.

Dr. Engr. Md. Alauddin Hossain — **Executive Editor**
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Assistant Programmer
RRI, Faridpur

RIVER RESEARCH INSTITUTE
Faridpur, Bangladesh.

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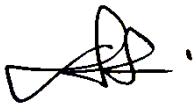
	**Engr. Swapan Kumar Das** Director (Add. charge) Geotechnical Research RRI, Faridpur	**Advisor**
	**Engr. Pintu Kanungoe** Director (Add. charge) Hydraulic Research RRI, Faridpur	**Advisor**

Editorial Note

River Research Institute

River Research Institute publishes an annual report every year focusing on its activities and financial performance in the bygone fiscal year. In order to accomplish this task an Editorial Committee and an Advisory Committee are formed at the end of the every fiscal year. Accordingly, the annual report of the fiscal year 2018-19 has been prepared by the Editorial Committee with the assistance of the Advisory Committee. This report includes general description of the institute, activities performed by its different directorates and financial management. It also highlights the backgrounds, objectives and findings of different physical and mathematical model studies and also the testing of various properties of soil, concrete, water and sediment. Moreover, this report contains the human resource development, research and development activities, future development prospects etc. which will assist to provide useful information to the organizations and individuals working in the water sector.

The Editorial Committee likes to express its sincere thanks and gratitude to Chief Advisor Mr. Md. Alim Uddin, Director General of RRI for his valuable direction, suggestion, assistance and back-up in publishing this annual report. The committee earnestly recognizes the guidance provided by the advisors for making this annual report informative and comprehensive. The committee is also grateful to the relevant personnel who extended their efforts and co-operation in preparing and publishing this report in time. Any valuable comments and suggestions regarding improvement of this report from among readers will be highly appreciated.



Engr. Pintu Kanungoe
Convener
&
Director (Add charge)
RRI, Faridpur.

Dr. Engr. Md. Alauddin Hossain
Executive Editor
&
Principal Scientific Officer
RRI, Faridpur.

State Minister
Ministry of Water Resources
Govt. of the People's Republic of Bangladesh
Dhaka

Message

I am very pleased to know that River Research Institute (RRI), an autonomous organization working under the Ministry of Water Resources, is going to publish its Annual Report for the financial year 2018-2019. As far as I am informed, RRI is providing excellent service to the nation in its arena of activities.

RRI was established as a national organization aiming at devising plans and actions to develop water resources by means of physical and mathematical modelling. As a country with its unique geographic location, Bangladesh is prone to a number of water related disasters to the detriment of its people. In order to achieve sustainable development goals, Bangladesh needs to cope with these disasters by devising technically sound and viable solutions to these problems. I have come to know that since its establishment RRI has been putting its best efforts to support water resources development and management activities undertaken by the Ministry of Water Resources. I am very happy to know that RRI has also extended its services to support development activities of other ministries of the government. The institute has already proven its capability by providing useful support to different river management and water infrastructure development projects by means of physical and mathematical modeling. I am quite hopeful that RRI will continue to play a vital role in water sector in the future.

Finally, I applaud the editorial committee for their meticulous efforts in preparation and publication of the annual report.

I wish it gets the deserved attention.

(Zaheed Farooque, MP)
State Minister, Ministry of Water Resources
Government of the People's Republic of Bangladesh

Deputy Minister
Ministry of Water Resources
Govt. of the People's Republic of Bangladesh
Dhaka

Message

I convey my heartiest greetings to River Research Institute (RRI) as it is going to publish its Annual Report 2018-2019. RRI ensures very essential support for sustainable planning, design and management of different water resources development projects of this country. As a matter of fact, the role of this institute has made itself part and parcel in water resource management.

Bangladesh, in physical geography, is a low-land country with numerous rivers. Flood, river erosion, cyclone etc. visit our country on and on. All of these pose not only disaster but also threat towards our sustainable economic growth by causing a great deal of loss of lives and property. Therefore, sustainable river and flood management has been the golden key to keep up our economic growth. With a view to facing these disasters, our Government has undertaken a number of initiatives in the form of plans and policies as well as disaster risk management. A good number of projects have been implemented in order to manage both tidal and non-tidal rivers. RRI has been performing with both physical and mathematical modeling tools to facilitate water resource management. I firmly believe that RRI will have the best performance and provide useful solutions to our national well-being.

Finally, I would like to offer my sincere thanks to the editorial committee for their painstaking efforts in preparation of the RRI annual report.

(AKM Enamul Hoque Shameem, MP)
Deputy Minister, Ministry of Water Resources
Government of the People's Republic of Bangladesh

Secretary
Ministry of Water Resources
Govt. of the People's Republic of Bangladesh
Dhaka

Message

I take immense pleasure in expressing best wishes to River Research Institute (RRI) on the publication of its Annual Report 2018-19. In today's world, development in digital technology is phenomenal and also crucial for all developing nations so as to emerge as an economy capable of sustaining its overall growth. The role of RRI is quite significant in the present scenario of technology-driven development. I am sure that RRI shall work hand-in-hand towards achieving these objectives.

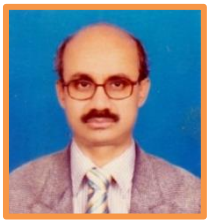
As a research organization in water sector under the Ministry of Water Resources (MoWR), RRI has been playing a part in providing technical assistance to different water resources development and management projects undertaken by the Government of Bangladesh (GoB) by using physical modelling technology. Side by side, RRI is also using state of the art mathematical modeling technology to meet the ever increasing demand for quality services to deal with the water related problems in a sustainable manner. So far, RRI has proven its capability of providing important technical assistance in implementation of a number of pride projects of the country by using both physical and mathematical modeling technologies. I expect that RRI would take up more and more problem oriented and site specific researches to develop insight into the problems and come up with sustainable solutions for the benefit of the country.

I would like to express my sincere thanks and appreciation to the editorial committee of RRI for their painstaking efforts in preparation of the RRI annual report.

Kabir Bin Anwar
Secretary, Ministry of Water Resources
Government of the People's Republic of Bangladesh

River Research Institute

Message from the Director General



River Research Institute (RRI) is a statutory public organization working under the Ministry of Water Resources, Government of the People's Republic of Bangladesh. It has been putting its efforts in providing technical support to different development initiatives undertaken by the Ministry of Water Resources. Side by side it also provides technical assistance to different water resources development activities of other ministries.

During 2018-2019 fiscal year, RRI conducted Physical Model Study for Padma River Dredging Management in Jajira and Naria Upazilla under Shariatpur District. RRI also provided hydraulic design support for sub-structure and river training works of the proposed Bangabandhu Railway Bridge over the Jamuna River by conducting three separate physical model studies. Besides, RRI conducted physical model study for sustainability of Buriganga River Restoration Project and a mathematical model study was conducted for hydro-morphological and environmental impact assessment of the Derai-Sullah Road in Sunamganj district. A multi-year Bamboo bandalling pilot project aiming with bank protection and land reclamation was implemented in this fiscal year in different site of the country and also going on. Another multi-year project entitled "Institutional Development and Capacity Building (IDCB) Project for River Research Institute (Phase-II)" was also continued. RRI conducted a series of in-house training program as well as seminar comprising RRI related topics and activities respectively.

Geotechnical Research Directorate of RRI conducted various tests on physical and engineering properties of soil, quality of construction materials, sediment characteristics and water quality of the rivers etc. The testing results have been used for planning and design of hydraulic structures like bridge, groyne, barrages, sluice gate, drainage channels, irrigation canals, sluices, closures etc. Two applied research work have been conducted under GR directorate in this fiscal year named as "Investigation of geotechnical reasons for bank failure on Daulatdia and Paturia side of Padma river of Bangladesh" and "Development of Suitable Technologies for Removal of Manganese from Ground Water in Household, Community and Municipal Levels".

The main activities of Administration and Finance Directorate comprises of the overall administration of RRI, accounts and audit, estate, library, public relation and photography and establishment. In addition, the directorate is responsible for operation and maintenance of all physical facilities in RRI.

Finally, I hope this annual report will provide the reader with good insight about the roles and activities of RRI during the fiscal year 2018-19. Sincere thanks are due to editorial committee and others who have contributed for the publication of this annual report.

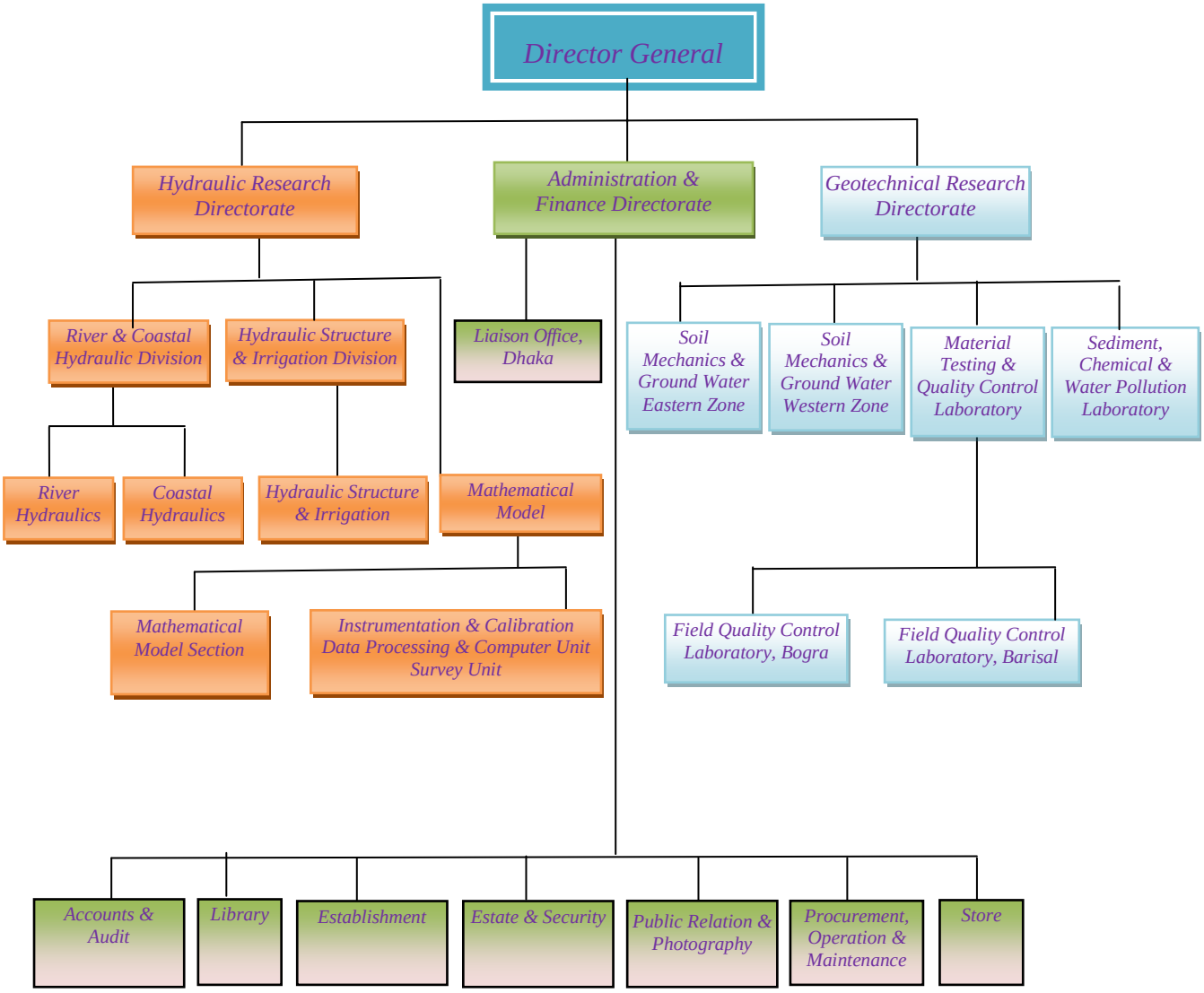
Md. Alim Uddin
Director General

BOARD OF GOVERNORS OF RRI

(As on October 2019)

1. Hon'ble Minister Ministry of Water Resources Government of the People's Republic of Bangladesh.	**Zaheed Farooque, MP**	**Chairman**
2. Chairman Zilla Parishad, Faridpur.	**Md. Lokman Hossain Mridha**	**Member**
3. Hon'ble Member of Parliament Nominated by the Government.	**Monjur Hossain, MP** Faridpur-1.	**Member**
4. Secretary Ministry of Water Resources Government of the People's Republic of Bangladesh.	**Kabir Bin Anwar**	**Member**
5. Secretary Ministry of Shipping Government of the People's Republic of Bangladesh.	**Abdus Samad**	**Member**
6. Vice Chancellor Bangladesh University of Engineering & Technology (BUET), Dhaka.	**Prof. Dr. Saiful Islam**	**Member**
7. Director General Bangladesh Water Development Board (BWDB), Dhaka.	**Engr. Md. Mahfuzur Rahman**	**Member**
8. Water Resources Engineer / Scientist.	**Prof. Dr. Umme Kulsum Navera** WRE, BUET.	**Member**
9. Water Resources Engineer / Scientist.	**Mr. Md. Mahmudul Hasan** Director General,WARPO	**Member**
10. Director General River Research Institute Faridpur.	**Md. Alim Uddin**	**Member-Secretary**

Administrative Structure of River Research Institute



CITIZENS CHARTER

RIVER RESEARCH INSTITUTE

Sl. No.	Name of the service
1	Providing consultancy services for viable technical solutions to the problems related to river bank erosion, flooding, drainage and irrigation.
2	Assisting in development of water resources by devising appropriate technological solutions for maintaining river flow, use of surface and ground water, environmental protection and reducing salinity.
3	Testing and assessment of quality of soil, sediment, water as well as materials used for construction of water infrastructures for water resources development and river management.
4	Conducting applied research on river management, sediment control of river, coast and estuary management etc. using physical and mathematical modeling technology and publishing the research results in report form as well as in periodicals and journals.
5	Field level implementation of research outcomes in limited form to assess its effectiveness.
6	Conducting basic research to develop understanding of river and coastal processes for the sake of applied research works.
7	Taking up problem oriented research and studies as to decrease in dry season flow of the rivers, sedimentation in river bed, loss of navigability of rivers, increase in flooding, long-term water logging etc. to furnish the outcomes to the planners and decision makers.
8	Taking up projects for capacity building of the institute as well as human resource development and conducting joint venture multi-disciplinary studies.
9	Determining the physical, chemical and engineering properties of sediment along with various chemical properties of surface and ground water such as arsenic, iron, calcium, magnesium, sulphate, carbonate, potassium, salinity, etc.

GENERAL INTRODUCTION

Figure: DG, RRI Mr. Md. Alim Uddin Welcomed by Mr. Arun Chandra Mahottam, Director (Admin & Finance) on behalf of the all Officers and Staff of RRI on the occasion of Happy New Year-2019

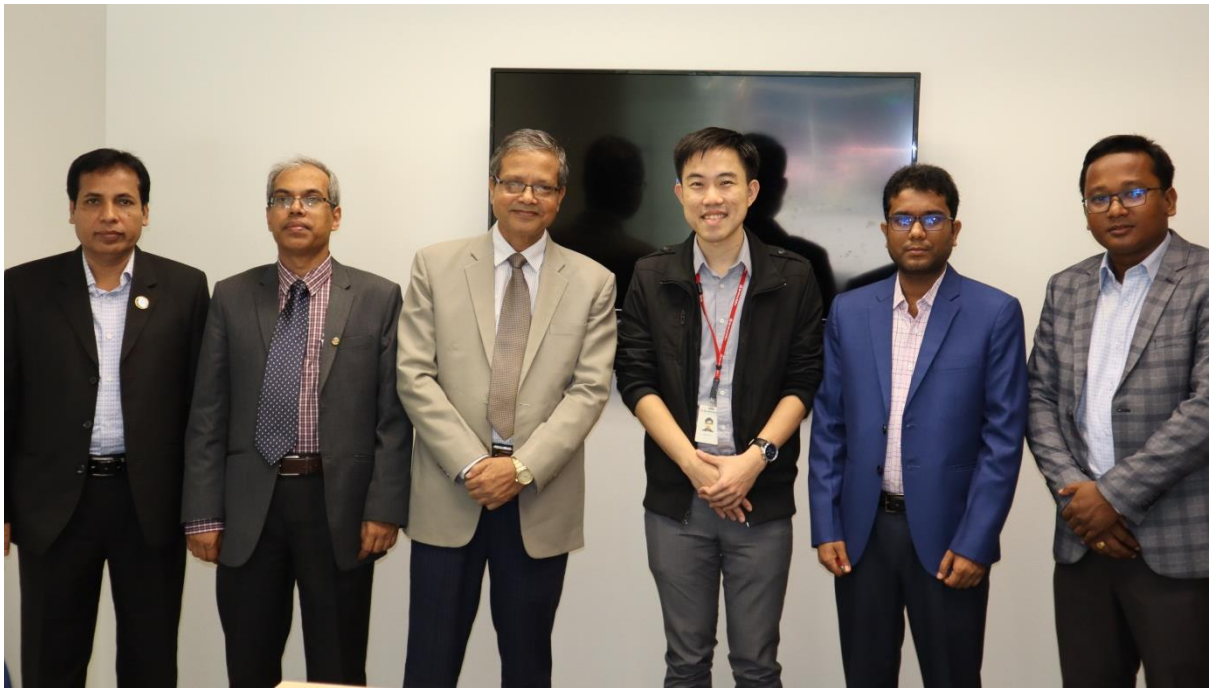


Figure: A moment of photo session of RRI team with Mr. Goh Jia Yi, Marketing Executive, SHIMADZU (Asia Pacific) Pte Ltd. in Singapore during pre-shipment inspection of Total Organic Carbon (TOC) Analyser in connection with the Institutional Development and Capacity Building for River Research Institute (Phase-II).

Figure: RRI team headed by Mr. Arun Chandra Mahottam observing Total Organic Carbon (TOC) analyser in SHIMADZU (Asia Pacific) Pte Ltd. in Singapore during pre-shipment inspection in connection with the Institutional Development and Capacity Building for River Research Institute (Phase-II)".

RRI Inspection Team (from right):

Arun Chandra Mahootam, Director (Admin & Finance)
Md. Moniruzzaman, Scientific Officer
Md. Mominur Rahman, Deputy Secretary, MoWR
Dr. Md. Alauddin Hossain, Principal Scientific Officer
Bikash Roy, Scientific Officer (behind)
Shimadzu Officials

1 INTRODUCTION

River Research Institute (RRI) is a national research organization in Bangladesh. It is working as a statutory public authority under the Ministry of Water Resources (MoWR), Government of the People's Republic of Bangladesh. RRI has a Board of Governors (**BoG**) comprising ten members chaired by the **Hon'ble Minister**, MoWR, Government of the People's Republic of Bangladesh which reviews and evaluates the activities of RRI and approves important proposals so that it can run with all its activities properly. Director General is the Chief Executive of the institute and responsible for implementation of the decisions approved by the BoG. The activities of RRI are conducted by three directorates namely, Hydraulic Research, Geotechnical Research, and Administration and Finance.

Figure: A view of a meeting Chaired by State Minister at MoWR conference room attended Secretary of MoWR and DG RRI along with other high Officials.

RRI is set up with a view to devising plans and actions to develop water resources in a sustainable manner to meet the development needs of Bangladesh. Since its establishment RRI has been conducting multi-disciplinary and problem oriented tests and researches in the field of River Hydraulics, Hydraulics of Structure and Irrigation, Coastal Hydraulics, Soil Mechanics, Material Testing and Quality Control, Sediment Technology, Hydro-chemistry, Geo-chemistry and Instrumentation. The results of such tests and research are playing a vital role in providing information and recommendations regarding different water resources development plans and interventions.

