LEARNING DELTAS ASIA INITIATIVE

Scoping phase Report

Prepared by

the PROCASUR Corporation for the Global Water Partnership

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www.gwp.org/en/gwp-south-asia

Contents

ABBREVIATIONS AND ACCRONYMS

ADAM	Adaptive Delta Management
ADB	Asian Development Bank
BBS	Bangladesh Bureau of Statistics
BUET	Bangladesh University of Engineering and Technology
BWP	Bangladesh Water Partnership
CEGIS	Centre for Environmental and Geographic Information services
CEIP	Coastal Embankment Improvement Project
CPWM	Community Participation Water Management
CRD	Coastal Resources Database
DC	Delta Coalition
DWIR	Directorate of Water Resources and Improvement of River Systems
EbA	Ecosystem-based approaches to Adaptation
FCD	Flood Control and Drainage
FFS	Farmer Filed Schools
FFWC	Flood Forecasting and Warning Center
GEF	Global Environment Facility
GIS	Geographic Information System
HLPW	High Level Panel on Water Security
IDA	International Development Association
IFAD	International Fund for Agricultural Development
IPCC	Intergovernmental Panel on Climate Change
IRRI	International Rice Research Institute
IWM	Institute of Water Modelling
IWRM	Integrated Water Resources Management
IWUMD	Irrigation and Water Utilization Management Department
JICA	Japan International Cooperation Agency
KfW	*Kreditanstalt für Wiederaufbau*

KJDRP	Khulna Jessore Drainage Rehabilitation Project
LDAI	Learning Deltas Asia Initiative
LGI	Local Government Institution
MSN	Mangrove Service Network
MmWP	Myanmar Water Partnership
MWRC	Myanmar Water Resources Committee
NGO	Non-Governmental Organization
O&M	Operation and Maintenance
PAD	Project Appraisal Document
PIF	Project Identification Form
RCP	Representative Concentration Pathways
SDP	Sector Development Plan
SRDI	Soil Resource Development Institute
TOT	Training of Trainers
WARPO	Water Resources Planning Organization
WB	World Bank
WMA	Water Management Association
WMF	Water Management Federation
WMG	Water Management Group

EXECUTIVE SUMMARY

The present scoping phase report provides background information for implementing a Learning Route in Bangladesh in the context of the LDAI including selected learning territories and learning areas from a common a agenda with Myanmar.

The Learning Delta Asia Initiative (LDAI): The LDAI is an initiative of the Global Water Partnership (GWP) with the support of global players in the sector aimed at stimulating increased cooperation worldwide between those involved in the governance of deltas; strengthening a science-policy interface and, developing a framework for analysis and action. The goal of the LDAI is to accompany urbanizing deltas in better connecting development processes that often unfold in relative isolation.

Several activities were undertaken during 2017, in order to advance with the objectives of the LDAI, mainly the implementation of scoping missions between Bangladesh and Myanmar which, were in line with the LDAI objective to build up effective South-South cooperation. Following the scoping missions, an operational and methodological approach was agreed upon with Bangladesh considered a learning territory due to its leadership in the region as well as its capacity to share knowledge on adaptive delta management for resilience.

Bangladesh Learning Territories. Areas selected in Bangladesh as a learning territory are known as hotspots, which are prototypical areas where similar hydrological and climate-change vulnerability characteristics and problems converge such as sea level rise, river erosion, Intensity of flooding, water shortages, and siltation constraints. These include the coastal area and the Barind track area. Characteristics of the Coastal and Barind Track areas are as follows:

- The **coastal area** covers over 32% of the country and about 26% of its population. It comprises an area of 47,150 km^2 with a population of 38.5 million based on 2011 data by the Bangladesh Bureau of Statistics (BBS) resulting in an average population density of 817 persons per km^2. It encompasses 19 of 64 districts in the south-west to southeast and eastern-hill zone of Bangladesh, which are mainly impacted by two natural phenomena: tidal influence and salinity intrusion as well as cyclones and storm surges.

- **The Barind region** is in the North-West Hydrological Region and covers most of Dinajpur, Rangpur, Pabna, Rajshahi, Chapai Nawanganj, Bogra, and Naogaon districts of Rajshahi and Rangpur Divisions. It consists of three physiographic sub- divisions: i) the Level Barind Tract, occupying 5,048 km^2 or 65% of the whole unit; ii) the High Barind Tract, in the west, covering 1,600 km^2 or 21%; and iii) the North-Eastern Barind Tract, covering 1,079 km^2 or 14% of the whole unit. The Barind area is a severely drought prone area. Perennial river flows are present in the major regional river systems, but many of the minor rivers lack sufficient environmental flows in the dry period. The region also suffers from lowering groundwater levels in aquifers due to rainfall deficit leading to water scarcity for households, industry and agriculture.

Bangladesh – Myanmar Learning Agenda: As agreed, future learning activities would be mainly implemented through the Learning Routes approach and would address four main concepts and their applicability in the Bangladesh coastal area hotspot: a) Integrated Water Resources Management (IWRM), b) Tidal River Management, c) polder management, and d) community participation in water management.

- **IWRM** is a process which promotes the coordinated development and management of water, land and related resources in order to maximise economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems.
- **Tidal river management (TRM)** aims at improving the drainage capacity of tidal rivers by natural dredging the river at the downstream of the basin. It allows the sediment to deposit inside the TRM basin and the natural movement of tidal flows from the river to an embanked low-lying area.
- **Polder management** aims at protecting farmers from saline water intrusion and tidal floods in low-lying tracts of land surrounded by embankments to ensure food security and livelihoods of rural inhabitants,
- **Participatory water management** is a voluntary process in which local stakeholders influence policy formulation, consider alternative plans/ designs, investment choices and management decisions affecting their communities by establishing a sense of ownership.

Learning issues identified in Bangladesh. The following issues would need to be addressed in the context of learning on how Bangladeshi authorities have addressed them:

a) Integrating different sectors in the implementation of water management projects and programmes,

b) Recognising that problems and solutions associated with IWRM implementation in different regions of a country or region may not be universal,

c) Considering that water resource management by public or government organisations requires the participation of actors not only dealing with water supply and wastewater treatment but must be combined with other functions such as flood control, poverty alleviation, food production,

d) Furthering channel engineering for the purposes of flood control, drainage improvement and, reduction of bank erosion,

e) Including fisheries and aquaculture for human survival and poverty reduction and nutritional demands,

f) Considering lessons from past initiatives for implementation of IWRM principles and policies,

g) Recognising that area populations are involved in various economic activities and that their occupations and economic conditions are different according to their income,

h) Considering the impact of TRM on agriculture and the labour market specifically for people involved in fish and shrimp farming and day labour,

i) Addressing compensational conflicts,

j) Addressing devolution of responsibility over operation and maintenance from the State to communities and duplication of functions of local government and community groups,

k) Ensuring the representation of women and the landless in decision-making processes,

l) Considering other water uses that are particularly important for women such as drinking water, bathing, sanitation, livestock and homestead garden irrigation,

m) Addressing assignment of responsibility of operation of gates from a state-employed gatekeeper to communities and

n) Addressing sustainability issues especially regarding maintenance challenges.

Selected case studies and learning pointers in Bangladesh: Two case studies have been initially selected:

a) the Coastal Embankment Improvement project (CEIP) and

b) the Blue Gold project

a. The Coastal Embankment Improvement Project (Phase 1- CEIP) (World Bank - P128276).

The project's development objectives are to:

I. Increase the area protected in selected polders from tidal flooding and frequent storm surges, which are expected to worsen due to climate change;

II. Improve agricultural production by reducing saline water intrusion in selected polders; and

III. Improve Government capacity to respond promptly and effectively to a crisis or emergency.

These objectives are being achieved by strengthening and upgrading embankments as part of an integrated approach to improve the polder system in the coastal area.

- **Learning pointers of CEIP:** A review of the project's documentation allows for selecting a number of learning pointers such as:

I. implementation of afforestation programmes and furthering community awareness of the protective and productive functions of trees;

II. building capacity of local institutions and communities in secondary maintenance schemes such as embankment afforestation, social forestry and protection of embankments against erosion;

III. strategies for achieving climate resilience;

IV. design of long term monitoring programmes of environmental changes;

V. stakeholder and beneficiary consultations;

VI. use of social mobilisation;

VII. use of resettlement action plans;

VIII. establishment of an environmental monitoring system gender inclusive approach in the overall implementation of the project and regarding resettlement and livelihood restoration of project affected peoples.

b. Blue Gold project - Participatory water management for development (funded by The Netherlands)[1]**.**

The project's overall objective is to reduce poverty in the coastal area by enhancing the livelihood of the rural population, through more efficient water resources management and increased productivity of crops, fishery and livestock in the polders and by empowering the communities to be the driving force. The aim is to "address both the immediate development needs, as well as the longer-term requirements for a continuing sustained development process, of the people in the selected area of intervention".