Figure: DG RRI Md. Alim Uddin (left) delivering his speech in a seminar along with DC Faridpur Mr. Atul Sarker (middle) and Director, Admin & Finance Mr. Arun Chandra Mahottam.

RRI has been conducting physical modelling in the field of water resources since its establishment. RRI has also been involved in mathematical modelling since 2009. Physical and mathematical modelling tools are complementary to each other. Both physical and mathematical model have been proved to be very essential for sound engineering judgments to find out solutions for different water resources development projects. In view of this, RRI has adopted hybrid modelling approach by using physical as well as mathematical modelling to improve the understanding of different water systems which may lead to safe and less expensive solutions for engineering problems. RRI has the mandate for conducting hydrodynamic and morphological study of the river mainly to derive and verify the design parameters of any hydraulic structures, bank protection and river training works.

Figure: DG, RRI delivering his speech in a Training Course as a chief guest and Dr. Md. Munsur Rahman, Professor, IWFM, BUET attended as a trainer along with special guest.

During fiscal year 2018-19, the following six studies were carried out at RRI, of which first five studies have already been completed and last one research study is going on at present fiscal year. Besides these six studies, four multi-year (2 and 3 year duration) pilot projects for bank erosion mitigation, land reclamation and maintain navigation route using Bamboo Bandalling structures and one multi-year (3 year duration) Institutional Development and Capacity Building (IDCB) project for RRI (phase-II) were underway in the 2018-19 fiscal year. Short description of four model studies appeared in section 2 and that of on-going & completed research works, IDCBP (phase-II) and pilot projects is furnished in section 3 respectively.

- **Physical Model Study for Padma River Dredging Management in Jajira and Naria Upazilla under Shariatpur District.**

- **Physical Model study for Supporting Design of the Proposed Bangabandhu Railway Bridge upstream of Existing Bangabandhu Multipurpose Bridge over the River Jamuna.**

- **Physical Model Investigation to study the Effectiveness of New Dhaleswari River Off-take Structure to support the Design Work of the Buriganga River Restoration Project.**
- **Mathematical model study for hydro-morphological and environmental impact assessment of the Derai-Sullah Road in Sunamganj district.**
- **Investigation of geotechnical reasons for bank failure on Daulatdia and Paturia side of Padma River of Bangladesh.**
- **Development of Suitable Technologies for Removal of Manganese from Ground Water in Household, Community and Municipal Levels (going on).**

RRI has conducted four in-house training and three seminars in 2018-2019 fiscal year for skill development of its scientists and engineers as well as all officials. In addition, remarkable Officials and staff are trained through out-side training. Details description of in-house training, out-side training and seminar are summarised in section 4.

As per requirements of different clients, some proposals have been submitted for model studies and correspondence with the relevant organization is going on. A large number of soil, water, sediment and construction material samples are received from different projects of Bangladesh Water Development Board (BWDB) and other organizations. These samples are tested with the sophisticated laboratory equipment of RRI as routine works of Geo-technical Research Directorate. The results and findings are sent to the project authorities concerned. Recently, many equipment has been procured under IDCB project (Phase-II) for Geo-technical Research Directorate and Hydraulic Research Directorate. Details description of procured equipment are summarised in section 3.2.

Figure : RRI team observing TOC test during pre shipment inspection in Singapore.

In addition, the operation and maintenance activities of office and residential buildings, roads, rest house, vehicles, water supply system, sewerage system, power distribution system including power generator etc. are routinely done and presented it under section 2.3.2

Figure: Mr. Md. Mahmudul Hasan, Additional secretary, MoWR visited RRI along with RRI Officials.

Qualified and trained personnel are very much essential to meet the objectives of RRI and maintain its standard to the international level. For this purpose a number of officials have already been completed their higher studies and obtained training in the related fields at home and abroad. Many others are expected to be trained in the near future. At present RRI has shortage of junior officers to undertake more responsibilities. For this reason recruitment of junior officials is under consideration. The existing manpower is, however, well experienced and well trained in the field of hydraulic, geotechnical and environmental engineering. Detailed list of existing administrators, scientists, supporting and managerial officers is shown in Annex-I. List of abbreviations is shown in Annex-III.

RRI has also been publishing journal named 'Technical Journal' yearly since 1991. RRI's technical journal got recognition in 2000 by ISSN - International Centre, 20, rue Bachaumont, 75002 Paris - France and its serial has been registered as ISSN 1606-9277 with key- title: Technical journal - River Research Institute, abbreviated key- title: Tech. J. - River Res. Inst. Multidisciplinary research activities and case studies of different water resources projects are published in the journal.

RRI undertakes sports and cultural activities and observes all national days. RRI officials and staffs along with their families take part spontaneously in the sports and cultural activities. In addition, RRI takes part in different world and international days such as "world water day" and different national program taken by the government such as National Development Fair (Jatio Unnayan mela), Information Fair (Tottho mela) etc. Some photographs showing celebrated of national days in RRI, visited RRI by dignitaries and memorable moments for RRI officials appeared in Annex-II.

Figure: A view of Bengali New Year "Pohela Baishakh" celebrated at River Research Institute Campus.

Figure: DG and other high Officials of RRI meet with Mr. Md. Lokman Hossain Mridha, BoG Member of RRI in a program at Faridpur town

ACTIVITIES OF RRI

2 ACTIVITIES OF THE INSTITUTE

The Directorates of Hydraulic Research and Geo-technical Research execute the research activities of this institute. The Administration and Finance Directorate is accountable for the overall Administration and Financial activities of RRI and works for its development. The activities of different directorates are briefly described below:

2.1 HYDRAULIC RESEARCH DIRECTORATE (HRD)

The Hydraulic Research Directorate has three divisions such as (i) River and Coastal Hydraulics (ii) Hydraulic Structure and Irrigation and (iii) Mathematical Model. These three divisions carry out studies and research work in the field of flood control and drainage, river training and bank protection, coastal engineering, hydraulic structure *a*nd irrigation etc. by means of physical and mathematical modelling along with other laboratory testing and studies. This directorate is well equipped with physical and mathematical modelling facilities.

Figure: A view of physical model study of Bangabandhu Railway Bridge Project during running condition.

Physical Modelling

Physical modelling is an authentic tool, which can be used confidently to verify the effectiveness of any structural intervention in the river by reproducing the natural phenomena of river hydro-morphology at a reduced scale. The causes of any river engineering problems are identified and its mitigation measures are investigated through physical modelling. Local scour, 3-dimensional flow phenomena like eddy and vortex, morphological processes and developments etc. are possible to reproduce well in physical model.The important design parameters such as local scour around the

structure, flow field, maximum velocity, appropriate location, dimension and orientation of hydraulic structures, spacing between groyne/spur like structures etc. can also be obtained by physical modelling. The physical process/phenomena, which are not possible to describe well by empirical formula and mathematical expression, can be easily reproduced precisely in physical modelling. Moreover, the real phenomena that are happening in the field are only possible to visualize by physical modelling. RRI has sufficient physical modeling facilities including Indoor and Outdoor model area. Other available facilities include various measuring instruments, tide generator, wave generator, sediment feeder, power generator, workshop etc.

Important Physical model studies conducted at RRI and achievement in the past

So far, more than two hundreds of Physical model studies of different projects have been conducted by Hydraulic Research Directorate since 1948. Some of the important Physical model studies carried out at RRI is as follows:

Name of the project	Year of completion	Objectives of the Physical modelling
Padma River Dredging Management Project	2019	to investigate the efficacy of dredging options, strategies and spoil disposal plan
Buriganga River Restoration Project	2019	To finalize the layout of the off-take structure such as guide bund, intake canal and sedimentation basin in order to get required discharge in Dhaleshwari River.
Bangabandhu Railway Bridge Project	2018	To determine the local scour around the proposed Bangabandhu Railway Bridge pier and to check the efficacy of the existing RTW with proposed railway bridge pier.
Laboratory Based Study Using Concrete Block Mats to control River Bank	2018	To determine the cost effectiveness and sustainability of Concrete Block Mats compared to traditional method of river bank protection
Paira Bridge Project	2016	To finalize the type, location, dimension and hydraulic design parameters of the proposed river training works
Ganges barrage project	2013	To finalize the location, effectiveness and design parameters of the proposed barrage.
Padma multipurpose Bridge project	2013	To check the efficacy of river training structure.
3rd Karnaphully bridge project	2006	To decide the effectiveness and design parameters of bridge piers.
Gorai river restoration project	2001	To find out the suitable options for sustainable measures.
Bangabandhu multipurpose bridge project	2000	To find out the efficacy of river training structure and to solve instantly arising any difficulties during the period of erection.

Name of the project	Year of completion	Objectives of the Physical modelling
Paksey roadway bridge project	1996	To verify the efficacy of river training structure.
Silt trap model for Teesta barrage project	1994	To finalize the effectiveness and design parameters of the barrage component.

Mathematical Modelling

At the present time, mathematical modelling tool is being widely used all over the world for research and studies in the field of water resources engineering. It has become an important tool for decision support in planning and management of water resources and sustainable water infrastructure development. In many cases mathematical modeling is complementary to physical modeling to arrive at sound engineering judgment as to planning, design and implementation of water infrastructure projects. In view of this fact, the GoB has equipped RRI with mathematical modeling facilities (MIKE Series) to enhance its quality of works. It is expected that RRI will play a vital role in water sector as well as in other related sectors to make the water resources development cost effective and sustainable. It can be mentioned here that RRI has already completed a number of mathematical model studies from 2009 to till. RRI has conducted a numbers of mathematical model studies which is mentioned in below. Recently, one mathematical model study entitled "Topographical, Hydrological and Morphological Study using mathematical model for Madanpur-Dirai-Sullah (Dirai-Sullah Portion) Road under Sunamganj Road Division during the year 2018-19 has been completed.

Important Mathematical model studies conducted at RRI in the past

- Detail Engineering Design of Kurigram Irrigation Project (South Unit),
- Wazed Miah Bridge project in Rangpur District
- Road Bridge over the Banar River on Mymensingh-Goffargaon-Toke Road in Mymensingh District
- Road Bridge over the Kalni River in Habiganj District.
- Road Bridge over the river Lohalia at Boga in Patuakhali District.
- Pagla-Jagannathpur-Raniganj-Aushkandi Road Project in Sunamganj District.
- Road Bridge at Nalua-Baherchar over the river Pandab-Paira in Patuakhali District.
- Road Bridge over the Monu River in Moulvibazar District.

Recently Mathematical model studies conducted at RRI

- New Sachna-Golakpur Road under Sunamganj Road Division.
- Proposed Sonahat Bridge over the river Dudhkumar under Kurigram Road Division.
- Proposed Kaharol Bridge over the river Punarbhaba River under Dinajpur Road Division.
- Improvement of Nikli – Soharmul - Karimganj Road &Gunnodhor GC -Mojlishpure GC Road under Rural Infrastructures Development Project of Kishorgonj District of LGED.
- Proposed Madanpur-Dirai-Sullah (Dirai-Sullah Portion Road link) Road under Sunamganj Road Division of LGED.

2.1.1 Model Studies Conducted by HRD in 2018-2019 fiscal year

A) Physical Model Study for Padma River Dredging Management in Jajira and Naria Upazilla under Shariatpur District

The Padma carries immense volumes of water and constantly shifting its main channel due to the emergence of chars (sand bars) and islands at different locations of the river near Jajira and Nariaupazilla in Shariatpur district. Apart from these, it has been eroding vast areas on one bank due to the collective effects of huge current, wave, tidal influences and upstream torrents. The outer (concave) bank of the river is gradually advancing towards the country side and the bend is becoming gradually sharper. This process of bank erosion is typical to the Padma and other major rivers of Bangladesh. Recently severe bank erosion occurred at Naria Upazilla health complex, bazar, mosque, educational institutions, important roads, homestead etc. have already been engulfed by the river. The Kundeshwar, Sureshwar Launch Ghat Terminal and Chandipur bus stand area are also vulnerable to massive erosion of the Padma river. As a consequence, erosion affected people have been compelled to take shelter elsewhere losing their ancestral homes. Furthermore, education is hampered and hence, poverty is intensified in that region making the people unhappy, upset and frustrated. Under this backdrop, BWDB has duly taken up a study project entitled “Physical Model Study for Padma River Dredging Management in Jajira and Nariaupazilla under Shariatpur district” and an agreement is signed between RRI & BWDB on 26th June 2018 to conduct the aforementioned study.

The model extent encompasses the river reach of about 36km between Mawa and Chandpur together with a river stretch of about 15km u/s & 5km d/s of the Lower Meghna starting from the confluence. The length and depth scale were selected as 1:600 and 1:80 respectively based on the consideration of the available physical modelling facilities at RRI such as available indoor and outdoor space, pumping capacity, measurements etc.and scale conditions to be fulfilled. The Index map of survey conducted for model study purpose is shown in **Figure 1.**

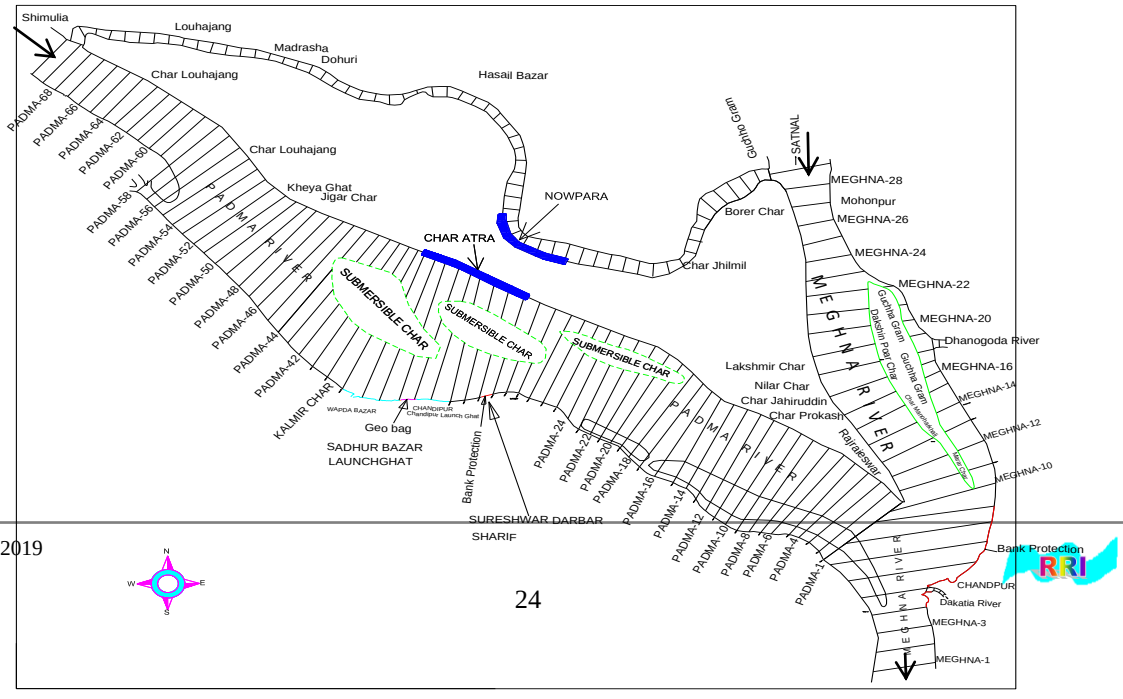


Figure 1: Index map of survey conducted for model study

The overall objective of the physical model study is to investigate the efficacy of dredging options, strategies and spoil disposal plan along Sureshwar and neighbouring areas under Jajira and Naria Upazilla in Shariatpur district and to investigate the hydraulic and morphologic effects of the dredging in relation to changes in flow field, sedimentation and river bank erosion. In this model,calibration test (T0) with existing condition and six applications test runs (T1-T6) with proposed interventions (dredged channel, revetment & T-head groynes) have been conducted.

The effectiveness of the proposed groynes in this test was found best in terms of flow diversion and sediment deposition trend between the groynes with varying discharges and water levels and present river flow pattern (**Figure 2-4**). The performance of the dredged channel was found better compared to other tests. Dredged channel was found to pass significant amount of flow at the initial stages of model run **(Figure 4)**. The effectiveness of dredged channel, groynes and bank revetment as observed after model run (T6) is shown in **Figure 5**. The typical cross section showing silting trend at different discharges is shown in **Figure 6**. The bed topography at the end of model run is shown in **Figure 7.** Tremendous turbulence with eddy and vortex was developed at the existing Sureshwar bank protection area that requires special attention/strengthening. Bank erosion at the downstream of Sureshwar protection was also noticed but in a smaller reach. Bank erosion at the left bank was also prominent in particular with flood discharge.

Figure 2: Model area before run (T6)

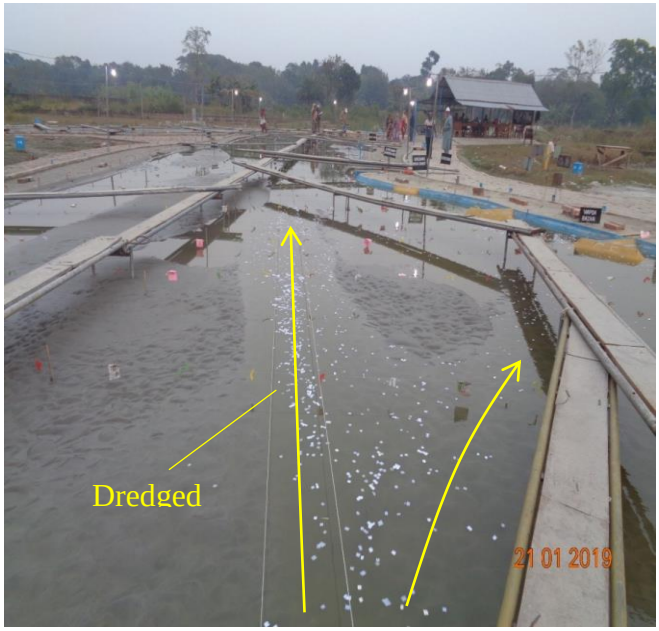


Figure 3: Flow diversion by the groynes during model run (T6)

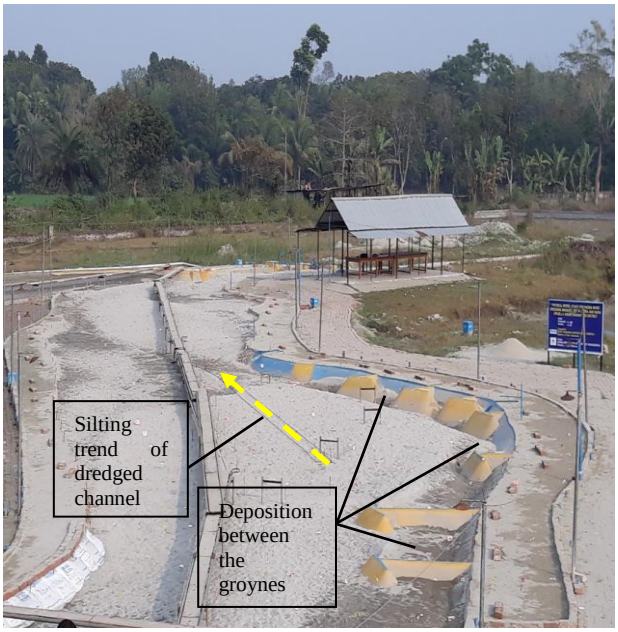
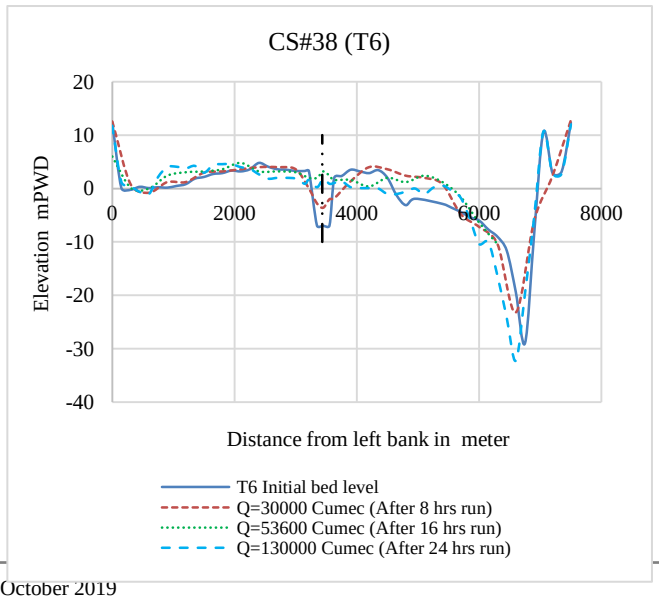


Figure 4: Flow through the dredged channel at low flow (T6)

Figure 5: Effectiveness of dredged channel, groynes and bank revetment as observed after model run (T6)



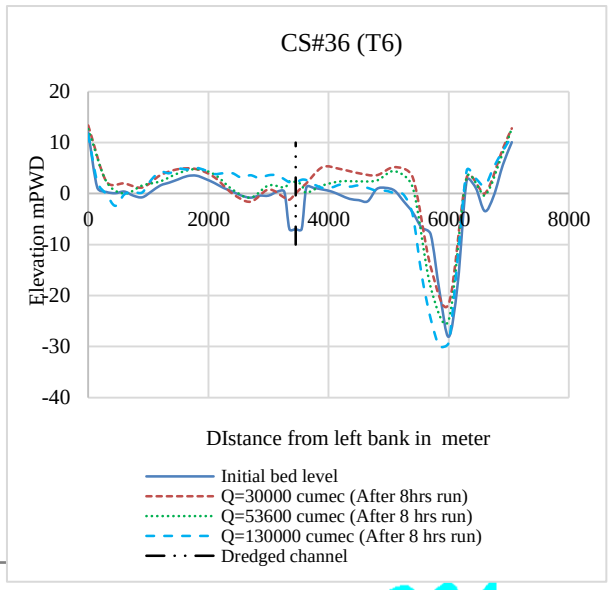


Figure 6: Typical cross section showing silting trend at different discharges

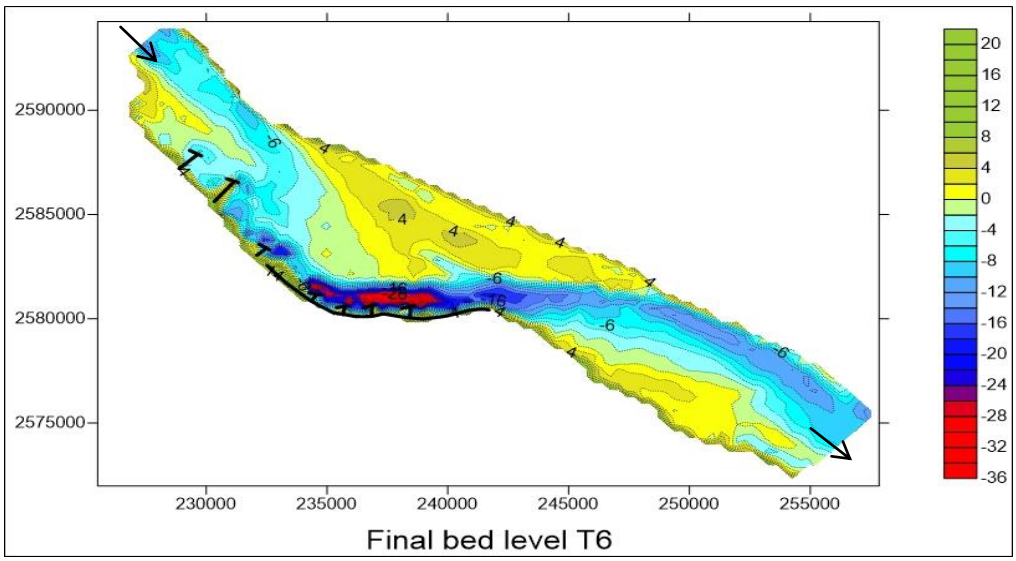


Figure 7: Bed topography at the end of model run

The following conclusions are made based on the test results of the physical model study.

- Velocity at the left bank in the calibration test was also large enough to cause bank erosion which should be taken into consideration. Right bank velocity was found to decrease to some extent due to the proposed dredged channel. Even though the velocity at the right bank was high enough to occur severe bank erosion at Jajira-Naria with 100-year discharge (1,30,000cumec).

- Maximum velocity measured around groynes in test T6 (Q=30,000 cunmec) is 2.61 m/s at groyne #4 and in test T6 (Q=53,560cumec) was about 3.00 m/s at groyne #6.

- Near bank velocity measured at L/B for different cross-sections of the river model in test T6 (Q=53,560 cunmec) varies 0.48-1.96m/s and (Q=1,30,000cumec) varies 1.04-3.54m/s.

- Maximum point velocity measured in test T6 (Q=1,30,000cumec) along different cross-sections of the river model reaches up to about 4.50m/s.

- Maximum velocity measured around groynes in test T6 (Q=1,30,000cumec) is about 4.75 m/s at groyne #7. Maximum scour (qualitatively as the model is distorted) measured around groynes in test T6 (Q=1,30,000cumec) is 21.04 m (-37.28 mPWD) at groyne #7.

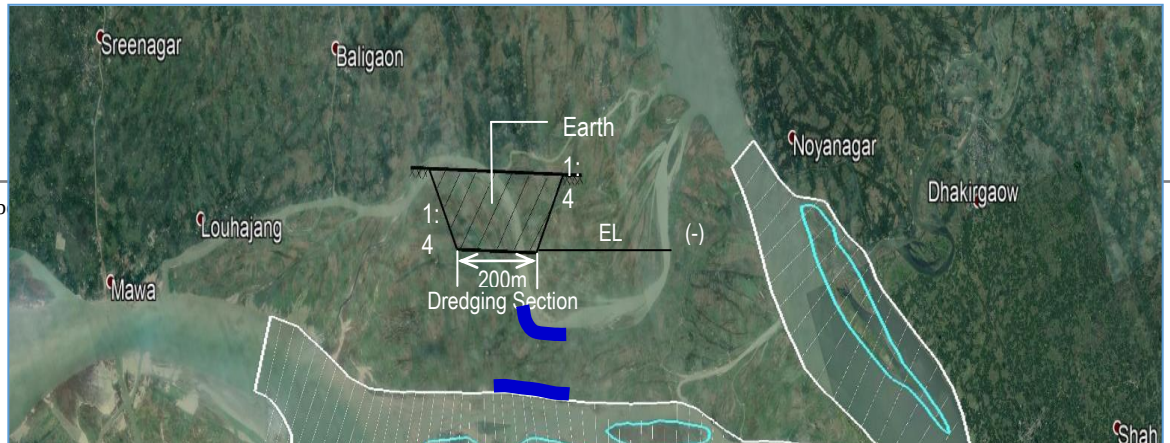


Figure 8: Detailed layout of the recommended revetment, T-head groynes and dredged channel

Figure: A view of RRI model visited by Mr. Md. Mahmudul Hasan, Additional Secretary, MoWR with the then DG, RRI.

B) Physical Model Investigation for Sustainability of the Buriganga River Restoration Project

The Buriganga is the main river flowing beside Dhaka, capital city of Bangladesh. Over the last several decades the flow of Buriganga, Turag, Shitalakkha and Balu river have been reduced

drastically. As a consequence, the water quality of the river Buriganga has been severely deteriorated due to insufficient river flow, solid waste, tannery and disposal of contaminant effluent from different types of industries. In addition, continual growth of population and changes of the socio-economic perspective have severely encroached the once famous inland navigation route of Dhaka and Narayanganj. In view of the above circumstances, Bangladesh Water Development Board (BWDB) has undertaken a project entitled "Burigarrga River Restoration Project (BRRP)" and an agreement has been signed between BWDB and RRl on 13th June, 2017 with a view to ensure sufficient flow in the river Buriganga by diverting flow from Jamuna through Dhaleswari river. The river New Dhaleshwari is the left distributary of the Jamuna in the immediately downstream (about 2.5km) of Bangabandhu Bridge. The off-take as well as the river course of the New Dhaleshwari and connecting rivers has gradually gotten silted up causing little or no flow situation during dry season.

The off-take area and the Jamuna and the Dhaleahwari river appear in Figure 1. At present (as of January 2018) the position of the centre point of the off-take mouth is 784765E, 2698518.4N.

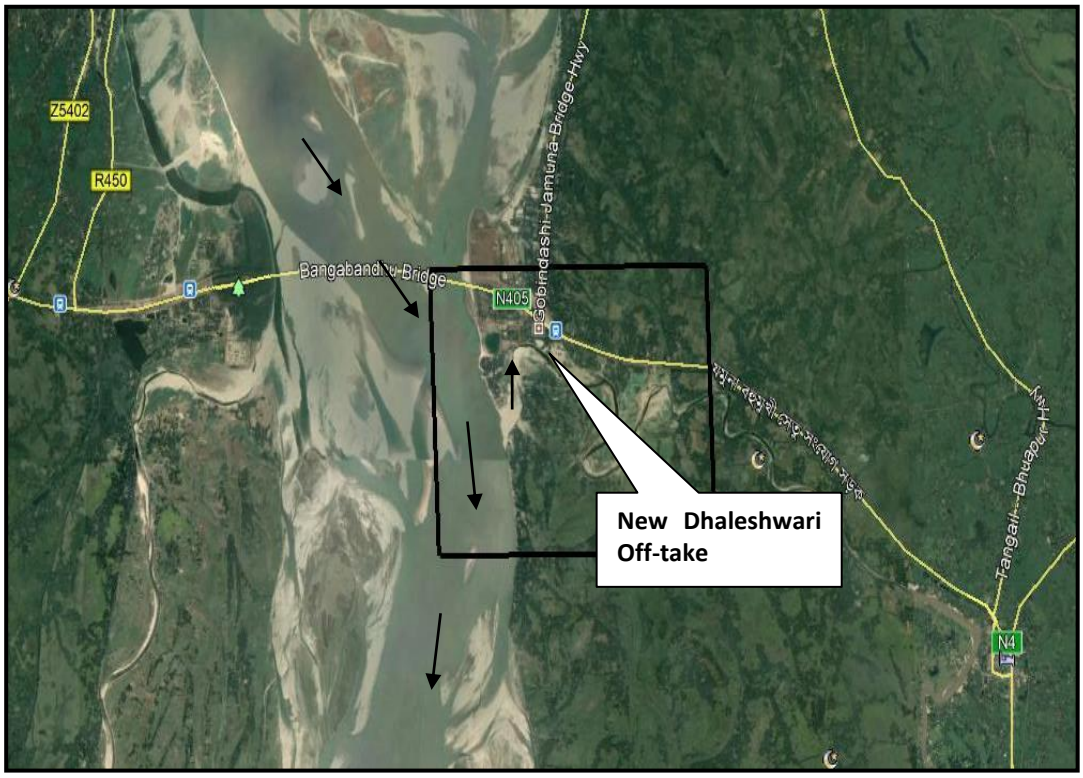


Figure 1: Dhaleshwari off-take and the Jamuna and the Dhaleshwari in the study area

The overall objective of physical model studies is to augment 141 cumec dry season flow in the Buriganga river by diverting 245 cumec water from the Jamuna river through the New Dhaleswari-Pungli-Bangshi-Turag-Buriganga river system.

Figure 2: Launching apron at the off-take mouth along the right bank

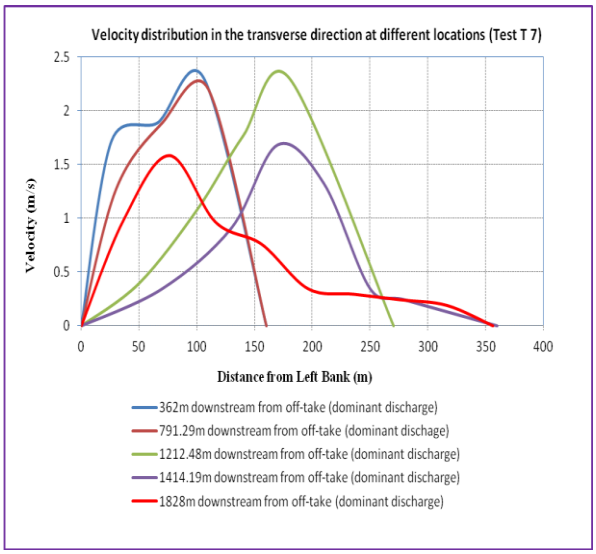


Figure 3: The velocity distribution in the transverse direction at different locations of the intervention area

The conducted tests comprise of base run (T0) and application tests (T1-T7). In Test T7, the launching apron has been provided along the interventions particularly at the scour prone locations as shown in **Figure 2.** During the test discharge through the New Dhaleshwari river has been measured several times at some pre-selected locations. Based on the measured discharges it can be concluded that for dominant discharge of the Jamuna river the percentage of discharge through the New Dhaleshwari river is about 3.60% (1510 m^3/s) of the Jamuna river. Also, the point velocities are measured along the pre-selected cross-sections both of the Jamuna and the New Dhaleshwari rivers.

It is to be noted here that visible morphological development is observed within the interventions area as well as downstream part of Dhaleshwari river due to increase of velocity. As a result, transverse velocity distributions as well as magnitude of maximum and average velocity have also been changed with time. The transverse velocity distribution at different locations as shown in Figure 3 is representative of equilibrium state of the model.

In response to the proposed interventions as in Test T7 the river channel within the intervention area and beyond will undergo morphological changes. The New Dhaleshwari river will experience an substantial increase in discharge for whole range of discharges of the Jamuna river. The location of cross-sections within the intervention location where measurements have been taken during model run has been shown in Figure 4.

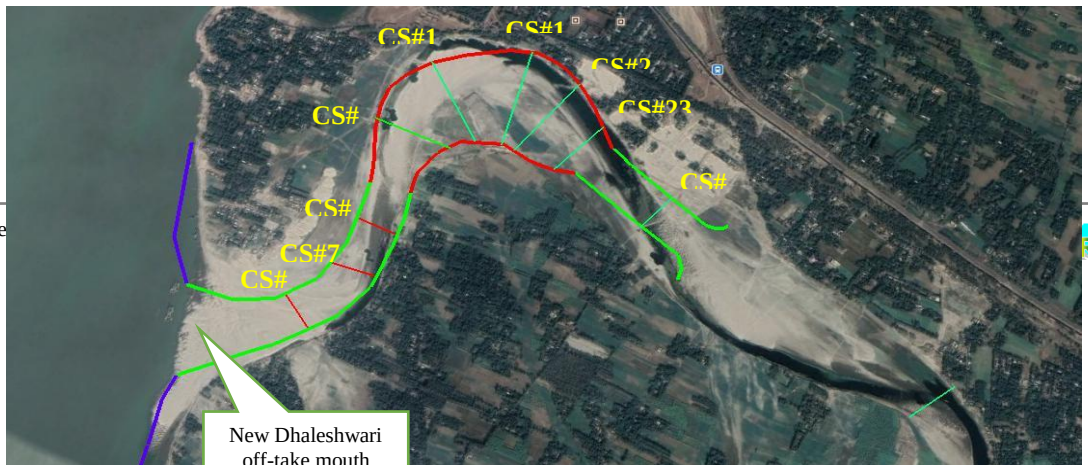


Figure 4: Location of cross-sections within the intervention location

The following conclusions have been remarked as per physical modeling study of Buriganga river restoration project:

- No flow situation occurs during dry season in the New Dhaleshwari river;
- The rivers surrounding the Dhaka city receive flow from the Jamuna river through New Dhaleshwari river
- In order to restore the polluted Buriganga river a flow of 141 m3/s has to be added to bring up the dissolved oxygen level to a tolerable limit. It could be done by augmenting 245 m3/s of flow from the Jamuna river through new Dhaleshwari river;
- Model results suggest that targeted flow augmentation of the New Dhaleshwari river is possible with the proposed interventions at the off-take and dredging as per design.

C) Topographical, Hydrological and Morphological Study using Mathematical Model for Madanpur-Dirai-Sullah (Dirai-Sullah Portion) Road under Sunamganj Road Division

Sunumganj district is located in the north-east region of Bangladesh. Dirai and Sullah are two upazilas under Sunamganj district. These upazilas are naturally resourceful with rice and fish cultivation. At present, there is no smooth road communication between these upazilas as the road link between the Dirai and Sullah upazila headquarters is not yet suitable for vehicular movement. While the Dirai upazila headquarter is connected with national road network by RHD zila road most of the people of these two upazilas can not avail this opportunity easily. Under this background, Road Division, RHD, Sunamganj has decided to conduct a comprehensive hydro-morphological study and a contract was signed between RRI and RHD on 22 January 2018.

The study aims to devise alternative options for the proposed Dirai-Sullah road link and to assess the devised options to select suitable road alignment and also to determine appropriate type, location and dimension of the road structures. In order to conduct the study needed primary and secondary data and other relevant information have been collected. A field survey campaign has been conducted to collect the recent bathymetric data of the rivers, bank line data, nearby road alignment and road elevation data, information on existing road structures and physical features in the study area, water level and sediment data etc.

The flow conditions in the study area have been investigated for one critical hydrological scenario. This scenario represents a condition when 50 year flood discharge occurs simultaneously in both the

Surma and Kushiyara systems. The baseline (Option-1) velocity field in the study area for the considered hydrological scenario has been shown in Figure 1. Under this condition two major road gaps at Nayagaon (Dhanpur Khararper) and Kashipur are considered to be blocked by ring shaped channel closures.

The hydraulic performance of the three alternative road alignments and associated road structures has been assessed hydrodynamically. Option-3 has been considered as preferred road alignment with all existing and newly suggested road structures. The type, location and dimension of the newly proposed road structures appear in Figure 2.