- **Learning pointers.** Several project activities can serve as learning pointers such as:

I. mobilisation processes including the creation of viable water management groups,

II. creation of Farmers Field Schools (FFS),

III. improvement of production system of crops and horticulture, fish, livestock, based upon improved water resources management,

IV. use of product value chain approach,

V. preparation and implementation of Business Plan defined by producers and upon an inventory of potential buyers, investors and market research,

VI. development of Community Action Plans for the rehabilitation or fine-tuning of water infrastructure related to the productive sectors,

VII. use of value chain analysis for marketing of agricultural products,

VIII. improving food access and food use for local inhabitants, in particular women,

IX. provision of credit and linkages with credit institutions and,

X. curriculum development and training for agricultural support service providers.

[1] http://www.bluegoldbd.org/

Bangladesh and Myanmar common Learning Agenda on Adaptive Delta Management

Issue	Learning Objective	Relevant experiences
I. Complexity of polder scheme construction/ rehabilitation involving land acquisition, physical and economic displacement of people	To understand land acquisition process and solutions adopted for people's displacement especially as related to the rehabilitation and improvement of polders including; i) embankment monitoring and public consultation plans, ii) development of a system to computerize land acquisition and resettlement data with GPS reference and, iii) verification of field data to guard against improper targeting of beneficiaries and/or false delivery of benefits.	CEIP Component B2 Implementation of a Social Management and Resettlement Policy Framework (SMRPF) and Resettlement Action Plans (RAP) [2]
II. Soil erosion and tidal surges severely affect coastal areas	To understand capacity building of local institutions and communities in embankment afforestation, social forestry and protection of embankment against erosion.	CEIP I Component 2A Afforestation.
II. Limited functioning of water controlling structures and silted internal drainage channels	Further understanding of technical issues involved in rehabilitation of critical portions of polder embankments including: i) slope protection work, ii) increasing embankment height in some stretches to improve resilience, (iii) repairing and upgrading drainage and flushing systems within polders, and (v) improving operations and maintenance.	CEIP Component A1 Rehabilitation and Improvement of Polders
V. Land ownership and competing land-use (fish and shrimp ponds, rice paddies, livestock grazing, settlement.	Understand optimisation of water use for the productive Sectors, while overcoming conflicting interests, will have to be ensured.	Blue Gold Project [3] CEIP
V. Gaps between participation in policy versus participation in practice,	Understand effective community participation by WMGs/WMAs in the design and planning of water resources infrastructure and in its implementation through labour contracts and operation and maintenance arrangements.	Blue Gold Project Component 3.1 Community Mobilization and institutional

[2] http://projects.worldbank.org/P128276/coastal-embankment-improvement-project-phase-1ceip-1?lang=en
[3] http://www.bluegoldbd.org/

Issue	Learning Objective	Relevant experiences
		strengthening component
VI. Lack of timely maintenance increases the chance of embankment failure.	To assess and understand engagement of local communities in minor maintenance works.	Blue Gold Project
II. Limited support for the productive sector including analysis of agricultural development options, provision of extension services, input supply, credit, processing technology and private sector involvement.	To analyze adoption and implementation of a value chain development approach for agricultural products and use Farmer Field Schools (FFS) for transferring new sustainable technologies	Blue Gold Project - Business Development and Private Sector Involvement component
II. Poor access to safe drinking water and sanitation by local inhabitants	To learn from action taken in terms of WASH including: i) access to safe water supply. ii) use of home latrines/toilets, iii) training of school children in sanitation and hygiene	BRAC WASH II. The Max Foundation and the Government of the Netherlands Blue Gold Project
X. Limited integration of different sectors in the implementation of water management projects and programmes	To assess the effectiveness of project implementation arrangements through Steering Committees with multi-stakeholder participation	Blue Gold Project

I. INTRODUCTORY BACKGROUND

The following document, prepared by the PROCASUR Corporation, summarises advances in proposed knowledge management activities undertaken in the context of the Learning Deltas Asia Initiative´ scoping phase (LDAI). This report covers the development of the LDAI, provides descriptions of the selected learning territories, and, introduces, the learning agenda that would be covered during a Learning Route in Bangladesh.

The Learning Route described herein is the result of several activities undertaken during 2017 to advance with the objectives of the LDAI, mainly the implementation of scoping missions between Bangladesh and Myanmar. A first mission to Bangladesh was undertaken by a Myanmar delegation in February 2017 to start building up a learning agenda between both countries. A second Mission saw a Bangladeshi delegation visiting Myanmar in early June 2017 were the agenda was further developed. These missions were in line with the LDAI objective to build up effective South-South Cooperation in the context of a learning and innovation initiative in rural and urbanising deltas by connecting processes that often unfold in relative isolation, and in learning from one another. Both missions focused on the Adaptive Delta Management (ADM) approach, which supports decision making about water policy, planning and infrastructural investments, linking current decision making to future choices while incorporating an assessment of climate change impacts, proposing adaptation measures.

The mission to Bangladesh considered knowledge exchanges on vulnerability and resilience in times of climate change, flood forecasting, community-based flood early warning systems, ecosystem services for poverty alleviation, climate change adaptation and water governance and TRM. Field visits included land reclamation activities in selected areas. In this mission, key learning topics were agreed to become part of LDAI´s initial learning agenda: a) TRM, b) Polder[4]

[4] The Dutch term “polder” is used to designate areas that are enclosed on all sides by dykes or embankments, separating them hydrologically from the main river system and offering protection against tidal floods, salinity intrusion and sedimentation. Polders are equipped by in- and outlets to control the water inside the embanked area. (World Bank)

management and, c) Management of water resources. Learning Territories were also selected encompassing: a) the Coastal area, b) the Barind Tract area in Bangladesh.


Workshops and field visits in Bangladesh organised by BWP and IWM Bangladesh

In Myanmar, the Ayeyarwady River Basin was identified as the territory for piloting innovations learned in the frame of the LDAI. The Bangladeshi mission to Myanmar explored the Ayeyarwady Delta, including the Kyet Pha Mye Zaung Polder in Pyapon Township, under responsibility of the Irrigation and Water Utilization Management Department (IWUMD) and, the Pyapon Town river bank protection works by the Directorate of Water Resources and Improvement of River Systems (DWIR). The Mission visited the Bogalay River and Mangrove Island, too. The Mangrove Service Network (MSN) and the Environment Education and Research Centre operates. The Mission also visited Dedaye, Kungyan Gon, Kaw Hmu, Twante, including Kun Gyan Gone Sluice Gate, Kun Gyan Gone Township, Yangon Region which is operated and maintained by IWUMD and the Paddy III project. The field trip also included a visit to the Mezali Sluice Gate located in Yangon Region and the Pan Hlaing Sluice Gate (operated by IWUMD). In Nyaung Done Township. Additionally, the Mission visited two project sites, riverbank protection works of Nyaung Done Town and bank protection at Bo Myat Tun Bridge Project site near Nyaung Done Town that are the works of DWIR.

Following the missions LDAI principal stakeholders agreed to organize a Learning Route as a combined practical and theoretical training in Bangladesh for 7 to 10 day.[5]

[5] Please refer to the Bangladesh Scoping Mission Report prepared by Bangladesh Water Partnership and the Institute of Water Modelling Bangladesh and the Myanmar Scoping Mission Report prepared by Myanmar Water Partnership and the Myanmar Irrigation and Water Utilization Management Department for more on the process and the outcome details.

Site visit to Ayeyarwady Delta area

II. THE LEARNING DELTAS ASIA INITIATIVE (LDAI)

The LDAI was initially conceived in 2014 as an "Enabling Delta Life" Initiative, a global project drafted with support of the Delta Alliance (DA) aimed at stimulating increased cooperation worldwide between those involved in the governance of deltas; strengthening a science-policy interface and, developing a framework for analysis and action. The initiative was further advanced with support of the Global Water Partnership (GWP) during three different events: a December 2015 Regional Workshop on Flood Management, in Guangzhou, China; a High-Level Panel on Water Security (HLPW) held in Yangon, Myanmar in May 2016 and, the Singapore Water Week in July 2016. Final agreements on the scope, objectives and implementation arrangements were completed during a workshop held in Manila, Philippines in October 2016. This section borrows heavily from an overview presentation on the LDAI prepared by Dr. Zaw Lwin Tun, Director, Myanmar Irrigation and Water Utilization Management Department as contained in the Second Phase Report prepared by the Myanmar Water Partnership[6].

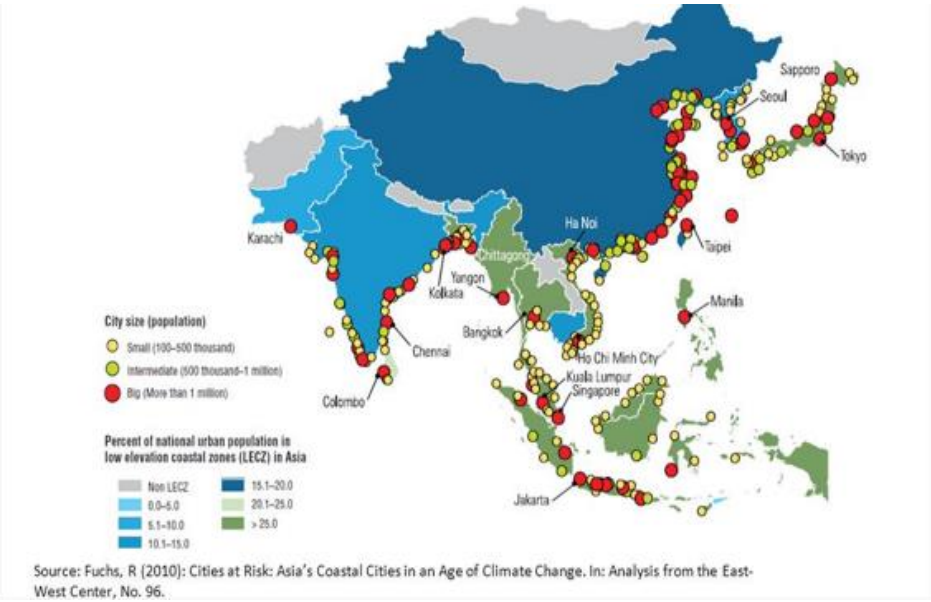


Figure 1 Coastal cities in Asia and percentage of national urban population in low elevation coastal zones

[6] http://www.gwp.org/contentassets/99ab8af8a32f4b449ef9b3d61a5a2147/ldai-myanmar-mission-report.310817-final.pdf

A. Objectives, activities and outcomes

Overall Objective of the Learning Delta Asia Initiative:

To develop a meaningful knowledge exchange project that will include learning mechanisms on Deltas in Asia through a scoping Phase between Myanmar and Bangladesh.