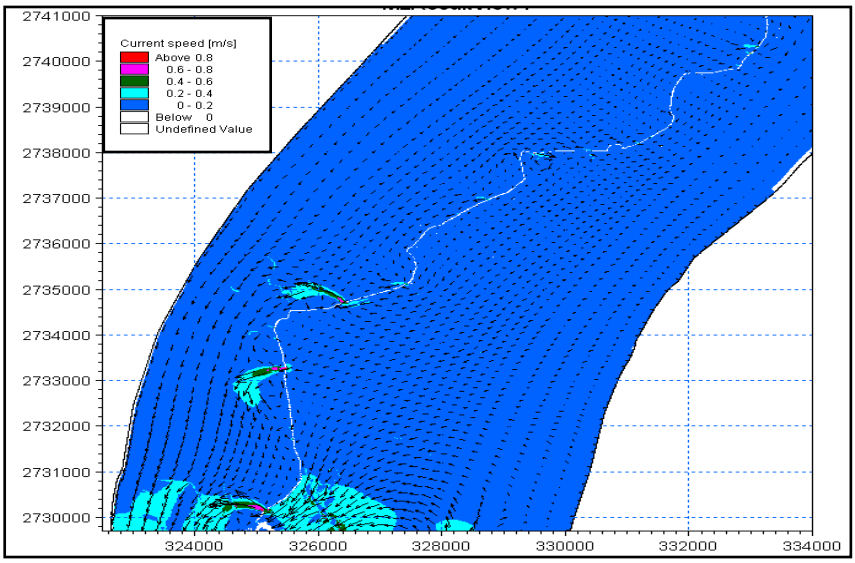


Figure 1: Velocity field in the study area for 50 year discharge in base condition

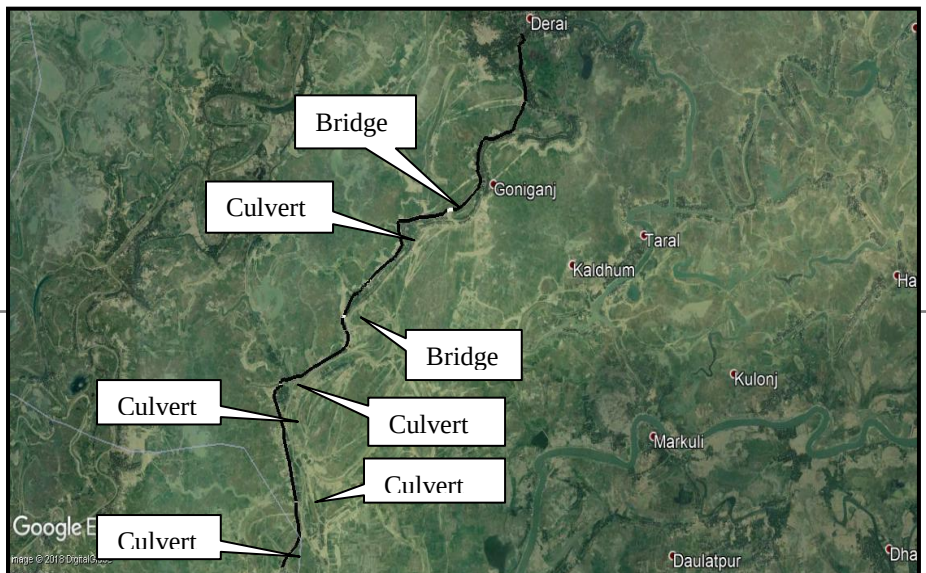


Figure 2: Location of the newly introduced road structures (Option-3)

The following conclusions have been drawn based on study results:

- The main rivers in the study area are Old Surma, Kalni and Champti-Darain. Besides, there are a number of channels that mainly drain the low-lying floodplains;
- The hydrological regime of the study area has already undergone substantial changes due to human interventions into the rivers and in the form of submersible roads, submersible embankments and other infrastructure;
- The flood level corresponding to 50 year discharge varies from 7.65mPWD to 7.70mPWD along the road. The water level slope is very mild. The average flood level is 7.675mPWD. On the other hand, the average flood level corresponding to 20 year discharge is 7.375mPWD;
- The model simulated flow velocity through the different existing and proposed road structures varies from 0.28m/s to 0.71m/s under Option-3;

2.1.2 On-going Model Study at RRI

A) Preservation and maintenance of the East Guide Bund (EGB) sectional model under proposed Bangabandhu Sheikh Mujib Railway Bridge Construction Project (BSMRBCP) over the river Jamuna.

A physical model study was carried out at RRI as per agreement signed on 28th May, 2017 between RRI and Development Design Consultants (DDC) Ltd. to support the design of the proposed Bangabandhu Sheikh Mujib Railway Bridge Construction Project (BSMRBCP) over the river Jamuna. Under the framework of the study, there were two sectional models and one flume model was constructed at RRI to fulfil the requirements for the design of the Proposed BSMRBCP. Those are namely West Guide Bund (WGB) model, East Guide Bund (EGB) model and Flume model. The scale of WGB, EGB and Flume model was1:100, 1:130 and 1:80 respectively. After calibration of the three models, different application test runs are conducted with various test scenarios. The final report was submitted to the client on 27th March 2018.

Afterwards, a new agreement was signed on 15 May 2018 between RRI and Oriental Consultants Global Company Ltd., Japan-Lead with a view to preserving the EGB model for 18 months with an effect from the contract signed. The preservation and maintenance of the sectional model is

required to carry out the additional test runs during the construction phase. As per agreement, three model layout set-up and test runs of EGB model will have to be performed under 100 and 200-year flood events with the adverse angle of approach for proposed Railway Bridge piers. The sectional model (EGB) encompasses a certain river reach upstream and downstream of proposed railway bridge with partial width of the Jamunariver. As per contract, the methodology as well as the details of the required tests will be provided by BSMRBCP authority when the tests are commissioned. Maintenance work of model bed is done regularly which can be seen from **Figure 1** and **Figure 2**

Figure 1: Routine maintenance work around the (EGB) model bed

Figure 2: Grass uprooting work at (EGB) model bed

2.1.3 Proposals for Model Study

During the 2018-19 financial year, RRI has submitted a number of technical and financial proposals to different clients for physical and mathematical model studies. Besides, RRI is in constant contact with different organizations for taking up studies to address different water related problems and to devise sustainable solutions. Some of the proposed studies have been mentioned hereafter.

- **Physical Model Study for Construction of Series of T-head Groynes on the Teesta River**
- **Physical Model Investigation for the Protection of Right Bank of the Jamuna River from Kurnibari to Chandanbaisa at Sariakandiupazilla in Bogra District.**
- **Physical Model Study for Sediment Management at the Offtake of Gorai River.**
- **A Study for Sedimentation Problem in Passure River adjacent to Mongla Port and Proposed Interventions to minimize it.**
- **Physical Model Study for Padma River Dredging Management from Majhirchar to Moksedpur via Narishabazar under Dohar Upazila of Dhaka District.**
- **Numerical and Physical Modelling of Sunkoshi Marin Diversion Multipurpose Project (SMDMP)**

- **Hydrological and Morphological Study for Proposed Shikirhat Bridge over the Bhairab River at 26th km of Narail-Fultala Zilla Highway (Z-7030) under Narail Road Division of Road Circle, Jashore.**

- **Hydrological and Morphological Study for the proposed Shuvapur Bridge on Feni River and the adjoint area Chagolnaiya, Feni at 33rd km. of Feni (Mohammad Ali Bazar)- Chagalnaiya-Konerhat (Z-1031) Road under Feni Road Division during the year 2019-2020**

2.2 GEO-TECHNICAL RESEARCH DIRECTORATE

Geo-technical Research Directorate comprises of three divisions. These are Soil Mechanics and Groundwater Eastern & Western Zone division (Soil mechanics division), Material Testing & Quality Control division and Sediment, Chemical & Water pollution division. The scope of works and facilities available in each division are described in the following sections.

Figure: A view of Geotechnical Research Directorate Building

2.2.1 Soil Mechanics and Ground Water Eastern & Western Zone (Soil Mechanics Division)

Soil Mechanics and Groundwater Eastern and Western Zone of Geo-technical Research Directorate is an utmost important wing of RRI. It has been conducting tests and research work for the determination of different physical parameters of soils which are required for planning and design of the infrastructures of flood control, irrigation, drainage, water development and other development projects. Ground Water Circle (GWC) of BWDB and other organizations explore site and complete their boring and collect soil samples from different project sites in connection with construction of hydraulic structures like bridges, dams, barrages, regulators, Sluices, weirs, flood control and river training works and other relevant works. Site investigation and boring logs are prepared by them are sent to RRI with collected samples. RRI has developed sufficient laboratory facilities for testing of soil samples received from the clients. The soil samples of these zones are tested with great care by the scientists and skilled soil technicians. Finally, the reports on the tested soil samples are prepared based on field investigation and laboratory analysis of data. The reports focus on the engineering characteristics of the soil samples according to the foundation needs. Then the approved report is sent to the respective clients along with bill. The works executed in connection with soil testing, analysis and publication of reports during 2018-19 have been discussed briefly in this section.

Testing of Soil Samples

A total 1268 nos. of disturbed samples from GWC of BWDB and other organizations in fiscal year 2018-19 were received in the laboratory. All the samples were tested and reports were sent to the respective clients. At first all the soil samples are visually examined in the laboratory and representative samples are selected for necessary testing. Generally, tests are conducted for determining Natural Moisture Content (NMC), Grain Size Distribution, Atterberg Limits, Density (γ), Void Ratio (e), Compression Index (Cc), Unconfined Compressive Strength (q_u), Shear Strength (cohesion c and angle of internal friction Φ), by Direct Shear, Tri-axial Shear with or without pore pressure, California Bearing Ratio (CBR) value and Permeability value etc. As per planned schedule, different tests are performed simultaneously in order to work out all necessary parameters quickly within the shortest possible time. Other necessary soil parameters are also tested according to client's requirements. A total of 12 no. of soil testing reports are published and sent to the respective clients during the fiscal year 2018-19. The detailed information has been tabulated in **Table 2.2.1**.

Figure: Director, Geotechnical Research briefing to the DG, RRI during soil laboratory visit.

Apparatus for determining Specific gravity of soil

Direct Shear testing machine

Electric Sieve Shaker

Undisturbed soil sample ejector

Table 2.2.1: List of samples received (project-wise in chart), billed amount and volume of work executed during 2018-19 in Soil Mechanics & Ground Water Division.

Sl No.	Report No.	Name of Division / Client	Name of Project	No. of Sample Received	No. of Tests Done	Billed amount (Taka)
01	01 (2018-19)	Executive Engineer, Patuakhali WD. Division, BWDB, Kalapara, Patuakhali.	Construction of Drainage-cum-flushing Sluice under Blue Gold Program under Patuakhali WD. Division, BWDB, Kalapara, Patuakhali.	112	672	317227
02	02 (2018-19)	Executive Engineer, Sub-Project Management Office Specialized Division, BWDB, Faridpur.	Construction of 1-Vent Regulator at Tita Khal and Gazipur Khal Under Alfadanga-Bowalmari Sub-Project under SWAIWRPMP(2nd phase), Specialized Division, BWDB, Faridpur.	112	672	251050
03	03 (2018-19)	Sub-Divisional Engineer, Cox's Bazar O&M Sub-Division, BWDB, Cox's Bazar.	Construction of Embankment along Sea Side(Sea Dyke) from km. 0.000 to km. 1.390=1.390km. with protective work in c/w Asrayan Project-2 at Khurushkul Mouza in Upazila and District- Cox's Bazar under Cox's Bazar O&M Division, BWDB, Cox's Bazar.	01	5	15654
04	04 (2018-19)	Executive Engineer, Faridpur O&M Division, BWDB, Faridpur.	Construction of 6-Vent Regulator at Joyjhap Khal Under Alfadanga-Bowalmari Sub-Project under Bil Shokunia Sub-Project under SWAIWRPMP(2nd phase), BWDB, Faridpur.	98	490	103702
05	05 (2018-19)	Superintending Engineer, Cox's Bazar WD. Circle, BWDB, Cox's Bazar.	Construction of Sluice Gate 1 and 2 under Sabrang Tourism Park Project at Teknaf, Cox's Bazar.	252	1260	360066

Sl No.	Report No.	Name of Division / Client	Name of Project	No. of Sample Received	No. of Tests Done	Billed amount (Taka)
06	06 (2018-19)	Executive Engineer, Chattogram O & M Division-1, BWDB, Chattogram.	Construction of Bakkhain-Konkar Zora 3-Vent Sluice at Maliara-Bakkhain-Vandargaon at Ashiya union under FCDI Project in Patiya Upazila Under Chattogram O&M Division, BWDB, Chattogram.	84	340	245175
07	07A (2018-19)	Executive Engineer, Lakkhipur O&M Division, BWDB, Lakkhipur.	Flood Control Embankment Protective Work under River Bank Protection Project (Phase-1) under Lakkhipur O&M Division, BWDB, Laxmipur.	02	8	7650
08	08 (2018-19)	Superintending Engineer, Cox's Bazar WD. Circle, BWDB, Cox's Bazar.	Construction of 3 Nos Bridge at Ashrayan Project-2 under Khurushkul Mouza in Upazila and District- Cox's Bazar under Cox's Bazar O&M Division, BWDB, Cox's Bazar.	210	1050	486150
09	09 (2018-19)	Superintending Engineer, Cox's Bazar WD. Circle, BWDB, Cox's Bazar.	Construction of Embankment at Naf Tourism Park(JALIAR DWIP) Project under BEZA at Teknaf, Cox's Bazar.	154	616	412350
10	10 (2018-19)	Superintending Engineer, Cox's Bazar WD. Circle, BWDB, Cox's Bazar.	Construction of Embankment at Naf Tourism Park(Jaliar Dwip) Project under BEZA at Teknaf, Cox's Bazar.	154	616	426825
11	11 (2018-19)	Mr. Engr. Debadi Biswas Proprietor SDS Engineering & Construction.	Sub-Soil Investigation for Construction of Proposed Rubber Factory Project at 214 MRO Area, Kurmitola, Dhaka Cantonment, Dhaka.	88	352	121125
12	12 (2018-19)	Sub-Divisional Engineer, Cox's Bazar O&M Sub-Division, BWDB, Cox's Bazar.	Re-Construction of 3.035km Sea-Dyke with 2.885km slope Protection work in Polder No. 68 at Shahaparir Dwip in connection with Re-construction of Embankment with Protective work in Polder No. 68 of Shahaparir Dwip(Sea dyke) in Upazila- Teknaf, District- Cox's Bazar.	01	5	11250
			Total	1268	6086	2758224

Field Services

In order to assist the quality control of earth works of different projects, RRI sends experienced technicians on deputation to the field in response to the request from the project authority (mainly from BWDB). During the deputation period, technicians are involved in conducting in-situ tests for the on-going projects. During the fiscal year 2018-19, three trained soil technicians were posted in

the different working sites (**Table 2.2.2**).Technicians are deputed in the field for several quality control works such as Field Compaction, Relative Density, Grain Size, Limit, Natural Moisture Content, Hydrometer, Field Quality Control, Loss-on-ignition etc. at different projects.

Table 2.2.2: List of soil Technicians deputed in the field for Quality Control Work in the fiscal year 2018-19

Sl. No.	Name & designation of deputed technicians	Name of division	Working period
1	Md. Nuruzzaman ST-B	Patuakhali O&M Division, BWDB, Kalapara, Patuakhali.	01.07.18 to 15.06.19
2	Md. Abdul Mannan ST-A	Bera O&M Division, BWDB, Bera, Pabna.	01.07.18 to 30.06.19
3	Md. Golam Mostafa ST-B	Cox's bazar O & M Division, BWDB, Cox's bazar.	01.07.18 to 30.06.19

Revenue

During the fiscal year 2018-19 the billing amount for soil tests was Tk. 27.58 lakh (for detail see **Table 2.2.1**) and 10% overhead charge on basic pay of the deputed soil technicians to BWDB has been earned. In total Tk. 51.56 lakh (after deducting net Tk. 39.54 lakh) has been received during the fiscal year 2018-19. A total of Tk. 14.71 lakh is remaining outstanding up to June 2019 to different divisions of BWDB.

2.2.2 Material Testing and Quality Control Division

The Material Testing and Quality Control discipline of Geo-technical Research Directorate deals with the determination of physical and engineering properties of concrete and concrete materials normally used for different types of river training works, hydraulic structures and other infrastructures. It also involves 'Laboratory Trial Mix' and computation of concrete mix design to attend particular design strength with materials to be used in the construction works. At present this discipline has two types of working facilities viz. laboratory oriented testing & research facilities and the other is monitoring & evaluation of construction works by conducting field tests and investigations for quality control of concrete to the ongoing projects.

Universal testing machine used for testing of MSrod, flat bar, concrete cylinder, block etc.

Compressive strength testing machine used fortesting of concrete cylinder, block etc.

Laboratory Activities in 2018-19 fiscal year

During the fiscal year 2018-19, a total of 63 number samples/specimens of cement, sand, shingles/stone chips, bricks, concrete cylinders were received from the different ongoing projects under the different divisions of BWDB and other Govt. and Non-Govt. organizations for conducting tests as specified by the clients. There is a very useful and sophisticated instrument named "The Universal Testing Machine (UTM)" used in the concrete laboratory for testing of MS rod, flat bar, concrete cylinder, block etc.

Figure: DG, RRI observing test activities in Concrete laboratory with Director, Geotechnical Research and concerned high Officials.

Category-wise list of samples received from different BWDB Divisions and other organizations during this fiscal year have been given in **Table 2.2.3**. The Division-wise list of sample tested with project name, their billed amount and the recovery amount of the different BWDB Divisions during the fiscal year 2018-19 are shown in **Table 2.2.4**.

Table 2.2.3: Category-wise list of samples received from different BWDB Divisions and other organizations during the fiscal year 2018-19.

Sl. No.	Name of division/Other organization/Field laboratory	Cement	Sand	Stone/ Khoa	Concrete cylinder/Core	M.S rod	Brick	Total sample
1	2	3	4	5	6	7	8	9
1	Faridpur O&M Division, BWDB, Faridpur.	05	11	06	18			40
2	Kushtia O&M Division, BWDB, Kushtia.				04			04
3	Magura O&M Division, BWDB, Magura.		03	02	04			09
4	Rajbari O&M Division, BWDB, Rajbari.	01	02	01				04
5	Executive Engineer, BADC, Barishal.				06			06

Sl. No.	Name of division/Other organization/Field laboratory	Cement	Sand	Stone/ Khoa	Concrete cylinder/Core	M.S rod	Brick	Total sample
Total		06	16	09	32		-	63

Table 2.2.4: Name of the Projects, total no. of samples received and billed amount & recovery amount of different BWDB Divisions and other organization during the fiscal year 2018-19

Sl. No.	Name of division/Other organization/ Field laboratory	Name of project	Total nos. of sample tested	Billed amount (in Taka)	Recovery (in Taka)
1	2	3	4	5	6
1	Faridpur O&M Division, BWDB, Faridpur.	• Protection work along the Right Bank of Padma River	40	109625	109625
2	Kushtia O&M Division, BWDB, Kushtia.	• Re-excavation of Kumar River Project.	04	7500	7500
3	Magura O&M Division, BWDB, Magura.	• Re-excavation of Naboganga River Project.	09	30000	30000
4	Rajbari O&M Division, BWDB, Rajbari.	• Rajbari Town Protection Work	04	17800	17800
5	Executive Engineer, BADC, Barishal.	• Construction Work Project.	06	5250	5250
		Total	63	170175	170175

Field Services

For quality control of works, a few numbers of trained technicians were deputed in the field in response to the request from the project authority. During the fiscal year 2018-19, 04 (four) number of technicians were deputed in the different work sites of BWDB. List of the concrete technicians deputed in the field for quality control works at different projects have been presented in Table 2.2.5.

Table 2.2.5: List of Concrete Technicians deputed in the field for Quality Control Work.

Sl. No.	Name & designation of deputed technicians	Name of division	Working period
1	Md. Shariful Islam ST-A/CT-A (in charge)	Cox's bazar O&M Division, BWDB.	01.07.18- 30.06.19
2	Md. Piarul Islam CT-B	Kushtia O&M Division, BWDB.	01.07.18- 30.06.19

3	Md. Taherul Islam CT-C	Kishoreganj O & M Division, BWDB.	01.07.18- 30.06.19
4	Md. Arif Mahmud CT-B	Chittagong O & M Division, BWDB.	01.07.18- 30.06.19

2.2.3 Sediment, Chemical and Water Pollution division

Sediment, Chemical and Water Pollution division is one of the testing and research discipline of Geo-technical Research Directorate of RRI. There are two laboratories under this division, namely Sediment Technology laboratory and Chemical and Water Pollution laboratory. Test and analysis of various kinds of sediment samples of different rivers of Bangladesh are being carried out in the Sediment Technology laboratory. The test results are used for planning and designing of hydraulic structures like barrages, drainage channels, irrigation canals, flushing sluices, closures etc. Sediment testing results are also used in physical and mathematical model studies. In the chemical and water pollution laboratory, samples of surface and ground water are being analysed for using water in different purposes.

Activities of Sediment Technology Laboratory during 2018-2019 fiscal year

A total number of 399 samples including general suspended sediment, bulk suspended sediment, river bed and bank soil samples and water samples were received and tested in the sediment technology laboratory as well as chemical laboratory during the fiscal year 2018-19. The general suspended sediment and bulk suspended sediment samples were collected by the field personnel of 4 (four) measurement divisions under the Surface Water Hydrology Circle-I of BWDB. The samples were collected as a routine work by the Surface Water Hydrology Circle-I of BWDB. The river bed and bank soil samples were collected by research team of Bamboo bandalling project (whole Bangladesh) authority of RRI for research purposes. The water sample was collected by the authority of Faridpur Fresh Drinking Water, a local drinking water production company of Faridpur.

The name of clients and category-wise list of samples tested during the fiscal year 2018-19 has been shown in **Table 2.2.6**.

Table 2.2.6: Category-wise list of samples with the clients

Sl. No.	Name of client	Category of samples	Nos. of samples received & tested

1	Surface Water Hydrology Circle-I of BWDB	General suspended sediment samples	179
2	Surface Water Hydrology Circle-I of BWDB	Bulk suspended sediment samples	181
3	Bamboo bandalling project authority of RRI	Bed and river bank material samples	15
4.	RRI Model		23
5.	Faridpur Fresh Drinking water		1

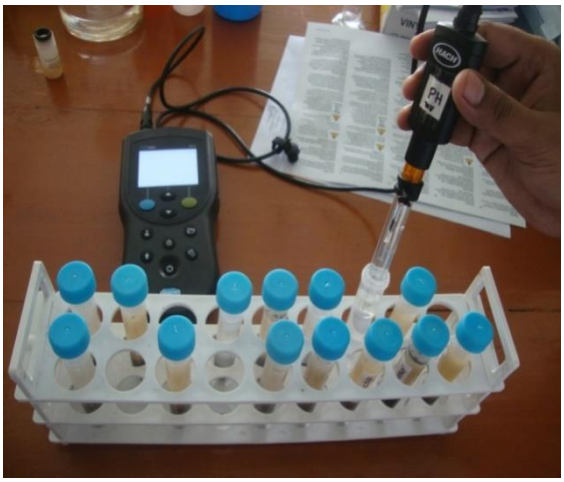
Figure: Showing Dr. Fatima Rukshana briefing to the DG, RRI about Chemical Laboratory activities during his visit at Geotechnical Research Directorate.

Testing Facilities in Chemical and Water Pollution Laboratory

Chemical and Water Pollution laboratory is well equipped laboratory with modern instruments including Gas Chromatography-Mass Spectroscopy, Atomic Absorption Spectrometer, Spectrophotometer, Portable spectrophotometer, portable multi-parameter meter, Aquaculture testing kit, etc. These equipment are designed with cutting-edge technology and are ideal for a wide range of applications including environmental, materials, geological, food safety, clinical and petrochemicals purpose. Recently RRI has procured Total Organic Carbon (TOC) analyzer and Carbon-Hydrogen-Nitrogen-Sulpher (CHNS) analyzer for Chemical Laboratory under Institutional Development and Capacity Building (IDCB) Project (Phase-II).

Atomic Absorption Spectrometer for detecting heavy metals such as Zn, Al, Pb, B, Cd, Cr, Mg, Fe, As, Hg etc in soil samples.

Gas Chromatography-Mass Spectroscopy for detecting volatile organic compound in soil and water.



pH measurement of Sediment samples using HACH 30QD multiparameter in chemical Lab.

Incubator used to maintain required temperature of reagents and samples.

'Gas Chromatography Mass Spectroscopy' is used in Chemical and Water Pollution Laboratory for detecting volatile organic compounds, pesticide, insecticide, etc. in soil, sediment and water samples. 'Atomic Absorption Spectrometer' is used in this laboratory for determining metals like Na, K, Ca, Cr, Ni, Cu, Mn, Mg, Si, Ba, Fe, Zn, Co, Bi, Cd, Pb, As, Pt, Ag, Al, Sb, Se, Hg, B, Sn, Be, Mo, etc. in soil, sediment and water. Hach Spectrophotometer is used to detect substances such as Al, Ba, B, Cd, Cr, Mg, Fe, Cl, C, Ni, Fl, SO_4, etc. in soil, sediment and water samples. Hach portable colorimeter is used to detect substances in the field as Hach spectrometer does in the laboratory. Portable Multiparameter meter is used to determine pH, DO, EC, TDS, Salinity, etc. from the river. Aqua-culture kit is used to measure Ammonia, Cl^-, CO_2, Hardness, etc. Digital Turbidity meter can be used in this Laboratory to detect turbidity of water samples.

The following facilities also exist in the Chemical and Water Pollution laboratory:

- Determination of p^H, arsenic, Salinity electrical conductivity, turbidity, free carbon di-oxide, bi-carbonate, sulphate, chloride, nitrate, sodium chloride, total solid content, hardness, calcium, magnesium, iron, silica, total dissolved solid, dissolved oxygen etc.

Revenue earned of Sediment, Chemical and Water pollution division

A total of Tk. 3.18 lakh has been billed during the fiscal year 2018-19 for testing of sediment samples. In total Tk. 2.76 lakh has been received in this fiscal year 2018-19 and a total of Tk. 3.08 lakh is remaining unpaid up to June 2019 in which Tk. 1.12 lakh is in 2018-2019 fiscal year and remaining Tk. 1.96 lakh from previous fiscal years from different clients of BWDB and other organisation.

Figure: Recently purchased CHNS Analyzer with air purifier for Chemical Laboratory of GR directorate.

Figure: All Officers under GR directorate taking user training on operation and testing procedure of TOC Analyzer

2.3 ADMINISTRATION & FINANCE DIRECTORATE

This Directorate consists of several sections namely, i. Establishment, ii. Accounts & Audit, iii. Public Relation & Photography, iv. Library, v. Estate & Security and vi. Store. The other activities include procurement, operation & maintenance of physical facilities.

2.3.1 Activities of Administration & Finance Directorate

The activities of Administration & Finance Directorate include overall administration of RRI, establishment, human resources development, financial management, photography, public relations, internal security, storing of materials, plantation, arrangement of different kinds of training, publications of annual reports, journal, newsletters etc. The approved and existing manpower working in this institute is 257 and 195 respectively. The details of manpower are given in the following table as shown below:

Figure: A view of normal working day of DG, RRI (back view) in his office.

Table 2.3.1: Class-wise approved and existing manpower in RRI

Sl. No.	Class	Approved manpower	Existing manpower
1	1st Class	68	41
2	2nd Class	03	01
3	3rd Class	122	90
4	4th Class	64	63
Total		257	195

This directorate also collects a number of books both from home and abroad, journals, research reports, newsletter and many other publications every year for library. Many researchers, students and teachers from different institutions use this library for their necessary documents. The total number of reading materials (including books, journal, newsletter reports and publications) is mentioned in Table 2.3.2. and The total expenditure under this directorate during the fiscal year 2018-19 is shown in Table 2.3.3.

Table2.3.2: Total collection of items in the Library

Sl.No.	Description	Collection in 2018-19	Total
1	Books	145	2221
2	Journal	4	2656
3	Reports	77	5509
4	Other publications	12	5212
	Total	248	15598

Table2.3.3: Total expenditure in establishment

Sl. No.	Description	Amount (Tk. in lakh)
1	Officers salary	232.95
2	Staff salary	345.49
3	Allowances	512.98
4	Supply and services	372.84
5	Capital expenditure	30.07
6	Refund of non-expended money	44.85
	Totals	1539.20

2.3.2 Other Activities

In addition to the above activities, this directorate also provides technical support services to the other directorates and divisions. This directorate is also responsible for procurement, operation & maintenance, and mechanical & electrical works of physical facilities. The work completed by operation and maintenance, and mechanical and electrical section during the fiscal year 2017-18 is outlined below.

Works executed by Operation and Maintenance (Civil Engineering)

- Repair and maintenance of different office building such as administration, medical centre, mosque, ansar camp as well as residential buildings. The repair and maintenance works include stripping of old plaster and replacing by new plaster works, white washing, plastic painting, synthetic enamel painting to window gratings, door polishing, wood work in door frames and replacing of glass panes in window shatters and replacing of doors under establishment budget.
- Purchase & replacing of plumbing materials of different buildings with new ones.
- Purchase of stationery, plumbing, hardware and construction materials for general use as well as model use.
- Cleaning of water tank in all office and residential buildings.
- Cleaning and maintenance of surface drain of RRI campus.

Figure: Modernization of Director General Office (Administration and Finance Building)

Works executed by Mechanical Section

- Installation, repair & maintenance of pump, motors, tailgates, gate valves, foot valves, model bridges etc.
- Repair and maintenance of mechanical tools.
- Repair, fitting & fixing of grill, window etc at residential and office buildings.
- Repair and maintenance of all the vehicles of RRI.
- Purchase of raw materials for mechanical workshop of RRI.
- Repair and maintenance of photocopy machines, air cooler and refrigerators.

Works executed by Electrical Section

- Purchased of fuel & batteries for generator.
- Routine maintenance of computer, printers, UPS, IPS and other electronic equipment.
- Purchased of computer accessories, electrical materials.
- Purchased of electric wires of different sizes.
- Electrification in model area.
- Purchased and installed the CC TV Camera in RRI Campus.

Figure: RRI whole campus under CC TV Camera

RESEARCH & DEVELOPMENT ACTIVITIES IN RRI

3 RESEARCH AND DEVELOPMENT ACTIVITIES

Research plays a significant role to improve the quality of lives of the people and also the socio-economic development of the country. Quick and effective decision making by proper use of information contributes for upliftment of the society. Researches in the field of hydraulics, geo-technical and environmental engineering carry great importance for the development of water resources of the country. In view of the above mentioned facts, RRI takes up research projects every year. The two directorates of RRI, namely Hydraulic Research and Geo-technical Research conduct research and development activities in their respective fields. These activities are briefly described in this chapter.

Two research works have been conducted in 2018-2019 fiscal year, which of one is completed and other one is being carried out at present fiscal year. Completed research work entitled “Investigation of geotechnical reasons for bank failure on Daulatdia and Paturia sites of Padma River of Bangladesh” and on-going research work entitled “Development of Suitable Technologies for Removal of Manganese from Ground Water in Household, Community and Municipal Levels” under Geo-technical Research Directorate. The undertaken two research projects, one Capacity Building project (IDCB project) and four Bamboo bandalling pilot projects have been briefly described hereafter, respectively.

3.1 THE RESEARCH PROJECT

(A) Investigation of Geotecnical reasons for Bank failure on Daulatdia and Paturia side of Padma river of Bangladesh

Riverbank failure is a common scenario at monsoon in Bangladesh. Bank failure almost in all major rivers in the country causes damage to valuable land, settlements and infrastructures from year to year. Because of high density of population along the river banks a great numbers of people are also displaced due to this bank failure process. These poor displaced people migrate to nearby towns and cities and live sub-human life in the slump areas. This has created a great natural and social problem in the country. Bank protection is therefore, one of the prime necessities for poverty alleviation and national growth. Before that stability analysis is an utmost important work for any of the bank protection.

Riverbank failure occurs both for hydraulic and geotechnical instability. Besides, constructed bridge crossings or other encroachments that involve acceleration and concentration of flood flows tends to cause ‘back eddies’ or reverse circulation downstream, which can sometimes erode river banks. Experts believe that hydraulic instability is caused by scour at the toe of a marginally stable bank, flood propagation and flood recession, debris and vegetation, removal of bank vegetation, detachment of coarse sediment by wave action, secondary current etc. In case of geotechnical instability experts also believe that the major causes are due to the use of geotechnical unstable materials, improper method of construction, seepage and sliding etc. among many reasons. All river banks experience erosion, but failure is dependent on the location and the rate at which erosion is occurring. Although each mode of failure is clearly defined, investigation into soil types, bank composition, and environment must be clearly defined in order to establish the mode of failure, of which multiple types may be present on the same area at different times. Once failure has been classified, steps may be taken in order to prevent further erosion.

As river bank failure occurs both for hydraulic and geotechnical instability so, an investigation is necessary to analysis the stability of geotechnical condition of river bank. Though some researchers already tried to characterize geotechnical properties of soil facing mass failure problem like landslides or containing organic matters even it is necessary to know more geotechnical reasons of river bank failure which can assist the protection works for preventing them from failure. Under such circumstances, the scientists take into consideration that if the study is done at most bank failure areas like Daulatdia ferry ghat of Rajbari district and Paturia ferry ghat of Manikgonj district through investigation of geotechnical reasons at Padma riverbank properly then it will be easier to find out the ways of protection from failure of this riverbank areas. The scientists anticipate that the analysis of this study will associate with river engineering as a major tool to accomplish bank protection works at these study areas. The undertaken study seems to meet up the analysis of the stability as geotechnical reasons are utmost important engineering aspects for stability analysis. As a result, the issue may be the safety of lives, land & sustainability of the infrastructures against the forces acting in the rivers.

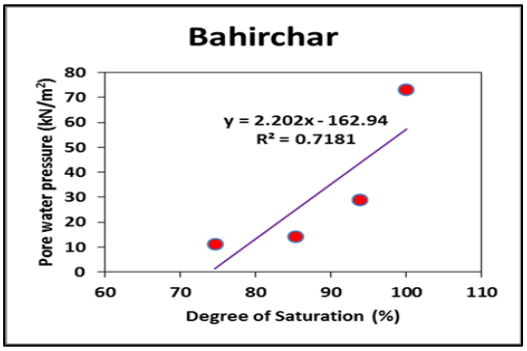
Affected area-Daulatdia ferry ghat side

The objectives of the research study are to determine the geotechnical properties of the study area, to find out the geotechnical reasons for why river bank fails, to improve the conventional river bank protection and to find out the geotechnical approach to associate with river bank protection.

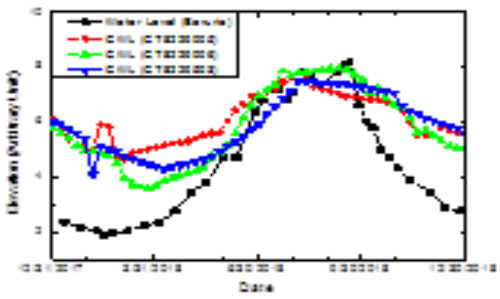
The research was carried out on following methods

- Reconnaissance and questionnaire survey at the affected area of the river bank communities
- Selection of study area
- Samples collection and in-situ investigation
- Laboratory investigation and data analysis
- Data Analysis and Findings

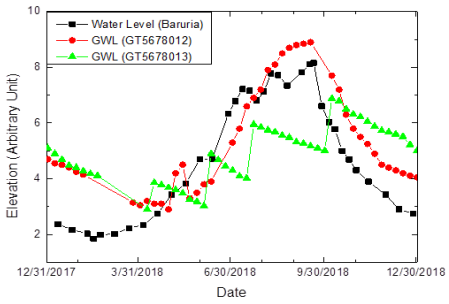
Laboratory shear strength investigation by triaxial shear test apparatus



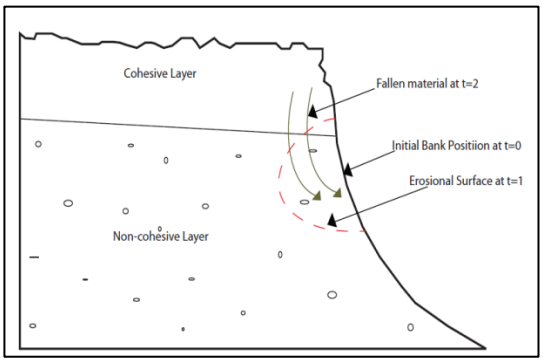
Effect of saturation on pore pressure of soil at Daulatdia side



Variation of Surface Water Level of Goalanda and Ground Water Level (GWL) of 2 Stations of Goalanda, Rajbari with Time.



Variation of Surface Water Level of Baruria and Ground Water Level (GWL) of 2 Stations of Shivalaya, Manikganj with Time



Bank failure phenomena at Afsar sheikher Char

The observations as well as findings were in Paturia side as the following:
i) Cohesive soil layers are observed up to (0-9)m ii) Non-cohesive soil layers are dominant after that depth iii) Slope is sufficient and as much as flat iv) Maximum 119.63kN/m2 stress could be taken by soil v) Due to overpressure on the bank of traffic loading and unloading causes bank failure at the study area

The observations as well as findings were in Daulatdia side as the following:
i) Cohesive soil layers are observed up to (0-12.5)m ii) A number of amount of non-cohesive soil layers are presented iii) Non-cohesive soil layers are dominant after that depth iv) Slope is not sufficient as much as need v) Seepage is more as there are permeable soil layer vi) Seepage line effect the bank vii) Cohesive soil layers are observed up to (0-2)m at Afsar sheikher Char of Daulatdia side viii) Non-cohesive soil layers are dominant ix) Bank is very steep (1:0.5 -1:1) x) Seepage is significant as there are maximum permeable soil layer xi) Shear strength has been decreased with the increases of pore pressure which tends to liquefaction xii) Liquefaction causes bank failure xiii) At monsoon, surface water as well as ground water raises and fluctuates xiv) Failure occurs during the raising period of surface water and fluctuation of ground water xv) Ground water fluctuation at the study area shows various gradient causing seepage failures during dry season xvi) At recession period, ground water level does not fall as surface water level due to various soil properties xvii) At recession period, there is no confining pressure causes bank failure

As per study result, the following recommendations were made:

i) It is essential geotechnical investigation in depth at the study area to adopt any bank stabilization/bank protection works ii) Wave action needs to be considered during the design of the ferry ghat protection works iii) Soil properties at the study area indicate soil strengthening required for bank protection works iv) Sand drain in river protection should be implemented up to low water level v) River bank slope should be horizontal 3 and vertical 1 vi) Water level fluctuation in the river of the study area is much higher during low and high flow, which requires special attention vii) Investigation needs for knowing soil profile and its properties as well as its hydrology viii) Continuous research needs for finding precise bank failure reasons.

A seminar was held at RRI on 25th June, 2019 to share the research objectives, methodologies and research findings so far achieved to the audience and the following picture represent that.

(B) Development of Suitable Technologies for Removal of Manganese from Ground Water in Household, Community and Municipal Levels.

Manganese is an element essential to the proper functioning of both humans and animals. But at excessive concentrations, manganese can be detrimental to health. Evidence from occupational exposure indicates that manganese can affect neurological function. The World Health Organization (WHO) has a provisional health based guideline value of 0.4 mg/l for manganese in drinking water to protect against neurological damage. The WHO guideline value from consumer acceptability consideration is 0.10 mg/l. Bangladesh Standard for manganese in drinking water is also 0.10 mg/1.

The presence of iron and manganese in groundwater could confer colour, poor bitter taste, staining of laundry and plumbing fixtures. Arsenic, on the other hand, if present does not pose any aesthetic problem, but is potential health hazard if its concentration is in excess of guideline value. Detection of high concentrations of manganese in groundwater has added a new dimension to the already

difficult safe water supply scenario in Bangladesh. However, manganese issue has attracted relatively less attention, partly because ground waters high in Mn are often found to be high in Fe as well, and both result in a similar metallic taste. It would be interesting to see whether Mn is removed significantly in the currently operational iron and/or Fe-As removal plants, which have been designed primarily for removal of iron and/or arsenic. In view of the widespread presence of manganese in groundwater in addition to arsenic and iron, it is important to raise awareness among the stakeholders about the manganese issue. It is also very important to identify areas unacceptable levels of manganese and to develop water treatment technologies accordingly. That's why RRI has taken up this research work to develop a suitable technology for removal of Manganese. The major objectives of the present work are to develop suitable technologies and design modifications for manganese removal from ground water in household, community and municipal levels.

Extensive column experiments will be conducted for evaluating the comparative performances of variable adsorbents. For this influent water of varying composition will be passed through filtering materials maintaining a specific flow rate and the effluent water will be collected and analysed for residual Mn. Additional column experiments will be carried out to assess the influence of dissolved oxygen (DO), iron, phosphate, silica, nitrate, chloride pH, Eh, alkalinity on the oxidation/removal of Mn in filter column by varying concentrations in the influent water. Sufficient numbers of filtration units having aeration, flocculation, sedimentation and roughing filtration system will be constructed and necessary modifications will be done at different water quality conditions for evaluating the comparative performances of variable adsorbents in removing Manganese.