The scoping phase resulted in a thorough knowledge exchange mechanism between key Asian deltas that will:

- Increase the understanding of challenges faced by communities/populations living in Asian deltas

- Foster cooperation to develop joint solutions for increased water security and climate resilience in Asian deltas

- Eventually lead to strengthened resilience of populations living in coastal/deltaic areas in Asia

Specific objectives include:

a) Enabling a process which promotes the coordinated development and management of water, land and related resources to maximise the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems;

b) Engaging broader sectoral integration and inclusive societal development processes that guide socio-economic resilience; and

c) upporting the planning and implementation of investment projects through innovative learning and knowledge processes while building commitment and capacities.

LDAI activities encompass organising and implementing exchange visits between Asian Delta countries, supporting local and international training programmes, preparing training material for local use and organisation of an international conference on delta management in the South and strategy development. LDAI supports joint research activities on typical delta issues being

carried out by local knowledge institutes. Research topics would be determined by LDAI partners and would include scenario development, adaptive delta management, decision making under uncertainty, transboundary issues, environmental flow and green growth. On strategy development, LDAI will support framework analysis for delta planning and establishment of relationships between delta planning with national and regional economic development goals and strategies. Other issues would cover adaptive planning techniques, scheduling of investments and investment planning.

Outcome:

The principal outcome of the LDAI would be enhanced capacity of engaged stakeholders and institutions in furthering policies leading to higher levels of impact and sustainability, allowing for scaling up of resilience of urban deltas while assisting them in climate change adaptation.

It is expected that implementation of knowledge exchange activities would result in:

a) Increased understanding of challenges faced by communities/populations living in Asian deltas;

b) enhanced cooperation among LDAI members to develop joint solutions for increased water security and climate resilience in Asian deltas; and

c) strengthened capabilities of local institutions to enhance targeted outreach, impact and sustainability of international donor co-financed projects and improved quality of project pipeline proposals.

B. Implementation arrangements for Scoping Phase

Implementation strategies and methodologies were arrived at following a **scoping phase** that began in February 2017 between Bangladesh and Myanmar. This phase allowed for defining in operational terms a methodological approach with Bangladesh considered a first **learning territory** due to its leadership in the region as well as its capacity to share knowledge on Adaptive Delta Management.

Implementation was initiated in Asia with the longer-term possibility of including at later stages additional countries such as Indonesia, Philippines and Vietnam. Implementation would be anchored in country level institutions such as the Bangladesh and Myanmar Water Partnerships under the overall guidance and support of the Global Water Partnership and the Delta Coalition.

Box 1. The Delta Coalition (DC)

The **Delta Coalition** aims at building a complete body of knowledge on deltas, adaptation, resilience and sustainable urban development while allowing delta countries to join forces to stimulate best practice, innovation and to increase opportunities for financing in order to facilitate implementation of projects that will reduce vulnerability to climate change. The coalition facilitates discussion, exchange, innovation and creativity between participating members and observers. Its objectives include inter alia: a) facilitating the development, availability and exchange of knowledge on deltas, resilience and (urban) sustainable development; and b) promoting practical implementation and cooperation to increase the resilience of urban deltas and to increase investments in sustainable urban delta management.

Implementation advanced during 2017 including agreements on the methodological approaches to further knowledge acquisition and sharing. Following the missions to Bangladesh by a Myanmar delegation and a Bangladeshi delegation to Myanmar agreements were reached on the topics in the common learning agenda and territories for implementing a Learning Route in Bangladesh.

Learning Route:

The Learning Routes, as conceived by PROCASUR, are knowledge sharing experiences in selected localities organized thematically around best practices on innovative rural and local development initiatives and approaches generating a space for individual and collective learning for visitors and hosts. Learning Route participants would come from government, civil society, the private sector and academia and community based institutions.

The Learning Route methodology sees participants, coming upon completion of the exchange, with a concrete innovation plan that brings knowledge gained by participants for subsequent application in their respective institutional settings and territories of operations. This aspect, as conceived by PROCASUR would represent the innovative value adding of the LDAI.

The lead agency for the first Learning Route in Bangladesh will be the Bangladesh Water Partnership (BWP) as the country has gained considerable experience on sustainable delta planning, has a developed knowledge infrastructure in this field cooperating with research institutes such as the Centre for Environmental and Geographic Information services (CEGIS), the Institute of Water Modelling (IWM), the Bangladesh University of Engineering and Technology (BUET), etc. As agreed, BWP set-up a Task Force for the Initiative, with a dedicated focal point. Collaboration with the Delta Alliance is also pursuit.

The LDAI programme is planned for five years with a total budget estimated in 10 to 12 million Euros. The major part of the financing would come from projects carried out in the framework of LDAI but financed as separate loans or grants. Donor strategies and operations with

relevance for the LDAI are described in Appendix 1.

Box 2 LDAI´s main stakeholders

Global Water Partnership (GWP)

The Global Water Partnership (GWP) is a global action network with over 3,000 Partner organisations in 183 countries. The network has 86 Country Water Partnerships and 13 Regional Water Partnerships. The network is open to all organisations involved in water resources management: developed and developing country government institutions, agencies of United Nations, bi- and multi-lateral development banks, professional associations, research institutions, non-governmental organisations, and the private sector. GWP's action network provides knowledge and builds capacity to improve water management at all levels: global, regional, national and local. Its networking approach provides a mechanism for coordinated action and adds value to the work of many other key development partners. GWP mobilises government, civil society, and the commercial sector to engage with each other to solve water problems through an integrated approach. It advocates for the application of an integrated approach to water resources management (IWRM) understood as "a process which promotes the coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems".(GWP). The GWP furthers capacity building by supporting development of skills needed for a behavioural change to manage water effectively. Building capacity includes supporting dialogue on participatory approaches and working with parliamentarians, women organizations, and urban planners. It funds the preparation of technical papers, from background papers to policy briefs, tackling issues ranging from effective water governance to water efficiency.

Delta Alliance (DA)

The Delta Alliance is an international knowledge-driven network organization with the mission of improving the resilience of the world's deltas. With increasing pressure from population growth, industrialization and a changing climate, it is more important than ever that these valuable and vulnerable locations increase their resilience to changing conditions. Delta Alliance brings people together who live and work in deltas. They can benefit from each other's experience and expertise and as such contribute to an increased resilience of their delta region. The strategy to realize this mission is outlined in the Delta Alliance Strategic Framework, and includes the following points: a) envisioning and defining resilience for deltas b) measuring and monitoring resilience c). reporting and creating pressure for improved resilience, d). providing inspiration for improved resilience and, v) providing assistance for improved resilience.

Bangladesh Water Partnership (BWP)

The Bangladesh Water Partnership's objective is to share knowledge, experience, expertise and best practices while supporting policy development and investment plans. More specifically the BWP aims at: i) coordinating and stimulating the development of innovative solutions and the dissemination of existing and emerging knowledge; ii) building capacity on delta issues; iii) undertaking collaborative research, iii) stimulating cooperation across sectors and disciplines. The BWP subscribes to international guiding principles including the need to recognize that: i) fresh water is a finite and vulnerable resources essential to sustain life development and the environment; ii) water development and management should be based on a participatory approach involving users, planners and policy makers at all levels; iii) women play a central part in the provision, management and safeguarding of water; and iv) water is a public good and has a social and economic value in its competing uses. The BWP is responsible for: a) facilitating water policy and strategies and preparation of national IWRM plans; b) developing programmes and tools in response to regional and county needs; and c) ensuring linkages between GWP and other sectors and issues.

Myanmar Water Partnership (MmWP)

Myanmar Water Partnership's (MmWP) liaises with its 15 partner organisations composed of governmental departments, agencies, services, academic and research institutions, business, social entities, professional associations, Non-Governmental Organisations (NGOs) and water users in the water sector and its related management areas. The principal objective of MmWP is to promote the Integrated Water Resources Management (IWRM) approach in Myanmar so as to ensure the sustainable management of water resources. The MmWP, established in 2007, is guided by the national apex body for water related matters, the Myanmar Water Resources Committee (MWRC). It is hosted by the Irrigation and Water Utilization Management Department under the Ministry of Agriculture, Livestock and Irrigation. MmWP was accredited as a Country Water Partnership in August 2016.

III. THE BANGLADESH AND MYANMAR LEARNING TERRITORIES

The learning territories described below were selected, as earlier mentioned, during missions by country delegations during the scoping phase of the LDAI in 2017. Areas selected in Bangladesh are known as hotspots, understood as a broad grouping of districts and areas facing similar natural hazard risks. According to the Bangladesh Delta Plan, "hotspots are prototypical areas where similar hydrological and climate-change vulnerability characteristics and problems converge (such as sea level rise, river erosion, intensity of flooding, water shortages, and siltation constraints)". In Myanmar, the selected Learning Territory is the Ayeyarwady Delta, which is the highest populated area in Myanmar with changes in land use representing approximately 80 percent land mostly to rice cultivation. Frequent migration and unstable settlements have contributed to mangrove forest degradation. Mangrove forests are said to have saved thousands of people's lives during the Cyclone Nargis in 2008.

A. The Bangladesh coastal area

A brief description of this area was provided in the report prepared by the Bangladesh Institute of Water Modelling (IWM) and submitted to the BWP in July 2017. Information on the coastal area has been supplemented with information contained in the Bangladesh Delta Plan 2100 of August 2015, the World Bank's Project Appraisal Document (PAD) for the Coastal Embankment Improvement Project Phase I of May 2013[7] and a research paper published in the Middle-East Journal of Scientific Research in 2013[8].

The coastal land area covers over 32% of the country and about 26% of its population. It comprises an area of 47,150 km^2 with a population of 38.5 million based on 2011 data by the Bangladesh Bureau of Statistics (BBS) resulting in an average population density of 817 persons per km^2. It encompasses 19 of 64 districts in the south-west to south-east and eastern-hill zone

[7] http://projects.worldbank.org/P128276/coastal-embankment-improvement-project-phase-1ceip-1?lang=en
[8] http://www.bdresearch.org.bd/home/attachments/article/nArt/20.pdf

of Bangladesh which are mainly impacted by two natural phenomena: tidal influence and salinity intrusion as well as cyclones and storm surges.