Figure: Removal of manganese by contact oxidation method.

For this research work, procurement of chemicals, reagents, filtering materials, materials for laboratory setups and other necessary things have been completed. Manganese removal by contact oxidation method has been started. One filtration units having aeration, flocculation, sedimentation and roughing filtration system has been constructed. Raw water and treated water samples with design criteria are being collected from the existing IRPs from different community and municipality for analysing of residual Mn. Procurement of necessary equipment and other materials are in process. A seminar was held at RRI in this connection on 25th June, 2019 to share the research objectives, methodologies and research findings so far achieved to the audience and the following picture represent that. It is expected that the research will be completed by June, 2020.

3.2 INSTITUTIONAL DEVELOPMENT AND CAPACITY BUILDING PROJECT (Phase-II)

River Research Institute (RRI) is a national organization in Bangladesh and working as a statutory public authority under the Ministry of Water Resources (MoWR), Government of the people's Republic of Bangladesh. Since its relocation to Faridpur in 1991 from Dhaka, RRI has got a big campus having model sheds, model beds, laboratory buildings, office buildings, workshops, residential colonies for officers and staffs, guest house, auditorium and ancillary structures like roads, utility services. Although these physical facilities have been good enough, nevertheless requires updating and replacement of old equipment to carry out multi-disciplinary research and tests in the field of River Hydraulics, Hydraulic Structures and Irrigation, Estuarine and Coastal Hydraulics, Soil Mechanics, Material Testing and Quality Control, Sediment Technology, Hydro-chemistry and Geo-Chemistry and Instrumentation.

RRI carries out tests, research and consultancy in the aforementioned fields using available testing and modelling facilities. Consultancy works and applied researches are being assigned to RRI by the local and foreign clients. In order to modernize the research facilities, RRI formulated and submitted a Development Project Proposal to the Ministry of Water Resources, Government of the People's Republic of Bangladesh in 2005. That project was approved for three years duration started from FY 2005- FY2008 and it was revised in 2008. But all equipment was not procured in time for many technical causes.

On the other hand, present equipment status is very much inadequate to meet up the present demand of the nation and to perform the activities in accordance with the mandate of RRI. In order to keep pace with modern research trend, more sophisticated instruments are needed. So, for the institutional development and capacity building it is necessary to procure new equipment along with replacement of old machineries, maintenance and construction of new research laboratory and repair of existing old buildings. For the continuation of the development of RRI the on-going development project proposal was submitted in 2017 and was approved in 2018. The overall objective of this project is to enhance and update of Geotechnical research laboratory facilities as well as physical and mathematical modelling facilities to conduct test and research in the field of water resources engineering in accordance with RRI's mandate. The specific goal of the project is to procure necessary equipment for the overall institutional development and strengthening of RRI research capability as well as to develop human resources. It is also essential to train up RRI scientists to utilize full potential of the sophisticated high-quality instruments. Considering the above

mentioned needs, the Government of Bangladesh has approved this development project with a project value of 4762.29 lakh BDT. The duration of the project is from January 2018 to July 2021.

Upon completion of this project, RRI in future will be the leading national Institute to contribute meaningfully to the sustainable Water Resources Development Projects in Bangladesh and RRI will develop itself as a self-earning institute under the Ministry of water Resources. RRI would be in a position to take up all sorts of test and researches pertaining to the overall water resources development of the country. The implementation of the project schemes is in progress in the present fiscal year.

There are 26 packages in DDP of which 18 work orders have been issued to the winner supplier. Total Organic Carbon (TOC) analyser, Carbon-Hydrogen-Nitrogen-Sulphur (CHNS) analyser, Real Time .....(RTK) survey system with handy GPS, Total Station, Menard Pressure Meter, Acoustic Doppler Current Profiler (ADCP), Soil and Thermal Resistivity Meter, Dry welding Machine, Pump-motor, Core Cutter Machine have been procured and installed under this project in the fiscal year 2018-19. Besides this, in total seven in-house trainings have been effectuated so far under this project. Officers from all spheres of RRI, has participated in the trainings.

Figure: User training of RTK Survey System

Figure: A view of photo session in connection with Training Course on Application of GIS and Remote Sensing in Water Resources Engineering

Figure: Showing Training sponsored by IDCB Project (Phase-II) on Public Procurement Rules (PPR).

3.3 BAMBOO BANDALLING PILOT PROJECT

River Bank Erosion is a common phenomenon in Bangladesh. Almost, every year, the complicated river network of Bangladesh experiences severe bank erosion all over the country. Changing climate has further aggravated the situation by introducing extreme events such as flash flood, intense precipitation and abnormality in precipitation pattern recurrently. Climate Change driven flash flood and excessive sedimentation in the river bed has caused severe bank erosion in the project locations. Thousands of hectares of agricultural land and household areas are already engulfed by the river bank erosion. Therefore, it is essential to address the bank erosion phenomenon and find out economical, sustainable and eco-friendly way to combat erosion and save life and livelihood of the rural people of Bangladesh. However, flood control, river bank protection and sediment

management consume large amount of government expenditure. Considering this issue, RRI had been conducted (2005-2007) laboratory-based study to investigate the effectiveness of bamboo bandaling structures to protect the river bank erosion and increase of channel navigability. Laboratory based study suggest that, low cost bamboo bandaling structures could be an effective solution to combat bank erosion in small to medium size river having low flow/velocity and less meandering characteristics. Laboratory based research also suggest that:

- Bandals are less expensive solution for the above mentioned problems over conventional methods.
- Bandals lateral interventions can be extended gradually that can be possible using conventional structures, such as groynes and revetments
- Bandals protect river bank erosion through controlling of river flow
- Bandals increase navigational channel depth
- Bandals reclaim river bank land
- Bandals are eco-friendly

3.3.1 Three Year Duration Project

The research-based findings encouraged the River Research Institute to formulate the following three pilot projects in 2016-2017 fiscal year to prevent bank erosion which have been completed during the financial year 2018-2019. Bandals constructed in the following projects are working effectively by reclaiming land, bank protection and channel deepening.

(A) The Pilot Project for the River Bank Erosion of different location in the Jamalpur and Sherpur District.

(B) Pilot Project for construction of Bamboo Bandalling Structures to protect from the erosion of the Old Brahmaputra in different places under Islampur Upazilla and Sadar Upazilla of Jamalpur District.

(C) Pilot Project to protect bank erosion and land reclamation in Rowmari and Fularchar Upazila and its surrounding areas under Kurigram district.

3.3.2 Four Year Duration Project

RRI has taken up a four year long (FY 2017-18 to 2020-21) pilot project entitled **"The Pilot Project in different areas of Bangladesh using Bamboo Bundling Structures to reduce river bank erosion, land reclamation and increase navigation"**. It is a GoB funded project with a financial worth BDT 2384.47 lakh. Under this project 47 km bamboo bandalling structures will be constructed at different rivers in six districts namely Barishal, Khulna, Faridpur, Rajbari, Sirajgonj and Netrokona . These districts have been chosen so as to examine the effectiveness of bandal structures in three types of rivers such as tidal, non-tidal and flashy river. The objectives of the project are as follows:

- to reduce river bank erosion;
- to reduce sedimentation in river bed;
- to increase navigational capacity of river;
- to protect environmental and social disaster by hindering river bank erosion;
- to make land reclamation;
- to develop construction manual for Bamboo Bandalling structures;

The pilot project has a research part comprising of RRI Scientists and consultants. RRI will develop a manual for Bamboo Bandalling structures from the research findings. Out of 25 packages (20 Bandalling construction+ 05 hydro-biological survey works), 24 packages have been tendered. Five work orders relating to hydro-biological survey works have been issued to eligible contractor after completing all due processes. Also 22 work orders for Bamboo Bandaling have been issued to eligible contractor after completing all due processes. Sedimentation to protect bank erosion around some bamboo bandal is already visible in this project. Details performance will be found of this project after end or completion of the project. Two seminars and a series of training program have been conducted from this Bamboo bandalling Project.

Figure: Bandalling in the Madhumati River, at Kamarkhali, Madhukhali, Faridpur

Figure: Bandalling in Shadha River, Doarika, Babuganj, Barishal

Figure: A view of Bamboo bandalling site visited by PD Kazi Rezaul karim (middle) in Shandha River, Doarika, Babuganj, Barishal

Figure: A view of Seminar on "the pilot project in different areas of Bangladesh using Bamboo bandalling structures" held at RRI on 26th June, 2019.

Figure: Mr. Pintu kanungoe, Project Director of the Pilot Project in connection with Bamboo Bandalling Structures presenting a seminar held at RRI on 30th June, 2019.

HUMAN RESOURCES DEVELOPMENT IN RRI

4 HUMAN RESOURCES DEVELOPMENT

RRI has been putting special emphasis to human resources development since its establishment in order to achieve its goals as mandated by the Government of the People's Republic of Bangladesh. Scientists and engineers are working at RRI whose efforts are being put with a view to reach the research standard through innovation of new technologies and ideas in the related fields of activities. RRI is a relatively new organisation of this kind of research in the country. As the technologies of the disciplines concerned are fast developing, the necessity of higher studies and advanced on the job training of the research personnel in the academic and research institutions of similar activities at home and abroad (especially in developed countries) has strongly been highlighted in order that it can keep them abreast of the latest development in the related fields of research. Some of the RRI personnel attended higher studies and training program both at home and abroad.

Figure: DG, RRI delivering speech in a Training Workshop as chief guest at RRI Conference room.

RRI conducted eight in-house training programs for skill development of its scientists and engineers during the 2018-19 fiscal year of which five training programs (serial nos 2, 4, 5, 7 and 8) organized under Institutional Development and Capacity Building (IDCB) Project (Phase-II) for River Research Institute (RRI), Faridpur and two training programs (serial nos 1 and 3) organized under Bamboo Bandalling Project and remaining under establishment budget. RRI also conducted three seminars to share knowledge, views and findings among the scientists and officers during the 2018-19 fiscal year. The venue for these training programs and seminars was RRI conference room. Almost all scientists and officers took part in these training programs and seminars. The title and duration of these training programs and seminars were as the following:

Sl No	Title of the training or Seminar	Duration
1	Training Course on Public Procurement Rules (PPR) particularly on Goods	12.10.18-14.10.18
2	Training Course on River Basin Modeling	18.12.18-20.12.18
3	Training on Annual Performance Agreement	19.01.2019
4	Short Training Course on Application of GIS and Remote Sensing in	

	Water Resources Engineering	31.01.19-02.02.19
5	An Overview of Development Project Proposal and Public Procurement Rules (PPR)	12.04.19-13.04.19
6	আচরণ বিধিমালা ১৯৭৯, সচিবালয় নির্দেশিকা ২০১৪, বার্ষিক কার্যসম্পাদন প্রতিবেদন এবং অভিযোগ প্রতিকার ব্যবস্থার উপর প্রশিক্ষণ কর্মশালা	22.05.19-23.05.19
7	Training Course on 1) Water Resources Engineering: Bamboo Bandalling and its effect and 2) Hydrodynamic and Hydro morphological Approach: A Perspective for Bank Protection Works	17.06.19-19.06.19
8	Training Course on Sustainable Management of River and Floodplain in Bangladesh	20.06.19-22.06.19
9	Seminar on Investigation of Geotechnical Reasons for bank failure on Daulatdia and Paturia side of Padma river of Bangladesh	25.06.2019
10	Seminar on Development of Suitable Technologies for Removal of Manganese from Ground Water in Household, Community and Municipal Levels.	
11	Seminar on The Pilot Project for the River Bank Erosion of different location in the Jamalpur and Sherpur District.	26.06.2019
12	Seminar on The Pilot Project in different areas of Bangladesh using Bamboo Bundling Structures to reduce river bank erosion, land reclamation and increase navigation.	
13	Seminar on Pilot Project for construction of Bamboo Bandalling Structures to protect from the erosion of the Old Brahmaputra in different places under Islampur Upazilla and Sadar Upazilla of Jamalpur District.	30.06.2019

RRI specialists also took part in training program or workshop organized by different organizations as an expert or trainer in the field of river hydraulics and morphology, navigation, hydraulic modelling, bridge hydraulics etc. Besides, some training has been conveyed to RRI officials and staffs of different categories on group basis. The name of the persons took part in seminar, conference; workshop and training (out side of RRI) during the year 2018-2019 are mentioned below.

Expert Workshop on "River Navigability and Inland Shipping in Bangladesh: Economic Importance and Impacts of Environmental Change"

Figure: Active participation in a workshop by Md. Alauddin Hossain, PSO, RRI at Dhaka University.

Figure: A view of in-house Training Workshop on Online Grievance Redress System held at RRI conference room.

Table 4.1: Persons attended in higher studies, seminar, conference, workshop and training in the fiscal year 2018-19

SL. No.	Name & Designation	Name of Course/Seminar/ Workshop/Training	Course Period (Date)
1	Engr. Md. Alauddin Hossain Principal Scientific Officer	Expert Workshop on "River Navigability and Inland Shipping in Bangladesh: Economic Importance and Impacts of Environmental Change" organized by Vanderbilt University of USA in partnership with Dhaka University, Independent University of Bangladesh, International Centre for Climate Change Adaptation and Development (ICCCAD) and Reverine people in Bangladesh held at CARS Auditorium, DU, Dhaka.	07.07.18
		Seminar on "River pollution, illegal acquisition and river protection from different pollution" organized by National River Protection Commission held at Head Quarters, NRPC, Dhaka.	29.10.2018
		Training on "Online Grievance Redress System Version-II" organized by Cabinet division held at Bangladesh Secretariat, Dhaka.	04.12.2018
		Training on "Development Project Preparation and Management" organized by BARD, Kotbari, Comilla.	06.01.19 to 11.01.19

SL. No.	Name & Designation	Name of Course/Seminar/ Workshop/Training	Course Period (Date)
		Training on "Online Grievance Redress System Version-II" organized by Ministry of Water Resources (MoWR) held at Bangladesh Secretariat, Dhaka.	04.02.2019
		National seminar on "Engineers for Leadership in Sustainable Infrastructure Development in Bangladesh" organized by IEB, held at Ramana, Dhaka.	03.03.19 to 04.03.19
		Certificate Training Course on "Fundamentals on GIS using ArcGIS" organized by Department of Geography and Environment of DU.	22.03.19 to 04.05.19 Every Friday & Saturday
2	Md. Azmal Hossain Fakir Librarian	E-book preparation course	11.10.18
3	Nayan Chandra Ghosh Scientific Officer	Certificate Training Course on "Fundamentals on GIS using ArcGIS" organized by Department of Geography and Environment of DU.	22.03.19 to 04.05.19 Every Friday & Saturday
		Public Procurement Processing and Approval Procedure	06.08.18 to 09.08.18
4	Engr. Sumiya Ferdhous Scientific Officer	Achieving Sustainable Development Goal in Bangladesh	01.07.18 to 05.07.18
5	Engr. Bikash Roy Scientific Officer	Concept and Practice of Integrated Resources Management Course	22.09.18 to 27.09.18
6	Engr. Md. Masuduzzaman Assistant Programmer	Training on "Online Grievance Redress System Version-II" organized by Cabinet division held at Bangladesh Secretariat, Dhaka.	04.12.2018
		Training on "Online Grievance Redress System Version-II" organized by Ministry of Water Resources (MoWR) held at Bangladesh Secretariat, Dhaka.	04.02.2019
7	A.K.M. Shahadad Hossain Audit Assistant	Financial Management Course	10.02.19 to 21.02.19
8	Md. Enayetur Rahman Khan Data Entry Operator	Fundamental Training Course	12.06.19 to 23.06.19
9	Md. Motahar Hossain Office Assistant-Cum-Computer Operator	Fundamental Training Course	05.11.18 to 25.11.18
10	Md. Rasel Kabir Computer Operator	Information Communication and Technology (ICT) Course	07.10.18 to 18.10.18
11	Md. Naimur Rahman Computer Operator	Office management and ICT course	09.09.18 to 20.09.18
12	Md. Abdul Mozid Sarker Lab Technician-C	Fundamental Training Course	05.03.19 to 01.04.19

SL. No.	Name & Designation	Name of Course/Seminar/ Workshop/Training	Course Period (Date)
13	A.B.M. Tajul Islam Soil Technician-B	Fundamental Training Course	11.10.18 to 21.10.18
14	Md. Nazrul Islam Soil Technician-B	Fundamental Training Course	29.10.18 to 25.11.18
15	Md. Mahbubul Alam Soil Technician-A	Fundamental Training Course	08.04.19 to 28.04.19
16	Md. Rasel Sheikh Lab Technician -A	Fundamental Training Course	04.03.19 to 24.03.19
17	Md. Ekramul Haque Lab Technician -A	Fundamental Training Course	03.12.18 to 23.12.18
8	Md. Altaf Hossain Office Helper	Fundamental Training Course	17.12.18 to 30.12.18
19	Md. Mahbubur Rahman Office Helper	Fundamental Training Course	19.04.19 to 12.05.19
20	Anil Kumar Singha Office Helper	Fundamental Training Course	23.06.19 to 27.06.19

Figure: Mr. Md. Motaher Hossain, Joined Secretary, MoWR delivering speech in a Training Program on Online Grievance Redress System (Version-II) at MoWR's Conference room

Figure: A view of Training Course on Application of GIS and RS in Water Resources Engineering at RRI Conference room.

Figure: A view of Training program on "Annual Performance Agreement" attended Mr. Md. Eusuf Harun Khan, Programmer, MoWR as a Trainer (left at first).

Figure: DG, RRI delivering speech in a training program

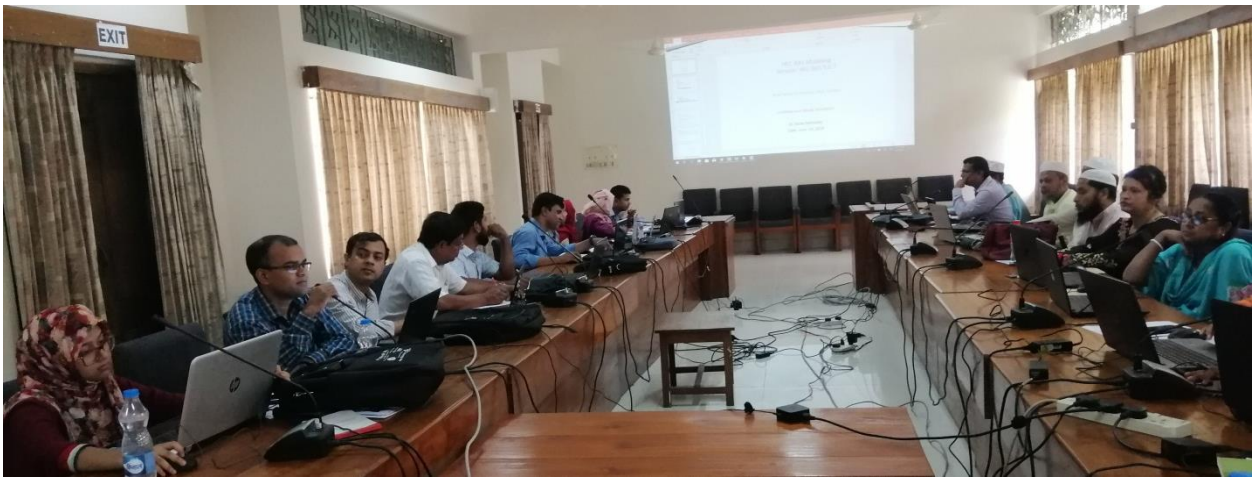


Figure: A moment of training on Hydrodynamic and Hydro morphological Approach: A Perspective for Bank Protection Works.

Figure: Professor Dr. Md. Munsur Rahman, IWFM, BUET delivering speech in a training program held at RRI.

Figure: Dr. Md. Alauddin Hossain, PSO receiving certificate from BARD, Comilla in connection with Development Project Planning and Management Training Course

5 FINANCIAL MANAGEMENT

River Research Institute is a national organization having mandate of a statutory Public Authority under the Ministry of Water Resources, Government of the People's Republic of Bangladesh. The annual expenses are being borne by its own income and some grant from the Government revenue budget. The main sources of RRI's own income are revenue received from model studies (physical and mathematical model), and geo-technical testing fee (testing of soil, concrete, water and sediment sample). Detailed budgetary information (income and expenditure) for the fiscal year 2018-2019 and 2017-2018 is given below:

Income and Expenditure account for the fiscal year 2018-2019

Income		Expenditure	
Items	Taka (Lakh)	Items	Taka (Lakh)
Govt. grant	1539.20	Establishment: • Officers salary 232.95 • Staff salary 345.49 • Allowances 512.98 • Supply and services 372.84 • Capital expenditure 30.07 • Refund of non-expended money 44.85	1539.20
Model study	186.11	Model study	126.60
Geotechnical testing fee	40.54	Geotechnical testing	18.40
Others	29.27	Surplus (+)	110.92
Total	1795.12	Total	1795.12

Income and Expenditure account for the fiscal year 2017-2018

Income		Expenditure	
Items	Taka (Lakh)	Items (Lakh)	Taka (Lakh)
Government grant	1376.60	Establishment: • Officers salary 223.86 • Staff salary 342.49 • Allowances 530.03 • Supply and services 193.32 • Repair & maintenance 52.22 • Capital expenditure 28.30 • Estab. cost by own fund -	1370.22
Model study	395.51	Model study	260.51
Geotechnical testing fee	31.42	Geotechnical testing	15.60
Others	27.57	Refund of non-expended money	6.38
Total	1831.10	Surplus (+)	178.39
		Total	1831.10

Significant features of RRI's income, expenditure and closing balance in recent years (last 5 years) are given below in Table 5.1, Table 5.2 and Table 5.3 respectively.

Table 5.1: Income statement

Sl. No.	Sources of income	Total (Tk. in lakh)				
		2014-2015	2015-2016	2016-2017	2017-2018	2018-2019
1	Model study & geo-technical testing fee	116.92	71.33	316.51	426.93	226.65
2	Govt. grant	840.00	1071.32	1245.00	1376.60	1539.20
3	Others	10.98	22.11	20.47	27.57	29.27
	Total	967.90	1164.76	1581.98	1831.10	1795.12

The above income statement is also presented below as pie chart.

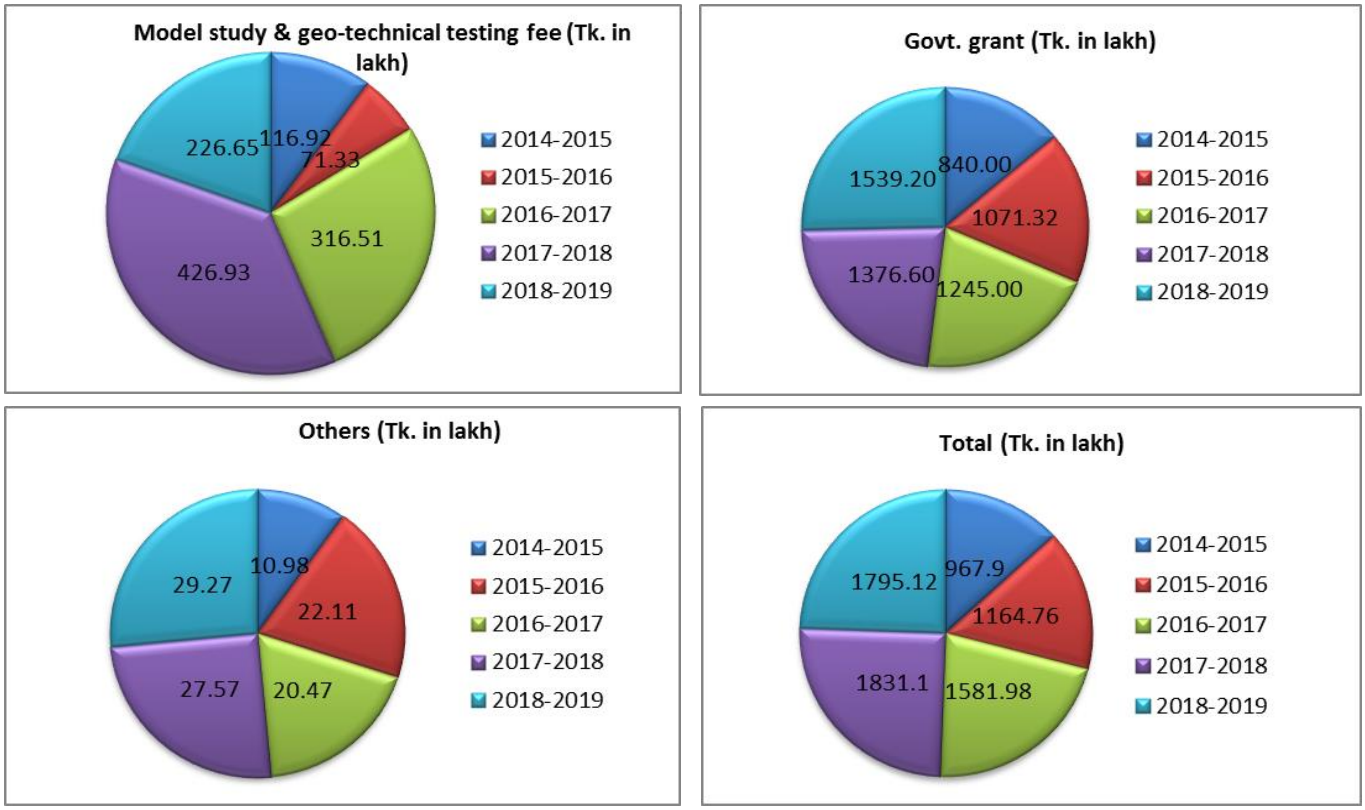


Figure: Income statement chart

Table5.2: Expenditure statement

Sl. No.	Description	Total (Tk. in lakh)				
		2014-2015	2015-2016	2016-2017	2017-2018	2018-2019
1	Model study and Geo-technical testing.	67.53	40.08	186.49	276.11	145.00
2	Establishment	835.27	1089.66	1290.57	1370.22	1494.35
3	Refund of non-expended money	4.73	-	-	6.38	44.85
	Total	907.53	1129.74	1477.06	1652.71	1684.20

The above expenditure statement is also presented below as pie chart:

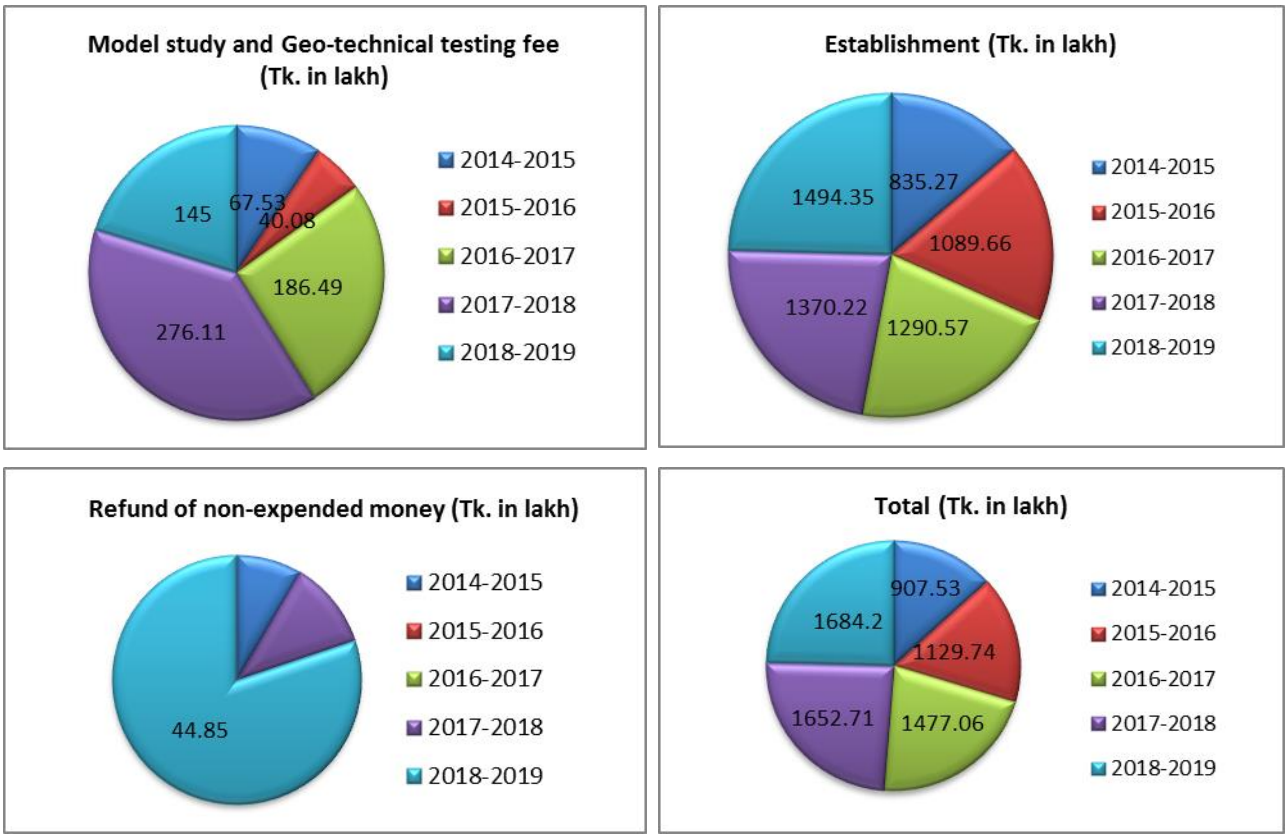


Figure: Expenditure statement chart

Table 5.3: Closing balance

Sl. No.	Description	Total (Tk. in lakh)				
		2014-2015	2015-2016	2016-2017	2017-2018	2018-2019
1	Closing balance on the basis of self income and govt. grant	(+) 60.37	(+) 35.02	(+) 104.92	(+) 178.39	(+) 110.92

NB: (+) indicates surplus.

The above closing balance is also presented below as pie chart.

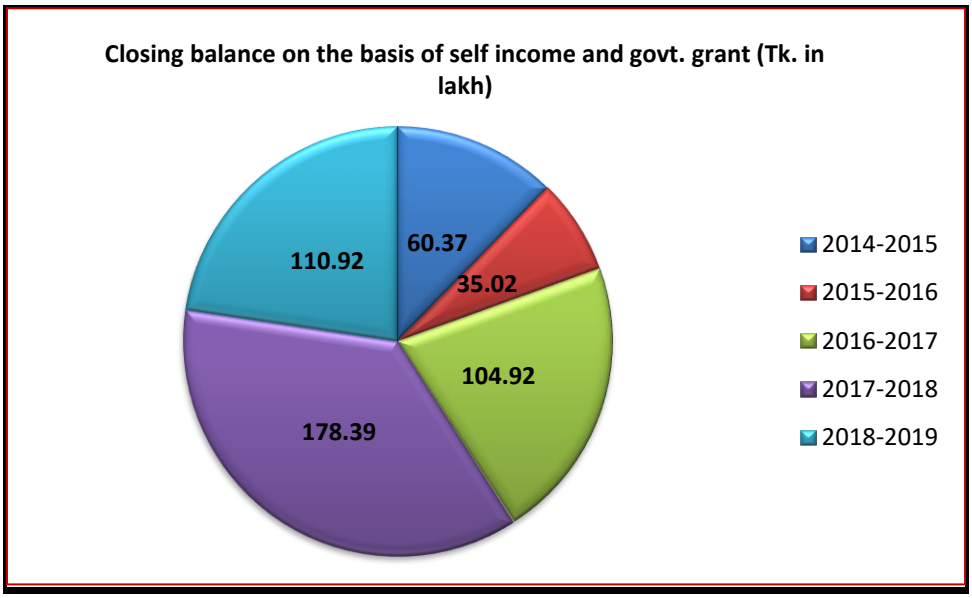


Figure: Closing balance chart

6 INVENTORY OF PROJECTS WITH REVENUE RECEIVED

The revenue earned from the model studies conducted by Hydraulic Research Directorate and revenue earned from the sample test conducted by Geotechnical Research Directorate is described in the following section.

HYDRAULIC RESEARCH DIRECTORATE

In the fiscal year 2018-19, Hydraulic Research Directorate has received revenue from six physical model studies. Partial money was received against three physical models. The name of the models with estimated cost and money received is shown in **Table 6.1**.

Table 6.1: Name of the models with estimated cost and money received

Sl. No.	Name of the model	Total estimated cost (Tk in lakh)	Money received during 2018-19 (Tk in lakh)	Remarks
1	Physical model study for supporting design of the proposed Bangabandhu Railway Bridge over the river Jamuna	350.00		Completed
2	Laboratory Based Study using Physical Modelling on River Bank Erosion Control using Concrete Block Mats and Placed Concrete Blocks with Filter on the Arial Khan River at Madaripur	74.73		Completed
3	Physical Model Investigation for Sustainability of the Buriganga River Restoration Project	95.00	24.12-	Completed
4	Preservation and maintenance of the east guide bund (EGB) sectional model	180.00	90.00	On going
5	Physical Model Study for Padma River Dredging Management in Jajira and Naria Upazilla under Shariatpur District	199.39	118.46	Completed
6	Math model study for hydro-morphological and environmental impact assessment of the Derai-Sullah Road in Sunamganj district.			Completed
	Total		232.58	

GEOTECHNICAL RESEARCH DIRECTORATE

During the fiscal year 2018-19, volume of works done and revenue earned by Geotechnical Research Directorate have been shown in Table 6.2.

Table 6.2: Volume of works done and revenue earned during the fiscal year 2018-19

Sl. No.	Name of the discipline	Total nos. of samples tested	Total billed (Tk. in lakh)	Money received (Tk. in lakh)
1	Soil Mechanics & Ground Water Eastern & Western Zone.	Disturbed-1268 Undisturbed-00	27.58	51.56
2	Material Testing and Quality Control.	63	1.70	1.70
3	Sediment, Chemical and Water Pollution.	399	3.18	2.76
	Total	1730	32.46	56.02*

***Received money is more than total billed amount because previous year due money has been received.**

7. FUTURE DEVELOPMENT PROSPECTS

Since its establishment as a national organization with distinct mandates for rendering services to deal with river related problems and to devise economic and sustainable solutions to the problem RRI has been discharging its responsibilities using established facilities and available man power. At the beginning, the main focus was physical modelling and soil and material testing mainly to support planning and design of different water infrastructures and Bangladesh Water Development Board (BWDB) was the main client. With the passage of time physical modelling technology has been applied to address wide range of river related issues namely sediment management at the off-take, river restoration, bridge and barrage hydraulics, river dredging etc. However, the application of physical modelling technology was very limited for tidal and coastal systems due to lack of required modelling facilities. In order to meet the growing need for comprehensive and multidisciplinary studies RRI adopted mathematical modelling technology in 2007 as a tool for conducting model studies side by side physical modelling technology. At the same time a number of RRI engineers and scientists pursued higher education in different disciplines and many of them are trained at home and abroad to enable RRI to carry out multidisciplinary studies. Under an institutional development and capacity building project a number of sophisticated equipment were procured to upgrade testing facilities. However, some facilities are yet to be established to carry out all mandated activities as well as to deal with new challenges and emerging issues in water sector. With this end in view the second phase of institutional development and capacity building project has begun in the financial year 2017-18.

For RRI to function as a pioneering organization in water sector and to cope with the increasing demand of the time in the competitive market; institutional development, instrumentation, sustainable technology and highly trained manpower are very essential to enhance the standard of service to international level. From this point of view the following future development prospects are important to be mentioned:

- Now-a-days, Information Technology (IT) has become a very useful tool for research and studies, sound management and transparent administration in the world. RRI has to encounter this new challenge to meet the demand for quality services.

- RRI has already established a network system by connecting all the activities of this institute. For this RRI has completed all the installations and collected software, hardware and networking components required. By this time, LAN is working at RRI. A complete wing (manpower & logistics) wing will be required to govern the IT sector in RRI.

- Two Material Testing and Quality Control field laboratories at Bogra and Barisal have already been established. A liaison office is situated at 72, Green Road, Dhaka. In the liaison office soil, building materials, sediment & water samples are being received from BWDB and other Govt, Semi-Govt, NGOs and consulting firms. There is system for bringing the collected samples to RRI headquarter in Faridpur within a short period of time to complete the tests in due time. The test results are furnished to the clients in report form to execute the work of the projects in scheduled time. RRI is contemplating to establish field laboratory in all district headquarters of the country to make its services easily available.

- RRI has already established well-equipped Math Model LAB with internet facilities and uninterrupted power supply required to support mathematical modelling. However, existing facilities need to be expanded and upgraded by purchasing more computers and accessories,

installing updated modelling softwares, introducing modelling in new areas and imparting training to the modellers. Some of the needs are expected to be fulfilled under the on going IDCB project. It is understood that in order to further expand the RRI mathematical modelling services a full-fledged Math Model LAB has to be established in Dhaka.

- RRI successfully completed the physical model studies of some of the biggest projects of Bangladesh namely Bangabandhu Railway Bridge Project, Paira Bridge Project, Bangabandhu Bridge Project, Padma Multipurpose Bridge Project, Ganges Barrage Project, Gorai River Restoration Project, Arial Khan Roadway Bridge Project, 3rd KarnafullyRoadway Bridge Project, Kushtia Town Protection Project etc. However, due to lack of needed facilities RRI could not do much in physical modelling of coastal systems. Initiatives have already been taken to establish the tidal and coastal modelling facilities and to train scientists in this field.

- RRI may act as a focal institution of its peripheral region to investigate regional water resources problems. A monitoring cell may be established at RRI to monitor the natural hazards like flood, draught, bank erosion, earthquake etc. As a focal institution, RRI may provide consultancy services to the Government, Local Authority of any organizations or may directly advise the beneficiaries to take precautionary measures against those hazards.

- RRI is working in collaboration with BUET and is willing to work with similar foreign institutions like CWPRS (India), DHI (Denmark), Delft Hydraulics (The Netherlands), HR Wallingford (UK), NHC (Canada), SMEC (Australia), LHI (Sri Lanka) etc. Efforts are being made by RRI to start joint venture/bi-lateral study/research projects with these similar international institutions.

- More opportunities should be extended for RRI research personnel for imparting higher studies leading to MS/Ph D degree and other advanced on-job training. There should also have enough scope for RRI officials to participate in the national/international seminar, symposium, congress, workshop etc.

- It can be mentioned here that though RRI is primarily catering the needs for national agencies, with the gradual development of manpower and technology, the institute will fulfil the demands for international bodies and organizations in future.

Water Resources Secretary, IHE expert and Ex-DC Faridpur in a meeting at RRI Conference room.