Due to siltation in the tidal rivers water, logging and drainage problems are considered serious in most coastal districts including Satkhira, Jessore, Khulna, Bagerhat Noakhali and Feni districts. The area is impacted by severe cyclones, the most devastating being cyclone Aila in 2009 displacing nearly 2 million inhabitants and destroying more than 700 kilometres of coastal embankments.

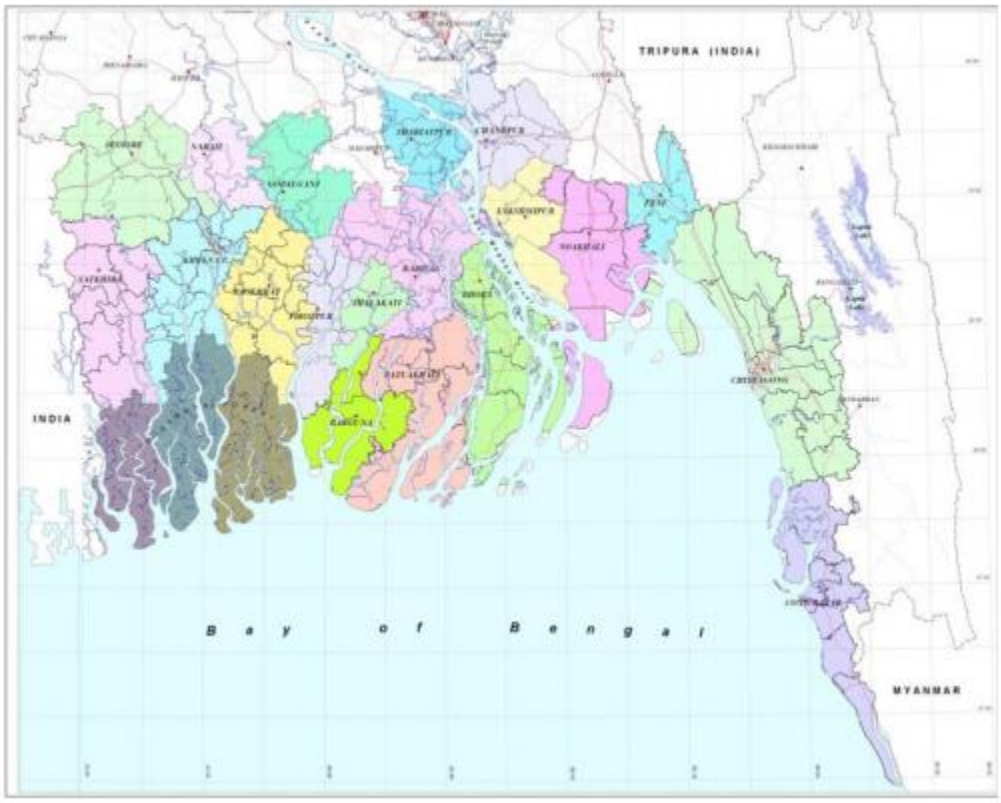


Figure 2: Coastal area of Bangladesh

The World Bank (WB) estimates that changes in precipitation and temperature patterns and increased risk of storm surge and tidal flooding disproportionally affect the livelihood of area inhabitants especially women and their families. Poor people largely depending on subsistence agriculture for their livelihoods are the least able to cope with such changes. These and other pressures force large numbers of people (mostly men) to move out of their rural communities

and towards large cities or abroad seeking better income with remittances representing nearly US$12.8 billion in 2012 equivalent to about 12% of Gross Domestic Product (GDP).

The years 2007 and 2009 were indicative of the vulnerability of coastal population and the development challenges faced by the Government. Severe flooding from July to September 2007 along the Ganges and Brahmaputra rivers affected the lives and livelihoods of over 13 million people and caused extensive damage to agricultural production and physical infrastructure. This catastrophic flood event was shadowed by cyclone Sidr, which made landfall across the southern coast on November 15, 2007**,** further causing over 3,400 deaths. The cyclone destroyed over a million tons of rice and incurred over US$1.6 billion in damages and losses.

The IWM Bangladesh report concludes that salinity intrusion in the river system depends on the volume of freshwater flow from the upstream, the salinity level of the Bay of Bengal near the coast and the coastal currents. The salinity in the river system is high during the dry season and severe in the south-west and eastern-hilly coastal zone. However, in the south-east and south-central zone the salinity problem is low.

The report further notes that: i) an area of about 0.1 million hectares were affected by soil salinity in 2009, according to a 2014 report by the Soil Resource Development Institute (SRDI), ii) the knowledge and data on the deeper aquifer is very limited, iii) due to over exploitation, the groundwater quality is often affected by arsenic, iron and/or manganese, which make the water unsafe or unsuitable for domestic uses. according to the Sector Development Plan (SDP) arsenic contamination is detected up to 150 meters depth in the aquifer, iv) a huge amount of sediment load with water flow is responsible for coastal bank erosion in some islands (Sandwip, Hatia, Bhola and Ramgati island) as well as formation of new lands and v) the mangrove forest, estuary and marine diversified ecosystem are in threat due to some human activities and salinity, vi) the area is threatened by climate change phenomena and sea level rise. According to the Intergovernmental Panel on Climate Change (IPCC) in its 2014 Assessment Report (IPCC,

AR5 2014) the mean sea level rise may be 0.3m in 2050 and 0.63 in 2100 according to a Representative Concentration Pathways (RCP) scenario, vii) water diversion through the Farrakka barrage and upstream dams in Ganges and Brahmaputra river basin lead to changes in the freshwater flow pattern in the coastal rivers which will impact water resources for agriculture and domestic water supply, fisheries, forestry, navigation, industry, biodiversity, and socio-economy development in the coastal regions. The report concludes that increasing over population and unplanned urbanization is putting pressure on land and water resources representing a growing challenge for government agencies and donors in pursuit of IWRM in the area.

From a social and economic point of view, the WB concludes that coastal districts are characterised by a high pace of population growth, projected to grow to 61 million by 2050. This trend continues to push millions of people to live in the low lying coastal areas, which as mentioned above are highly vulnerable to natural hazards. Poverty indicators in the coastal area show a higher percentage of population living below the absolute poverty line compared to the rest of the country.

B. The Bangladesh Barind Tract

A brief area description was prepared as part of the IWM Bangladesh report. Additional information is provided herein as contained in the Global Environment Facility (GEF) Project Identification Form (PIF) for the Ecosystem-based approaches to Adaptation (EbA) in the drought-prone Barind Tract and Haor wetland area.

The Barind region is in the North-West Hydrological Region in Bangladesh and covers most of Dinajpur, Rangpur, Pabna, Rajshahi, Chapai Nawanganj, Bogra, and Naogaon districts of Rajshahi and Rangpur Divisions. It consists of three physiographic sub- divisions: i) the Level Barind Tract, occupying 5,048 km^2 or 65% of the whole unit; ii) the High Barind Tract, in the

west, covering 1,600 km^2 or 21%; and iii) the North-Eastern Barind Tract, covering 1,079 km^2 or 14% of the whole unit.

Area weather is very dry with lesser rainfall compared to other parts of the country. The region covers roughly an area of about 7,770 km^2. It has long been recognised as a unit of old alluvium, which differs from the surrounding floodplains. This physiographic unit is bounded by the Karatoya River to the east, the Mahanada River to the west, and the northern bank of the Ganges River to the South. A lower fault scarp marks the eastern edge of the Barind Tract, and the Little Jamuna, Atrai and Lower Punarbhaba Rivers occupy fault troughs. The western part of this unit has been tilted up; parts of the western edge are more than 15m higher than the rest of the tract and the adjoining Mahananda floodplain. The southern part of the main eastern block is tilted down towards the southwest and passes under lower Atrai basin sediments in the south.

The Barind area is a severely drought prone area. Drought is especially severe in the High Barind (Natore, Bogra, Thakurgoan Districts). Perennial river flows are present in the major regional river systems, but many of the minor rivers lack sufficient environmental flows in the dry period. Since the main source for water use is groundwater, lowering of groundwater levels in aquifers due to rainfall deficit leads to water scarcity for households, industry and agriculture. Due to intensive groundwater use and development of (boro rice) irrigation systems, the groundwater table has gradually declined, particularly in the high Barind tract.

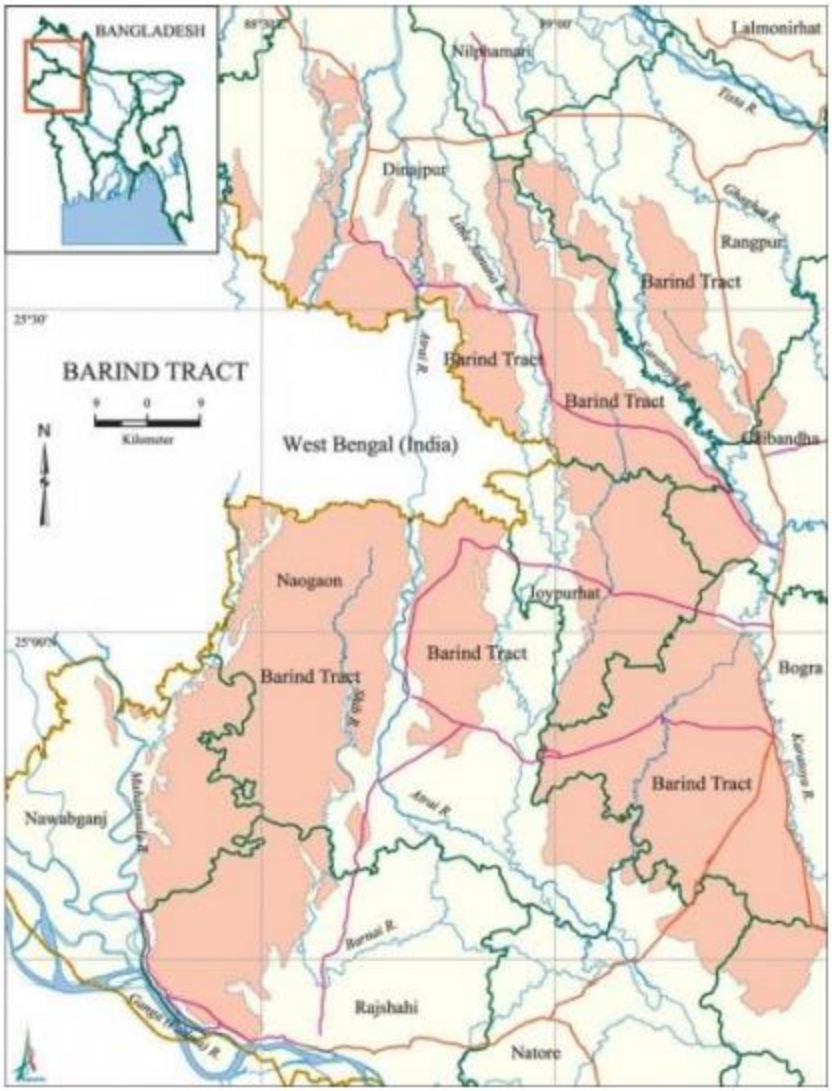


Figure 3: Map of the Barind area in Bangladesh

Communities living in the Barind Tract are dependent on a range of ecosystem services agricultural production/food provision, water filtration, groundwater recharge, and erosion control. However, the provision of these services is under threat due to land degradation, deforestation, and poorly planned development activities. These problems are further exacerbated by the impacts of climate change as the area is particularly vulnerable to climate change hazards such as increased severity and frequency of seasonal droughts and dry spells, which negatively affects local community livelihoods activities and results in reduced household

income and food security. Main challenges are ensuring food and water security, protecting community livelihoods, and protecting infrastructure.

As indicated in the GEF PIF, area communities are vulnerable to current and expected climate change impacts, including increased average temperature, increased frequency and severity of drought and dry spells, and changing rainfall patterns including heavier and more erratic rainfall. The vulnerability of affected populations to these climate change impacts is exacerbated by limited capacity, knowledge and financial resources to adapt. Therefore, there is an urgent need to implement adaptation interventions that will build the climate change resilience of communities living in these areas. Further, on-going development investments, for example in irrigation, by Government and donors in the project region will be undermined if these investments are not climate-proofed. Urgent interventions are required to build capacity to plan, implement, research and upscale ecosystem based adaptation measures to advance climate change adaptation.

C. The Myanmar Ayeyarwady Delta and River Basin

The area description provided herein has been compiled from the LDAI Scoping Phase Myanmar Mission Report of June 2017 prepared by the MmWP with PROCASUR support. Additional information comes from a recent Vulnerability and Resilience Assessment of the Ayeyarwady Delta paper prepared by the Delta Alliance and a WB Project Appraisal Document (PAD) for the Ayeyarwady Integrated River Basin Management project.

The WB report notes that the Ayeyarwady is Myanmar's largest river basin accounting for about 60 % of Myanmar's landmass and is home to some 70 % of its population. The river runs from the mountain ranges in the north, through the agriculturally important dry zone in the middle basin, to the productive yet fragile delta in the south. Due to the relatively high share of the population in the dry zone and the delta, these two regions account for nearly two-thirds of the poor in Myanmar.

The Ayeyarwady is a river of global proportions, with an average annual flow of over 400 billion cubic meters, or roughly 85 % of the Mekong. Groundwater resources in the basin are believed to be equivalent to at least 50 % of the basin's current surface water storage volume, and countrywide as high as perhaps 495 billion cubic meters. The WB notes that agriculture in the Ayeyarwady Basin has historically been the mainstay of the Myanmar economy. Myanmar's wealth of land and water resources have made the country food secure; but exports and incomes could be significantly enhanced by increasing agricultural productivity and diversifying production. Currently, there are no dams on the mainstream of the Ayeyarwady River. Construction on what would have been the first mainstream dam (a large storage-backed hydropower dam at Myitsone) was halted in 2011 due to public concerns. The river has the 5th highest sediment load of any major river in the world and many believe that the rate of sedimentation is rapidly increasing because of deforestation in the river's fragile upstream landscape and widespread land use changes across the basin.

The area's description in the MWP report underlines that the Ayeyarwady Delta is one of the largest classical shape (triangle) deltas in the world. From the apex to the sea, it covers about 300 km and widening to approximately 250 km in the coast. It includes eleven ocean outfalls: Pathein (Bassein), Thetkethaung, Ywe, Pyamalaw, Pyinzalu, Ayeyarwady, Bogale, Pyapon, Thandi, Toe (China Bakir) and Yangon Rivers. There are approximately 140 channels with 75 junctions and seawater intrudes into the delta from these channels during the summer time.

The report further points out that the Ayeyarwady Delta is the highest populated area in Myanmar with changes in land use representing approximately 80% land mostly to rice cultivation. Frequent migration and unstable settlements have contributed to mangrove forest degradation.

The river's major flood embankments were originally built in the 1863-80 period. Presently, the IWUMD builds flood embankments and polders to protect many of the islands in the lower delta. Polder systems in the area were firstly introduced by the Lower Burma Paddy Land

Development Project I (Paddy I) financed by the World Bank in 1975-1985. The Paddy I project areas consisted of one polder in the mid Ayeyarwady Delta, ten polder systems in the southern part of the lower Ayeyarwady Delta to protect flood and tidal intrusion by construction of embankments, sluice gates, drainage excavation and some rehabilitation works for a total of 185,000 acres of farm land, including the reclamation of 65,000 acres of abandoned and cultivable wasteland. The project was completed in May 1985. Additionally, four polder systems situated in the lower Ayeyarwady Delta were implemented by the Lower Burma Paddy Land Development Project II (Paddy II) also financed by the World Bank in 1978-1990. The objective of the Paddy II project was to protect flood and tidal intrusion by construction of embankments, sluice gates, drainage excavation and some rehabilitation works for total of 175,000 acres of farmland, including the reclamation of 50,000 acres of abandoned and cultivable wasteland.

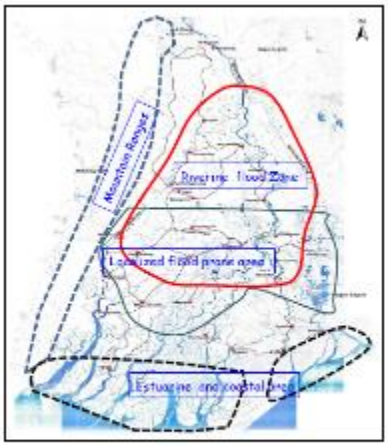
After completion of the Paddy I and Paddy II Projects, substantial development of paddy land areas was increased in the Ayeyarwady Delta. Polder system management was also introduced in these developed polder systems and certain level of experience related to operation and maintenance of these systems was gradually gained.

In May 2008, Cyclone Nagis struck part of the Ayeyarwady and Yangon Regions, which included some of the Paddy I and Paddy II project areas. These polder systems had been severely damaged, and their renovation has been done by IWUMD with partial support provided by the Japan International Cooperation Agency (JICA). Along these activities, not only the renovation of Paddy I and Paddy II project's polder systems but also the development of new polder systems in the Ayeyarwady Delta has been implemented.

From a social and economic point of view, the Delta Alliance Report points out that the number of landless amounts to more than 45% of the population with incomes below the poverty line with many of the landless being paddy workers and casual labours who do wage work. The report further notes that landless households have very limited skills due to low education

levels and little opportunity for learning modern technology/technique for generating new income. In terms of natural resources, the analysis underlines that these are limited for landless households with land being largely used for paddy production.

Flood protection works



Vulnerable areas in Ayeyarwady Delta

IV. TOWARDS A LEARNING AGENDA

The following section provides the conceptual framework to guide learning objectives and activities, summarizes projects and emerging learning pointers in the Bangladesh Coastal Area hotspot.

A. Conceptual framework

Future learning activities to be mainly implemented through the Learning Routes approach would address four main concepts and their applicability in the Bangladesh coastal area hotspot: a) Integrated water resources management, b) Tidal River Management (TRM), c) Polders and polder management, and d) Community participation in water management.

1. Integrated Water Resources Management approach

The IWRM approach has been defined by the GWP[9] "as a process which promotes the coordinated development and management of water, land and related resources to maximise economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems". GWP underlines the fact that, many different uses of water resources are interdependent, reiterating the IWRM principles adopted at the International Conference on Water and the Environment in Dublin, Ireland, in 1992 as follows: a) fresh water is a finite and vulnerable resource, essential to sustain life, development and the environment; b) water development and management should be based on a participatory approach, involving users, planners and policy-makers at all levels, c) women play a central part in the provision, management and safeguarding of water and; d) water has an economic value in all its competing uses and should be recognized as an economic good. GWP underlines that an IWRM approach focuses on three pillars: i) an enabling environment of suitable policies, strategies and

[9] http://www.gwp.org/en/About/why/the-need-for-an-integrated-approach/

legislation for sustainable water resources development and management, ii) putting in place the institutional framework through which to put into practice the policies, strategies and legislation, and iii) setting up the management instruments required by these institutions to do their job". GWP concludes that applying an integrated approach requires i) water development and management takes into account the various uses of water and the range of people's water needs; ii) stakeholders are given a voice in water planning and management, with particular attention to securing the involvement of women and the poor; iii) policies and priorities consider water resources implications, including the two-way relationship between macroeconomic policies and water development, management, and use; iv) water-related decisions made at local and basin levels are along the lines of, or at least do not conflict with, the achievement of broader national objectives; and v) water planning and strategies are incorporated into broader social, economic, and environmental goals.