Annex-I

PERSONNEL OF RRI

List of the Existing Scientific, Administrative and Supporting Managerial Personnel of RRI

(As on October 2019)

Sl. No.	Name of Officer	Designation & Contact Information	Qualification	Photo
1	Md. Alim Uddin (Joined Secretary)	Director General	M.S.S. (Economics), DU, Dhaka	
2	Arun Chandra Mahottam (Deputy Secretary)	Director (Admin & Finance) mahottam@yahoo.com	M.S.S. (Social Welfare), ISWR, DU, Dhaka	
3	Dr. Engr. Md. Lutfor Rahman	Director H/R (Suspended) mdlutforrahman10@yahoo.com	B.Sc.Engg. (Civil), BUET, PGD (Env. Water) in UK, M.Engg. (WRE), BUET, Ph. D, DUET; Life F-IEB, M-BCS, M-BAAS, Life M-NOAA, Life M-SH.	
4	Engr. Swapan Kumar Das	Director G/R (In charge) & Chief Scientific Officer (H/R) swapanwre@gmail.com	B.Sc.Engg. (Civil),Engineering College, Khulna, M.Engg. (WRE), BUET; PGT in IHE, Delft, The Netherlands, India & Canada; F-IEB.	
5	Engr. Pintu Kanungoe	Director H/R (In charge) & Chief Scientific Officer (H/R) pintu_kanungoe@yahoo.com	B.Sc. Engg. (Civil), BUET, M.Engg. (Hydraulic Engg.), IHE, Delft, The Netherlands; PGT in Nepal, The Netherlands, Myanmar and Indonesia; F-IEB.	
6	Engr. Kazi Rezaul Karim	Chief Scientific Officer razu6511@yahoo.com	B.Sc. Engg. (Civil), BUET, PGD (Hydrology), Belgium.	
7	Uma Saha	Principal Scientific Officer umasaha_65@yahoo.com	B.Sc. (Hons), M.Sc. (Physics), JU, MBA (MIS), PU; PGT in The Netherlands, Malaysia & India; LM-BPS.	
8	Sheela Rani Chowdhury	Principal Scientific Officer sheela_chowdhury@yahoo.com	B.Sc. (Hons), M.Sc. (Physics), RU; PGT in The Netherlands & India; LM-BPS.	

Sl. No.	Name of Officer	Designation & Contact Information	Qualification	Photo
9	Engr. A. K. M. Ashrafuzzaman	Principal Scientific Officer ashrafcebuet89@gmail.com	B.Sc. Engg. (Civil), BUET, M. Engg. (Water Resources), BUET; M. Sc. (Hydrology & Water Resources), IHE, Delft, The Netherlands; PGT in IIT, Roorkee, India, Trained in BPATC; F-IEB.	
10	Engr. Md. Abul Ala Moududi	Principal Scientific Officer moududi80@yahoo.com moududi78@gmail.com	B.Sc. Engg. (Agril), BAU, Mymensingh, M. Engg. (WRE), BUET; PGT in IHE, Delft, The Netherlands, Trained in BUET; F-IEB.	
11	Engr. Md. Azizul Haque Podder	Principal Scientific Officer mdazizul66@yahoo.com	B.Sc .Engg. (Agril), BAU, M.Sc. (WRS), ITC, The Netherlands; F-IEB.	
12*	Engr. Syed Md. Anwaruzzaman	Principal Scientific Officer anwaruzzaman1968@gmail.com	B.Sc .Engg. (Agril), Gold Medalist, BAU, M. Engg. (WRE), BUET; Trained in IEB, BPATC, RPATC& BIM; F-IEB, M-KIB & MBSAE.	
13	Engr. Md. Matiar Rahman Mondol	Principal Scientific Officer mrmondol68@gmail.com	B.Sc. Engg. (Civil), BUET, M.Sc. Engg. (Civil & Environmental Engg.), BUET, Trained in RPATC; F-IEB.	
14	Dr. Engr. Md. Alauddin Hossain	Principal Scientific Officer alauddin_1968@yahoo.co.uk babulala68@gmail.com	B.Sc. Engg. (Agril), BAU, Mymensingh, M. Engg. (WRM), UNESCO-IHE, Delft, The Netherlands; PhD, RU; PGT in IRBM (China), Building Flood Disaster Resilience of cities (Nepal), River Delta Planning (Vietnam), PGD in Groundwater Governance (India & Nepal); Life F-IEB, M-KIB, M-BSAE.	
15	Md. Zahangir Alam	(Deputy Secretary-7869) Deputy Director zalam14bcs@gmail.com	B.A. (Hons), M.A. (History) Jahangirnagar University, Savar, Dhaka	
16	Engr. Gias Uddin Ahmed	Senior Scientific Officer	B.Sc.Engg. (Agril), BAU, Mymensingh; Trained in BPATC.	
17	Dr.Engr. Moniruzzaman Khan Eusufzai	Senior Scientific Officer mzk1973_82@hotmail.com	B.Sc. Engg. (Agril), M.S (IWM), BAU, PhD (Environmental Science), Japan; Post doc (Climate Change), Japan; F-IEB	
18	Dr. Engr. Fatima Rukshana	Senior Scientific Officer frukshana11@gmail.com	B. Sc. Engg.(Agril), M.S (FPM), BAU; PhD (Soil and Environmental Sci.), LTU, Australia; PGT (GIS and Remote Sensing for Water Sector), UNESCO-IHE, The Netherlands; F-IEB, M-ASSI, M-IUSS.	

Sl. No.	Name of Officer	Designation & Contact Information	Qualification	Photo
19	Engr. Shailen Kumer Ghosh	Senior Scientific Officer shailenghosh1967@gmail.com	B.Sc. Engg. (Mechanical) BIT, Dhaka; M-IEB, Trained in BPATC, RPATC, BIM	
20	Engr. Md. Johurul Islam	Senior Scientific Officer johurul1999@yahoo.com	B.Sc. Engg. (Civil), BUET, Trained in BUET, BPATC, RPATC, BIM; M-IEB.	
21	Md. Abul Ehsan Miah	Photographer/ PRO ehsanrubel68@gmail.com	B.S.S RU, Trained in Photography, BPI, Dhaka.	
22	Md. Abu Zafar	Assistant Director	M.A (NU), LLB, Trained in RPATC.	
23	Md. Azmal Hossain Fakir	Librarian azmal1966@gmail.com	B.A (Hons), M.A (Geography); PGD in Library & Information Science, RU; PGT in New Delhi, India; Trained in RPATC.	
24	Nasima Khatun	Personal Secretary to Director General	B.A, NU, Diploma in Computer Science; Trained in RPATC.	
25	Engr. Mohammad Mehedi Hasan	Scientific Officer mhsn.rri.bd@gmail.com	B.Sc. Engg. (Agril), BAU, Mymensingh; M.Sc. (Environmental Engg.), BUET; M.Sc.Engg. (WRE), KU Leuven, Belgium; Trained in RPATC, NAPD; M-IEB.	
26	Md. Dulal Bawali	Scientific Officer dulal.bawali@gmail.com	B.Sc. (Hons), M.Sc.in Applied Physics Electronics and Communication Engineering, Islamic University, Kustia.	
27**	Engr. Md. Zubayerul Islam	Scientific Officer zubi_ageng@ yahoo.com	B.Sc. Engg. (Agril), M.S in Farm Structure, BAU, Mymensingh; M-IEB.	
28	Md. Jahangir Alam	Accounts Officer Jahangir_rri@yahoo.com	B.Com, DU; Trained in RPATC.	

Sl. No.	Name of Officer	Designation & Contact Information	Qualification	Photo
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***** Indicates Mr. Anwaruzzaman has been expired on 08.09.2018 at 1.00 AM (Inna lillahe owa inna illahe owa rajeun)

** Indicates deputation for higher study in abroad

# Indicates deputation within the country

ANNEX-II

NATIONAL DAYS CELEBRATED IN RRI, VISITED IN RRI AND MEMORABE MOMENT

National Mourning Day-2018

DG RRI along with Directors watching drawing competition arranged on the occasion of National Children's Day 2018 and birth anniversary of the Father of the Nation

Photo: Placing Floral wreaths to Bangabandhu's Portrait on National Mourning Day 2018

Photo: Mournful procession in RRI Campus on National Mourning Day 2018

Victory Day-2018

	Photo: DG, RRI along with high Officials and staff rising flag on the occasion of victory day 2018
	**Photo: Placing Floral wreaths to Bangabandhu's Portrait on Victory Day 2018**
	Photo: DG, RRI watching drawing of a child on the occasion of victory day 2018

	Photo: DG, RRI along with high Officials seated RRI auditorium for discussion meeting on the occasion of victory day 2018
	Photo: DG, RRI along with Officials watching game on the occasion of victory day 2018

Language Martyrs Day and International Mother Language Day-2019

Photo: DG, RRI along with Officials and Staff waiting to pay respect to the Language Martyrs

Photo: Placing Floral Wreaths at Shahid Minar to pay respect to the Language Martyrs

Photo: Procession on the occasion of Language Martyrs Day and International Mother Language Day

National Children Day and Birth Anniversary of Father of the Nation-2019

Photo: DG, RRI along with Officials and Staff waiting to pay respect to the Father of the nation

Photo: Placing Floral wreaths to Bangabandhu's Portrait on National Child Day 2019

Photo: A colorful rally on the occasion of National Child Day-2019 in RRI Campus

Photo: DG, RRI and others watching drawing competition on the occasion of National Child day 2019

Photo: Showing drawing competition in RRI campus on National Child Day-2019

Photo: DG, RRI and others watching drawing competition on the occasion of National Child day 2019

Photo: DG, RRI delivering speech and celebrating birth anniversary of the father of the nation

Photo: Birth anniversary of the father of the nation celebrating typical way in RRI rest house

National and Independence Day-2019

Photo: DG, RRI along with high Officials and staff rising flag on the occasion of Independence day 2019

Photo: A view of moment at RRI auditorium during the occasion of the independence day-2019

Photo: DG, RRI and other high Officials seated in a prize ceremony on the occasion of Independence day

Figure: A view of audience at RRI auditorium on the occasion of National Day-2019

Figure: DG RRI along with Directors distributing prize to the winner of drawing competition on the occasion of National Child Day and birth anniversary of the Father of the Nation.

Figure: DG RRI along with Directors distributing prize to the winner of drawing competition on the occasion of National Child Day and birth anniversary of the Father of the Nation.

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Photo: DG, RRI leading a colorful rally on the occasion of Bengali new Year celebration.

Photo: A view of moment during celebration of "Pohela Baishakh" at RRI campus.

Photo: DG, RRI and other Officials and Staff waiting for colorful procession at RRI Campus.

Figure: Pohela Baishak celebration with cultural program in RRI Campus

Figure: DG, RRI along with other Officials and Staff watching and enjoying cultural program.

Figure: Pohela Baishak celebration with cultural program in RRI Campus

Photo: A view of Baishakhi voje at RRI Campus before starting cultural program.

World Water Day-2019

Photo: A colorful procession of RRI team during the World Water Day-2019

Photo: A colorful procession of RRI team during the World Water Day-2019

RRI visited by

Figure: Water Resources Secretary getting informed about RRI physical model activities during his model site visit

Figure: Water Resources Secretary along with IHE Experts, the then DC Faridpur, the then DG RRI and

RRI Officials during his visit to RRI

Photo: DG, RDA and Mongla Port Representative visit model facilities in RRI.

Photo: Mr. Md. Mahmudul Hasan, Additional Secretary, MoWR visited RRI and observed model study.

Photo: Ex DG of RRI Mr. Md. Azam Khan, Joined Secretary visited RRI.

Photo: Mr. Md. Mahmudul Hasan, Additional Secretary, MoWR visited RRI.

Memorable moment (Never-to-be forgotten)

Photo: Water Resources Secretary welcome to DG, RRI at MoWR's Conference room.

Photo: DG, RRI Mr. Md. Alim Uddin giving greetings to Mr. Zahangir Alam, DD, RRI during fare-well program.

Photo: Dr. Md. Alauddin Hossain (middle) having a memorable moment with others trainees at BARD, Comilla.

Photo: A view of memorable moment in Singapore visited for pre shipment inspection in connection with Institutional Development and Capacity Building Project (Phase-II).

LIST OF ABBREVIATIONS

Annex III

AD	Assistant Director
ADB	Asian Development Bank
AFPM	Active Flood Plan Management
A & F	Administration and Finance
A & FD	Administration and Finance Directorate
AIT	Asian Institute of Technology
ASTM	American Society for Testing Materials
ASO	Assistant Scientific Officer
ASSSI	Australian Society of Soil Science Inc.
B.A	Bachelor of Arts
BAU	Bangladesh Agricultural University
BARD	Bangladesh Academy for Rural Development
BCL	Bangladesh Consultant Limited
BCSIR	Bangladesh Council of Scientific and Industrial Research
BIAM	Bangladesh Institute for Administrative Management
BIM	Bangladesh Institute of Management
BIT	Bangladesh Institute of Technology
BIWTA	Bangladesh Inland Water Transport Authority
BIWTC	Bangladesh Inland Water Transport Corporation
BoG	Board of Governors
BPATC	Bangladesh Public Administration Training Centre
BPI	Bangladesh Photographic Institute
BPS	Bangladesh Physical Society
BRRP	Buriganga River Restoration Project
BUET	Bangladesh University of Engineering & Technology
BWDB	Bangladesh Water Development Board
CBM	Concrete Block Mats
CBR	California Bearing Ratio
CC	Certificate Course
CERP	Coastal Embankment Rehabilitation Project
CEGIS	Centre of Environmental and Geographic Information Services
CPT	Cone Penetration Test
CPU	Central Processing Unit
CPTU	Central Procurement Training Unit
CSO	Chief Scientific Officer
CT	Concrete Technician
CUET	Chittagong University of Engineering & Technology
CWPRS	Central Water and Power Research Station
CZEM	Coastal Zone Engineering and Management
DDC	Design Development Consultants Limited
DC	District Commissioner
DD	Deputy Director
DG	Director General
DHI	Danish Hydraulic Institute
DIFPP	Dhaka Integrated Flood Protection Project

Dip.	Diploma
DIFPP	Dhaka Integrated Flood Protection Project
DPP	Development Project Proforma
D/S	Downstream
DU	Dhaka University
DUET	Dhaka University of Engineering & Technology
EC	Electrical Conductivity
EEE	Electrical & Electronics Engineering
EGIS	Environmental and Geographic Information Service
EGB	East Guide Bund
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
ESIA	Environmental impact statement
ENGG.	Engineering
FAP	Flood Action Plan
FCDI	Flood Control, Drainage & Irrigation
F-IEB	Fellow of the Institution of Engineers, Bangladesh
FM	Fineness Modulus
FPM	Farm Power and Machinery
GBSP	Ganges Barrage Study Project
GDP	Gross Development Profit
GHH	Ground Water Hydrology
GIS	Geographic Information System
GO	Government Order
GoB	Government of Bangladesh
GR	Geotechnical Research
GRD	Geotechnical Research Directorate
GRRP	Gorai River Restoration Project
GWC	Ground Water Circle
Hons	Honours
HP	Horse Power
HR	Hydraulic Research
HRD	Hydraulic Research Directorate
HRL	Hydraulic Research Laboratory
IAD	Integrated Agricultural Development
IBAIS	International Business Administration and Information System
ICDDRB	International Centre for Diarrheal Disease Research and Rehabilitation, Bangladesh
IDCB	Institutional Development and Capacity Building
IEB	Institution of Engineers, Bangladesh
IHE	International Institute for Infrastructural, Hydraulic and Environmental Engineering
IIT	Indian Institute of Technology
IMED	Implementation, Monitoring and Evaluation Department
IRD	Integrated Rural Development
ITC	International Institute for Aerospace Survey and Earth Sciences
IUSS	International Union of Soil Science
IWFM	Institute of Water and Flood Modelling
IWM	Institute of Water Modelling / Irrigation and Water Management
IWRM	Integrated Water Resources Management
JOCL	Japan Overseas Consultants Limited.
JU	Jahangirnagar University
KUET	Khulna University of Engineering & Technology

KUL	Katholic University of Leuven
KVA	Kilo Volt Ampere
LA	Laboratory Attendant
LAB	Laboratory
LGB	Left Guide Bund
LHI	Lanka Hydraulic Institute
LLB	Bachelor of Law
LM	Life Member
LOI	Letter of Intent
LT	Laboratory Technician
LTU	La Trobe University
M.A	Master of Arts
M-ASCE	Member of American Society of Civil Engineer
M-BAAS	Member of Bangladesh Association for Advancement of Science
MBA	Master of Business Administration
M-BCS	Member of Bangladesh Computer Society
M-BES	Member of Bangladesh Environmental Society
MC	Main Consultant/Moisture Content
M-IEB	Member of the Institution of Engineers, Bangladesh
MIS	Management Information System
M-JSCE	Member of Japan Society of Civil Engineers
MLSS	Member of the Lower Class Subordinate
M-NOAMI	Member of National Oceanographic and Maritime Institute
MoU	Memorandum of Understanding
MoWR	Ministry of Water Resources
MP	Member of the Parliament
MPA	Mongla Port Authority
MS	Mild Steel
M.S/M.Sc.	Master of Science
M. Phil	Master of Philosophy
NHC	North Hydraulic Consultants Limited
NMC	Natural Moisture Content
NU	National University
NAHRIM	National Hydraulic Research Institute Malaysia
O & M	Operation & Maintenance
OTM	Open Tendering Method
PABX	Public Automatic Branch Exchange
PATC	Public Administration Training Centre
PC	Personal Computer
PD	Project Director
PGD	Post Graduate Diploma
PGT	Post Graduate Training
PhD	Doctor of Philosophy
PLOI	Provisional Letter of Intent
PPM	Parts per Million
PS	Private Secretary
PSO	Principal Scientific Officer
PU	Prime University
PWD	Public Works Department
RAC	Regional Accounts Centre

RDPP	Revised Development Project Proforma
REBRFM	Research on the Effect of Bandalling on River Flow and Morphology
RFQ	Request for Quotation
RGB	Right Guide Bund
RHD	Roads & Highways Department
RPATC	Regional Public Administration Training Centre
RRI	River Research Institute
RTW	River Training Work
RU	Rajshahi University
RUET	Rajshahi University of Engineering & Technology
SAE	Sub-Assistant Engineer
SICT	Support to Information and Communication Technology
SMEC	Snowy Mountain Engineering Corporation
SO	Scientific Officer
SRNDP	Southwest Road Network Development Project
SSD	Submerged Soil Density
SSO	Senior Scientific Officer
SSFCDI	Small Scale Flood Control, Drainage & Irrigation
ST	Soil Technician
SWH	Surface Water Hydrology
SWMC	Surface Water Modelling Centre
TDS	Total Dissolved Solids
ToR	Terms of Reference
TU	Technical University
UGC	University Grant Commission
UK	United Kingdom
UNESCO	United Nations Educational, Scientific and Cultural Organization
UPM	University Putra Malaysia
U/S	Upstream
USA	United States of America
UTM	Universal Testing Machine
WR	Water Resources
WRDP	Water Resources Development Project
WRE	Water Resources Engineering
WRM	Water Resources Management
WRS	Water Resources Survey

A view of signing ceremony of Annual Performance Agreement between Secretary, MoWR and DG, RRI at MoWR's Conference room chaired by the State Minister (left)

DG, RRI along with other high Officials placing flower wreath to Bangabandhu's portrait on the occasion of National Child Day-2019

River Research Institute

OBJECTIVES OF RIVER RESEARCH INSTITUTE

The activities of RRI as per Act 53 of 1990 are directed towards the achievements of the following objectives:

- To carry out studies for design supports in river training, river bank protection, flood control, irrigation & drainage works and to conduct research in river engineering, sediment control, estuary and tidal effects by means of physical model.
- To conduct mathematical model studies on river flow & regional flow network, hydrology, surface & ground water utilization and environmental issues with special attention to salinity intrusion & water quality with a view to develop the water resources.
- To perform tests on construction materials required for river training, river bank protection, flood control, irrigation & drainage structures and to inspect & evaluate the quality of the construction works thereof.
- To conduct training program on the above mentioned subjects and to publish reports &periodicals related to technical aspects.
- To advise the Government, Local Authority or any organizations regarding the problems and best approach towards the solution on the above mentioned subjects.
- To co-operate & conduct joint ventured research work with other similar local or foreign organizations.
- To take any necessary steps for performing the above mentioned works.

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