2. The Tidal River Management (TRM) approach.

The TRM approach has been widely studied and analysed. IWM Phase I report provides a comprehensive description, noting that TRM is a very effective measure to improve the drainage capacity of tidal rivers by natural dredging the river at the downstream of the basin. It allows the sediment to deposit inside the TRM basin and the natural movement of tidal flows from the river to an embanked low-lying area or *beel* - a lake-like wetland with static water- through a link channel. During floods, tidewater, with huge sediment load enters the low-lying area where the sediments are deposited due to reduction of flow velocity and storage for long duration. During ebb tide, water from the low-lying basin flows out with reduced sediment load, which erodes the riverbank and bed at the downstream. Thus, drainage capacity/conveyance of the river increases which also maintains the river's navigability. Over time, the low-lying area is raised considerably due to deposition of silt. The average life of a TRM basin is 5-6 years.

TRM has been implemented in several projects in Bangladesh, such as the Khulna Jessore

Drainage Rehabilitation Project (KJDRP)[10] funded by the ADB and completed in 2004. The project had as its main objective to reduce poverty by increasing agricultural production and creating farming jobs. More recently, TRM has been applied after cyclones Sidr and Aila struck the coastal zone causing severe damage to infrastructure, life and property through implementation of the International Development Association (IDA) credit for the Emergency Cyclone Recovery and Restoration Project (ECRRP)[11] in 2007.

3. Polders and polder management approach and issues

The following description of the polder management approach and issues has been summarised from relevant sections of the Bangladesh Delta Plan 2100[12]. The Plan defines a polder as a low-lying tract of land enclosed by earthen embankments known as dykes that form an independent hydrological entity which has no physical connection with outside water other than through manually operated water control structures. Polders were introduced in the early 60s in Bangladesh to control tidal flooding and salinity intrusion and the occasional cyclonic storm surges. About 139 coastal polders were constructed during 1960 to early 70s.

The document highlights the fact that the immediate socio-economic consequences of polder construction were very impressive and positive with the construction of a polder itself providing massive employment opportunities. Notwithstanding, the Plan identifies many issues requiring attention and proposes a series of needed actions. The document points out that the major problem of polders is water logging due to siltation of the peripheral river, which is likely to deteriorate in future with the combined effect of precipitation increase, sea level rise and subsidence adding that the height of peripheral embankment of polders is not adequate to prevent the overtopping of storm surge since it is designed based on monsoon spring tide level not storm surge level. It further points out, governance issue of polder management involving multi institutions and the local community is crucial for successful

[10] https://www.adb.org/sites/default/files/project-document/69811/pcr-ban-21087.pdf
[11] http://projects.worldbank.org/P146500?lang=en
[12] http://www.bangladeshdeltaplan2100.org/wp-content/uploads/2015/10/Coast-and-Polder-Issues1.pdf

functioning of polders in intensification of agriculture, aqua culture and other related economic activities. Polders should be managed in an integrated manner to include a system of embankment maintenance, afforestation in the foreshore, fisheries and agriculture development.

The Delta Plan also warns of effect of climate change on coastal polders including overtopping of embankment, damage of drainage systems, waterlogging, crop damage and decline of livelihood opportunities for farmers and fishers concluding that current water.

The plan concludes that the polder concept and approach should be accepted as a basis for the future development of most of coastal Bangladesh although suggesting to renew and modify the polder concept in such a way that it becomes robust for ensuring food security and economic development and can withstand the long-term challenges of climate change. It recommends furthering improvement of coastal polders, a continuation of on-going improvements including the CEIP and Blue Gold projects while scaling up and improving TRM to tackle current problems of siltation and waterlogging in an integrated and holistic way. It further concludes that a strategy needs to be formulated for long term sustainability of polders by restoring tidal plains for increasing tidal prism in the tidal rivers and allowing tide for sediment deposition in the polders for building low-lying areas.

4. Participatory Water Management[13]

National authorities have recognised the importance of Community Participatory Water Management (CPWM) by approving in 2001, a guidelines document that defines participation and provides the mandates and responsibilities of community organizations: Community Groups, Associations and Federations.

The Guidelines understand participation as an important voluntary process in which local stakeholders influence policy formulation, consider alternative plans/ designs, investment

[13] http://www.lged.gov.bd/UploadedDocument/UnitPublication/17/366/gpwm.pdf

choices and management decisions affecting their communities by establishing a sense of ownership. The Guidelines consider participation as an effective self-management of activities by individuals, communities and/or stakeholder groups. The document recognises that, with increased participation of local stakeholders in managing water resources, project selection, service delivery and cost sharing would improve implementation of projects and programmes, stressing the essence of participation is to exercise voice and choice enhancing the effectiveness and sustainability of water resources projects.

The Guidelines define three main actors: a) Water Management Groups, b) Water Management Associations and, c) Water Management Federations.

Water Management Group.

The broad tasks and responsibilities of the Water Management Groups (WMG) include, *inter-alia*, to: i) carry out interactive activities through preliminary discussions, meetings and motivation with all stakeholders, ii) establish working procedures and interaction processes to ensure participation in all stages of a project cycle, iv) prepare annual crop and other production and operational maintenance plans, iii) mobilise local resources and collect beneficiary contributions towards scheme investment and operation and maintenance costs, iv) keep account records and auditing, v) work with implementing agencies, NGOs, community level self-help groups and Local Government Institutions (LGI), vi) progressively take up full or shared water management responsibilities and, vii) resolve conflicts, elect/ select office bearers, vii) explore dimensions of economic activities around water resources projects scheme.

Water Management Association.

The broad tasks and responsibilities of the Water Management Association (WMA) include among others to: i) prepare budgets and participate in overall activities ii) review and resolve conflicts or issues referred to by WMGs, iv) liaise with project implementing agencies, LGIs, NGOs and community self-help groups concerned, v) sign documents for management transfer

on behalf of the WMGs with implementing agencies or LGIs as appropriate and , vi) formally represent the beneficiaries and project affected persons in all issues relating to water management.

Water Management Federation.

The broad tasks and responsibilities of the Water Management Federation (WMF) include, among others: i) liaising with implementing agencies, ii) overseeing the activities o! WMAs, iii) coordinating the functions of various stakeholders in water management, iv) mobilizing joint efforts for effective application of rules/ procedures regarding water management, v) representing beneficiaries and project affected persons on issues relating to water management, vi} preparing annual crop and other production and O&M plans prepared by WMA, vii) collecting where applicable from the WMAs beneficiary contributions towards operation and maintenance of projects or schemes and viii) supervising scheme-level construction to ensure that it is done as per design.

In order to achieve CPWM objectives, the guidelines stress the need to further capacity development of WMOs regarding organizational, technical and financial aspects, stating that capacity development is not only needed to develop the capacities of WMOs but also to ensure the improvement of the capacities of those who work with them, such as, LGIs, NGOs and Implementing Agencies. The guidelines underline that a capacity development approach should be taken as a comprehensive task aimed at enhancing capacities of all the key stakeholders in participatory water management for which public water projects should include a training component for transfer of knowledge and technology. The Guidelines further suggest addressing capacity development as a two-way communication process while furthering the use of Training of Trainers (ToT) courses to be organised by implementing agencies.

B. Learning issues and objectives[14]

The following issues would need to be considered in the context of learning how Bangladeshi authorities have addressed them: a) integrating different sectors in the implementation of water management projects and programmes, b) recognising that problems and solutions associated with IWRM implementation in different regions of a country or region may not be universal, c) considering that water resource management by public or government organisations requires the participation of actors not only dealing with water supply and wastewater treatment but must be combined with other functions such as flood control, poverty alleviation, food production, d) furthering channel engineering for the purposes of flood control, drainage improvement and, reduction of bank erosion, e) including fisheries and aquaculture for human survival and poverty reduction and nutritional demands, f) taking into account lessons from past initiatives for implementation of IWRM principles and policies, g)recognising that area populations are involved in various economic activities and that their occupations and economic conditions are different according to their income, h) considering the impact of TRM on agriculture and the labour market specifically for people involved in fish and shrimp farming and day labour, i) addressing compensational conflicts, j) addressing devolution of responsibility over operation and maintenance from the State to communities and duplication of functions of local government and community groups, k) ensuring the representation of women and landless in decision-making processes, l) considering other water uses that are particularly important for women such as drinking water, bathing, sanitation, livestock and homestead garden irrigation, m) addressing assignment of responsibility of operation of gates from a state-employed gatekeeper to 'communities and n) addressing sustainability issues especially regarding maintenance challenges

[14] For a detailed analysis of IWRM and CPWM issues see
Rahaman, Muhammad Mizanur and Varis, Olli, Integrated Water Resources Management: Evolution, Prospects and Future Challenges (April 12, 2005). Sustainability: Science, Practice, & Policy, Vol. 1, No. 1, Spring 2005.
C; Buisson, M.-C. and Mukherji, A. 2014. The imposition of participation? The case of participatory water management in coastal Bangladesh. Water Alternatives 7(2): 342-366

Learning objectives would then include understanding water resources management engineering in low coastal areas and above all institutional and social dimensions.

C. From theory to practice. Selected case studies

The LDAI Learning Agenda, which includes the organisation of Learning Routes, will require selecting case studies or exemplary demonstrations of tried approaches such as those analysed earlier. National authorities and international financial institutions are putting into practice the main theoretical and conceptual frameworks identified above in the coastal area hotspot. The following two projects under implementation provide the required learning environment.

1. The Coastal Embankment Improvement Project (CEIP)[15]

Approved in 2013 for a total of US$ 375 million IDA Loan, the project, with an expected closing time in December 2020 is currently under implementation by the BWDB. It includes six coastal districts (Bagerhat, Khulna, Satkhira, Barguna, Patuakhali and Pirojpur), providing direct protection to the 760 000 people living within the project's polder boundaries, and expected to benefit the 8.5 million people living in the six coastal districts through agriculture development, employment and food security.

The project's development objectives are to: (a) increase the area protected in selected polders from tidal flooding and frequent storm surges, which are expected to worsen due to climate change; (b) improve agricultural production by reducing saline water intrusion in selected polders; and (c) improve Government capacity to respond promptly and effectively to a crisis or emergency. These objectives are being achieved by strengthening and upgrading embankments as part of an integrated approach to improve the polder system in the coastal area.

[15] http://projects.worldbank.org/P128276/coastal-embankment-improvement-project-phase-1ceip-1?lang=en

The Project Appraisal Document (PAD) stresses the need to include all stakeholders from the outset as this has been shown to promote sustainability and to ensure the long-term integration of social and environmental considerations during project construction and post construction underlining that reform initiatives of the Government over the last decade such as the National Water Management Plan approved by the Government in 2004 and through the WB funded Water Management Improvement Project (WMIP) have created an enabling environment to introduce participatory approaches for improved water management. The CEIP-I project will pilot this approach through WMO in 4-6 polders.

The project has five components: a) Rehabilitation and Improvement of Polders; b) Implementation of Social and Environmental Management Frameworks and Plans; c) Construction Supervision, Project Monitoring and Evaluation, and Coastal Zone Monitoring; d) Project Management, Technical Assistance, Training and Strategic Studies; e) Contingent Emergency Response.

Learning pointers. A review of the project's documentation allows for selecting a number of learning pointers such as: a) implementation of afforestation programmes and furthering community awareness of the protective and productive functions of trees; b) building capacity of local institutions and communities in secondary maintenance schemes such as embankment afforestation, social forestry and protection of embankments against erosion; c) strategies for achieving climate resilience; d) design of long term monitoring programmes of environmental changes; e) stakeholder and beneficiary consultations; f) use of social mobilization; g) use of resettlement action plans; h) establishment of an environmental monitoring system; i) gender inclusive approach in the overall implementation of the project and in particular regarding resettlement and livelihood restoration of project affected peoples.

2. Blue Gold project[16]

Approved in 2013 for a six-year period, the project's operations are concentrated on the polders of three districts: Patuakhali, Khulna and Satkira in the costal hotspot benefitting 150 000 households directly. Funded by the Government of The Netherlands for a total close to € 50 million, the project's overall objective is to reduce poverty in the coastal area by enhancing the livelihood of the rural population, through more efficient water resources management and increased productivity of crops, fishery and livestock in the polders and by empowering the communities to be the driving force. The aim is to "address both the immediate development needs, as well as the longer-term requirements for a continuing sustained development process, of the people in the selected area of intervention".

Main project components include: a) community mobilisation and institutional strengthening, b) sustainable integrated water resources management, c) food security and business development, and d) livelihood and crosscutting issues.

Learning pointers. Many project activities can serve as learning pointers such as: i) mobilisation processes including the creation of viable water management groups, ii) creation of Farmers Field Schools (FFS), iii) improvement of production system of crops and horticulture, fish, livestock, based upon improved water resources management, iv) use of product value chain approach, v) preparation and implementation of Business Plan defined by producers and upon an inventory of potential buyers, investors and market research, vi) development of Community Action Plans for the rehabilitation or fine-tuning of water infrastructure related to the productive sectors, vii) use of value chain analysis for marketing of agricultural products, viii) improving food access and food use for local inhabitants, in particular women, ix) provision of credit and linkages with credit institutions and, x) curriculum development and training for agricultural support service providers.

[16] http://www.bluegoldbd.org/

V. LEARNING ISSUES, OBJECTIVES AND ACTIVITIES

A. Overall Conceptual framework.

Learning issues, objectives and activities should be viewed in the context of a conceptual framework articulated by the GWP and the Delta Alliance known as **Adaptive Delta Management (ADM**). The Delta Alliance understands ADM as "a structured, iterative process of robust decision making in the face of uncertainty which encourages an integrated and flexible approach to land and water management aimed at reducing vulnerability while limiting the risk of over or underinvestment in future challenges such as flood risk management and freshwater supplies".

A World Bank article [17] recognises that ADM helps to ensure that short term investments address the long-term challenges facing the Bangladesh Delta by considering not only the short-term benefit of investments, but also anticipating and avoiding possible adverse longer-term consequences. ADM takes account of all aspects of infrastructure systems and services such as agriculture and aquaculture, fisheries, forestry, transportation, water and sanitation, energy, industry, ecosystems as well as physical infrastructure in each of these sectors, which impact lives and livelihoods of the inhabitants of the delta. The WB underlines that the ADM approach looks for opportunities to combine different investment agendas with the aim of making actions easier and cheaper while yielding more societal and paying consideration to the consequences of climate change. The approach furthers resilience in all sectors by ensuring that vulnerabilities in one sector do not compromise others by adopting a holistic approach to reduce people's exposure to both anthropogenic and climate-induced hazards.

[17] http://www.worldbank.org/en/news/opinion/2015/06/05/managing-bangladesh-delta-needs-different-approach

Table 1. Learning issues, objectives and relevant experiences

Issue	Objective	Relevant experiences
Complexity of polder scheme construction/ rehabilitation involving land acquisition, physical and economic displacement of people	To understand land acquisition process and solutions adopted for people's displacement especially as related to the rehabilitation and improvement of polders including; i) embankment monitoring and public consultation plans, ii) development of a system to computerise land acquisition and resettlement data with GPS reference and, iii) verification of field data to guard against improper targeting of beneficiaries and/or false delivery of benefits.	CEIP Component B2 Implementation of a Social Management and Resettlement Policy Framework (SMRPF) and Resettlement Action Plans (RAP)
Soil erosion and tidal surges severely affect coastal areas	To understand capacity building of local institutions and communities in embankment afforestation, social forestry and protection of embankment against erosion.	CEIP I Component 2A Afforestation.
Limited functioning of water controlling structures and silted internal drainage channels	Further understanding of technical issues involved in rehabilitation of critical portions of polder embankments including: i) slope protection work, ii) increasing embankment height in some stretches to improve resilience, (iii) repairing and upgrading drainage and flushing systems within polders, and (v) improving operations and maintenance.	CEIP Component A1 Rehabilitation and Improvement of Polders
Land ownership and competing land-use (fish and shrimp ponds, rice paddies, livestock grazing, settlement.	Understand optimisation of water use for the productive Sectors, while overcoming conflicting interests, will have to be ensured.	Blue Cross and CEIP projects
Gaps between participation in policy versus participation in practice,	Understand effective community participation by WMGs/WMAs in the design and planning of water resources infrastructure and in its implementation through labour	Blue Gold Component 3.1 Community Mobilization and institutional

	contracts and operation and maintenance arrangements.	strengthening component
Lack of timely maintenance increases the chance of embankment failure.	To assess and understand engagement of local communities in minor maintenance works.	Blue Gold project
Limited support for the productive sector including analysis of agricultural development options, provision of extension services, input supply, credit, processing technology and private sector involvement.	To analyze adoption and implementation of a value chain development approach for agricultural products and use Farmer Field Schools (FFS) for transferring new sustainable technologies	Blue Gold- Business Development and Private Sector Involvement component
Poor access to safe drinking water and sanitation by local inhabitants	To learn from action taken in terms of WASH including: i) access to safe water supply. ii) use of home latrines/toilets, iii) training of school children in sanitation and hygiene	BRAC WASH II. The Max Foundation and the Government of the Netherlands Blue Gold Polders:
Limited integration of different sectors in the implementation of water management projects and programmes	To assess the effectiveness of project implementation arrangements through Steering Committees with multi-stakeholder participation	Blue Gold project

VI. CONCLUSIONS

Having concluded activities under Scoping Phase of the LDAI it appears now necessary to move ahead with implementation of a first Learning Route in Bangladesh for which agreements must be reached with national authorities in terms of the suggested learning issues to be covered. A final decision on the territory to be covered and the respective projects hosting the learning exchange should be taken.

Once decisions are being taken regarding the learning objectives of the Route and required funding is allocated a Call for Applications for participation should be issued and widely disseminated especially among countries and organizations members of the Delta Alliance. The Call should include a description of the issues to be addressed. The Call should additionally describe activities planned and a detailed programme and schedule. The 'host cases" should be described in detail including main themes and what learning achievements are foreseen.

It would be necessary to also provide background information on the LDAI and In accordance with the Learning Route methodology, a detailed description of the Innovation Plan approach should be included detailing the contents of the Plan and its financing structure.

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VIII. Appendix 1

A. International Financial Institutions: Strategies and operations

1. The World Bank

The **Bangladesh** strategy[18] includes three main pillars and objectives:

- **Growth and Competitiveness**: a) Increased power generation capacity and access to clean energy, b) Improved transport connectivity c) Improved delivery of basic services in urban areas, d) Enhanced business environment and trade facilitation, and e) increased financial intermediation.
- **Social Inclusion:** a) Improved equity in access and quality of education; b) Improved access to quality maternal and infant health services; c) Improved social protection coverage for the poor, and d) Enhanced rural income opportunities for the poor;
- **Climate and Environment Management:** a) Increased resilience of population to natural disasters in urban and coastal areas, b) Improved water resource infrastructure for climate resilience, and c) Increased adoption of sustainable agricultural practices.

Operations include: i) Regional Waterway Transport Project (US$ 400 million[19]) xP154511 approved Jjune 30 2016 Closing date June 30, 2024 , (ii) Weather and Climate Services Regional Project [20](US$ 113 million) P150220 approved 3 June 2016 Closing December 31 , 2022

The **Myanmar strategy** [21] includes three main pillars and objectives**:**

- **Reducing rural poverty:** a) provide support to help increase agricultural incomes and productivity, rural electrification, community-driven investments in local infrastructure and services, b) improve Ayeyarwaddy River navigation and flood control, and c) reduce vulnerability to shocks.

[18] http://documents.worldbank.org/curated/en/362231468185032193/pdf/103723-REVISED-PUBLIC-IDA-R2016-0041.pdf
[19] http://projects.worldbank.org/P154511?lang=en
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[21] http://documents.worldbank.org/curated/en/132341486543566177/Myanmar-country-partnership-framework-for-the-period-2015-2017

- **Investing in people and effective institutions**: i) provide support for empowerment and inclusion and transparent institutions; b) provide targeted support to further universal access and improvement of the quality of essential social services, especially health and education and, c) provide support for State institutions to deliver effectively at the local level.
- **Supporting a dynamic private sector:** i) support institutions and investments that can foster a competitive private sector, ii) provide support to build modern financial institutions and markets, iii) foster development of the formal private sector and trade, investment, and private sector job creation.

The following operations are relevant: i) Southeast Asia Disaster Risk Management Project (US$ 117 million); ii) Flood-and-Landslide-Emergency-Recovery-Project-(US$ 200 million); iii) National Community Driven Development Project (US$ 400 million) and, iv) Aveyandawy Integrated River Management project (US$ 100 million).

2. The Asian Development Bank

In **Bangladesh**[22] the ADB will support: (i) easing infrastructure constraints in key sectors, such as energy, transport, and urban development; (ii) creating conditions for greater private sector participation to attract investment; (iii) enhancing the productivity, and skills of the workforce; (iv) increasing the productivity of agriculture and creating gainful rural employment opportunities outside agriculture; (v) helping Bangladesh take advantage of its location as a regional transport and trade hub; (vi) managing environmental and climate change-related vulnerabilities; and (vii) addressing institutional capacity constraints and improving governance.

Operations in Bangladesh include: i) Flood and Riverbank Erosion Risk Management Investment Program US$ 100 million; ii) Rural Infrastructure Maintenance Program US$ 210 million; iii) Flood and Riverbank Erosion Risk Management Investment Program III (US$ 80 million); iv)

[22] https://www.adb.org/documents/bangladesh-country-partnership-strategy-2016-2020

Climate Change and Disaster Resilience Small Scale Water Resource Management (US$ 100 million); and v) Coastal Towns Environmental Infrastructure Project

In **Myanmar** the ADB's Country Partnership Strategy 2017–2021[23] aims to support: (i) improving access and connectivity to connect rural and urban areas and markets, and to link Myanmar with regional and global marketplaces; (ii) strengthening human capital to promote a skilled workforce and increased employment, and enable the poor and disadvantaged to benefit from economic growth; and (iii) promoting structural and institutional reform to support the modernization of the economy.

Operations in Myanmar include: Climate Friendly Agribusiness Value Chains, US$ 20 million and Disaster Resilient Rural Development in Myanmar, US$ 40.4 million.

3. The International Fund for Agricultural Development (IFAD)

IFAD's **Bangladesh**[24] strategic objectives include: a) enabling poor people in vulnerable areas to adapt their livelihoods to climate change better; b) helping small producers and entrepreneurs to benefit from improved value chains and greater market access and, (c) empowering marginalized groups including poor rural economically and socially.

Operations include a total of six projects; i) Participatory Small-scale Water Resources Sector Project (US$ 32 million) and ADB (US$ 55 million), ii) Char Development and Settlement Project IV (US$ 47.3 million) and a Netherlands grant US 20.6 million in coastal areas, iii) Haor Infrastructure and Livelihood Improvement Project (US$ 71.1 million) and Spanish Fund (US$ 27.9 million)j; (iv) Coastal Climate Resilient Infrastructure Project (US$ 60 million) ADB (US$ 20 Million) Climate Fund (US$ 30 million, (KfW US$ 8.8 million) and (v),Promoting Agricultural Commercialization and Enterprises Project (US$ 40 million.

[23] https://www.adb.org/documents/myanmar-country-partnership-strategy-2017-2021
[24] https://operations.ifad.org/documents/654016/10db1b34-565b-4d32-a754-8b5b2755c84e

IFAD's **Myanmar Strategy**[25] aims at: a) empowering rural people with access to agricultural resources, technologies, services and markets; b) creating business and employment opportunities for rural women and men, and c) promoting the social and economic empowerment of marginalized populations, especially ethnic groups.

Current operations include: a) Fostering Agricultural Revitalization in Myanmar Project for a total of US$ 19.5 million.

[25] https://webapps.ifad.org/members/eb/111/docs/EB-2014-111-R-6.pdf

IX. Appendix 2

A. Bangladesh Institutional framework

1. Ministry of Water Resources

The Ministry is responsible for development and management of national water resources. It formulates policies, plans, strategies, guidelines, instructions and acts, rules, regulations, relating to the development and management of water resources, and regulation and control of the institutions reporting to it. The Ministry prepares and implements development projects relating to flood control and drainage (FCD); riverbank erosion control; delta development and land reclamation; and provides irrigation, drainage, flood protection, bank erosion protection, land reclamation facilities by constructing barrages, regulators, sluices, canals, cross-dams, embankments and sea-dykes along the banks of rivers and the coast, Additionally, it collects, processes, stores and disseminates hydrological and hydraulic data and information, provides flood forecasting and warning information through the Flood Forecasting and Warning Center (FFWC) of BWDB. The Ministry has also research and coordinating institutions such as the River Research Institute (RRI) responsible for physical and mathematical water modeling;

Other principal activities of the Ministry include expansion of irrigated areas, water conservation, surface and groundwater use, estuary control, anti-salinity measures and anti-desertification activities, re-excavation of canals and rehabilitation of embankments, international cooperation, liaison with the international organizations, processing matters relating to treaties and agreements with other countries and world bodies in the field of water development and management.

2. The Bangladesh Water Development Board [26]

[26] http://en.banglapedia.org/index.php?title=Bangladesh_Water_Development_Board

The BWDB has jurisdiction for administering the flow of all rivers, waterways and ground water bodies and to undertake programmes relating to the water resources sector including project formulation, implementation, operation, maintenance and evaluation in line with the National Water Policy and the National Water Plan. Its responsibilities include to; i) further development and control of rivers, river basins and construction of water reservoirs barrages, embankments, regulators and other structures for flood control, drainage and irrigation system development and drought prevention; ii) undertake re-excavation of water ways, canals, water bodies for the improvement of water flow or to divert its course with a view to easing irrigation, fisheries, shipping, afforestation, wild life preservation and environment development; iii) protection, recovery and reclamation of land and management of river estuaries; iv) protection of river banks, towns, markets and places of historical and national importance from river erosion; v) construction and protection of coastal embankments; vi) prevention of infiltration of saline water and desertification, vii) harvesting of rain water for irrigation, environment protection and drinking purpose, viii) forecasting and warning of flooding and drought; ix) conducting hydrological investigation and research and collection, preservation and dissemination of information and data regarding these matters; x) construction of roads on dams and embankments, implementation of fisheries projects and afforestation on own land to ensure environmental protection and development; (xi) organising beneficiaries of implemented projects to continue the programmes.

3. The Water Resources Planning Organization (WAPRO).

Under the Ministry of Water Resources, WARPO responsibilities include to: i) determine national policies and strategies for the scientific utilization and conservation of water resources, ii) provide consultancy services to other organizations involved in the development, utilization and conservation of water resources, iii) review and evaluate the impact of actions taken by any organization involved in the development, utilization and conservation of water resources and offer counsel in those matters, iv) improve the level of education, training and professional standards related to the utilization of water resources, v) collect and review information related to the utilization of water resources and to arrange for its dissemination, vi) arrange and

conduct national and international seminars, conferences and workshops related to water resources with prior approval of the government for international events.

4. The Institute of Water Modelling (IWM)

The IWM aims at becoming a world-class institute of learning and research in the field of water modelling, computational hydraulics and allied sciences in enhancing the quality of planning and implementation activities in the relevant fields and providing solutions to water problem in holistic approach.

5. The Centre for Environmental and Geographic Information Services (CEGIS)

CEGIS is a scientifically independent center of excellence for sustainable socio-economic development using integrated environmental analysis, geographic information systems, remote sensing techniques, database, information including geo-informatics and modeling and social development tools and techniques. Areas covered encompass water resources, agriculture, fisheries, forestry, power and energy, river morphology, climate change, disaster management and, spatial planning.

6. Bangladesh University of Engineering and Technology (BUET)

BUET is the leading public university in the country. It has sixteen teaching departments under five faculties and three research institutes. .A significant part of the university's research works are directed towards the study and solution of field problems including: i) sedimentation rate of alluvial rivers, ii) coastal erosion protection; iii) saline water intrusion; iv) Instream flow requirements of rivers; v) characterization and impact evaluation of drought; vii) flood

discharge and flood frequency analysis; vii) **c**limate change impacts on the hydro-morphology of rivers; viii) regional estimation of climatic parameters; ix) impact of agricultural land use changes on surface and ground water; x) floating pump irrigation; xi) stochastic analysis of deficiency of crop water requirement; xii rainfall estimations using satellite data; xiii) Assessment of crop damage due to flood using Geographic Information System (GIS) technology.

7. River Research Institute (RRI).

Under the Ministry of Water Resources, RRI is responsible for conducting: (i) physical model studies for design of river training, river erosion control, flood control, irrigation and drainage activities and also for research works in the fields of river engineering, sediment control, estuary and tidal effects; (ii) Mathematical Model Studies in the fields of river flows and hydrological zones, hydrology, utilisation of surface and ground water, environmental aspects, specially salinity intrusion and water quality; (iii) conduct tests on different construction materials used in the works of river training, erosion control, flood control, irrigation and drainage structures and also to investigate the quality of construction works and evaluation thereof; (iv) training programmes on the above mentioned subjects and to publish related technical journal and reports; (v) to advise the government, local authority or any other organisations on the aforesaid subjects; (vi) to co-operate with and to conduct joint venture programmes with other local or foreign organisations engaged in similar activities; and (vii) to take any necessary actions to perform the above mentioned responsibilities.