

## **Part 3: Appendix I**

### **Project Costs and Benefits Analysis**



## Appendix I : Project Cost and Benefit Analysis<sup>161</sup>

### I.1 Introduction

The Government of Bangladesh has initiated the Bangladesh Delta Plan 2100 (Delta Plan or BDP2100) to define a long-term vision for Bangladesh's development. The Delta Plan links Bangladesh's medium-term goal to become an upper middle income country with its long-term goals to manage water, ecology, environment, and land resources sustainably. Given its deep experience with managing delta issues, the Government of the Netherlands is providing technical assistance to the Government of Bangladesh for the formulation of the Delta Plan. The General Economics Division (GED) of the Planning Commission is coordinating consultant inputs from BanDuDeltAS (Team A) and Policy Research Institute (Team B) to develop the Delta Plan. Both teams have now submitted Zero Draft Delta Plans, which are being reviewed by GED.

To support implementation of the Delta Plan, the World Bank Group (WBG)<sup>162</sup> is assisting GED with the formulation of a BDP2100 Investment Plan. The Investment Plan will include relevant projects for implementation through 2030. Because Bangladesh is one of the most economically dynamic and climate change vulnerable countries in the world, any proposed investments must be planned in a fully adaptive way to ensure successful implementation and sustainability. The Investment Plan does this by applying the principles of adaptive delta management (ADM) to develop a credible, implementable, and sustainable Investment Plan to support the Delta Plan.

The purpose of this report is to assess BDP2100 priority projects for eventual inclusion in the Investment Plan. Team A has prepared Project Concept Notes (PCNs) for over 100 projects for consideration for the Investment Plan. These PCNs have varying levels of detail, from detailed project concepts to initial project ideas. GED has provided 34 of these PCNs to the WBG Investment Plan team to consider for the Investment Plan. Of these 34 projects (detailed in Section I.7), the Team was able to obtain enough detailed information for 26 projects for a full project assessment to determine suitability for inclusion in the Investment Plan. The other eight projects do not yet have sufficient information to be properly assessed. GED rejected a further two projects for inclusion because they are already in advanced stages of consideration for implementation, and the Investment Plan team identified another three projects that had already secured funding. GED also combined two pairs of related projects. This resulted in a total of 19 projects to be considered for detailed assessment. The results of this project assessment will be used to develop the Investment Plan.

#### The report is structured as follows:

- **Section I.2:** describes the assessment process and criteria. The Investment Plan team considered various aspects of each project, including costs and benefits and feasibility study results.
- **Section I.3:** summarizes the project cost benefit analyses and describes the methodological issues.

<sup>161</sup> This Project Costs and Benefits Analysis report was developed as one of the early stages of the Investment Plan formulation process. It only covers projects for which there was sufficient information available.

<sup>162</sup> In collaboration with the 2030 Water Resources Group

- **Section I.4:** presents the Investment Plan team's overall observations of the group of projects. The full list of projects received (Batches 1-3) is given in I.7. We have since received a fourth batch of initial project ideas on 24 September 2016 for consideration in the Investment Plan. These additional preliminary project ideas are given in I.8. The Batch 4 concepts will be analyzed as part of the Investment Plan.
- **Section I.4:** suggests how projects could be prioritized in the Investment Plan and demonstrates how the prioritization approach works with the current batch of projects.
- **Section I.6:** presents the detailed assessments for each project. Although these assessments are based to a significant extent on information in the BDP2100 PCNs, the Investment Plan team has conducted considerable additional research and consultations where feasible to supplement the information in the PCNs. A record of the additional research and consultations is provided in I.10.

## **I.2 Project Assessment Process**

The projects were screened in two phases. Here we describe the analytical process for the initial assessment, detailed assessment, and the project prioritization framework. Overall observations from the analysis are given in Section I.3 and Section I.4. Detailed project assessments are included in Section I.6.

### **I.2.1 Initial Assessment**

For each project, we compiled as much background information as possible to supplement the information in the PCN. We also consulted with relevant stakeholders within each Ministry and Department. Based on this information, we conducted an initial assessment of each project's state of readiness, development history, consistency with Government plans, linkages to climate change adaptation, and suitability for private sector participation.

First, we examined the information available, such as feasibility studies, environmental and social impact assessments, cost benefit studies, and development project proformas (DPPs) or preliminary development project proformas (PDPPs). The amount of information available, and when studies were completed or updated, is an indication of the project's state of readiness. Where information is outdated or studies have not yet been carried out, we have noted these needs.

Next, we did a high-level check of whether each project is consistent with the Government of Bangladesh's stated objectives. These objectives were derived from laws, policies, and plans such as the Seventh Five-Year Plan (FYP). I.7 lists all the documents that we reviewed as part of this assessment. We also assessed whether each project is in line with BDP2100 goals.

We noted the history of the project's development, such as which agency first proposed the project, and any delays with the project proposal.

Finally, we conducted an initial assessment of whether the project is linked to climate change adaptation measures, and whether this type of project has a track record of private sector participation internationally.

### **I.2.2 Detailed Assessment**

From 130 project proposals received, 26 have sufficient information to be considered "detailed" PCNs. Detailed project assessments were conducted for each of these projects. In addition to the information from the initial assessment, the detailed assessment includes:

- A brief description of the project history
- Problems and challenges that the project aims to address
- An assessment of the project costs and benefits
- A technical assessment
- Linkages to existing policies and initiatives
- Linkages to other projects, ongoing or planned
- An assessment of the application of ADM principles
- Linkages to climate change adaptation issues
- Assessment of private sector financing potential
- Assessment of the policy and institutional reforms required for successful implementation.

We analyzed each of the above areas by reviewing the PCNs, reading all supporting documents wherever available, and having conversations with line agencies responsible for developing and implementing these projects and with other experts as appropriate. I.10 details the research and consultations we conducted. Below, we explain what we analyzed in each of the areas identified above.

### **Brief description of the project history**

For each project, we describe how the project idea was first conceived, and which agency or agencies first proposed the project. We describe how the project was developed, including any feasibility or environmental and social impact assessments conducted.

### **Problems and challenges the project aims to address**

This describes the specific issues that each project is designed to address. We draw linkages to any relevant BDP2100 goals and issues.

### **Economic costs and benefits**

We summarize the available information on capital costs and operating and maintenance costs. We assess whether these cost estimates seem reasonable. We also assess the benefits assumed for these projects and identify areas for improvement. We note where information is outdated, and where additional studies are needed to provide more accurate cost and benefit information.

This section also considers potential environmental and social costs and benefits drawn from environmental and social impact assessments and cost-benefit analyses. Where applicable, we note if studies need to be carried out or updated, and suggest methods to address methodological flaws.

### **Linkages to existing policies and initiatives**

Government ownership and alignment with Government policies and initiatives is an important requirement for any project to be included in the Investment Plant. We evaluated each project's linkages to the Seventh Five-Year Plan and other sectoral plans, policies, and regulations, including ones related to climate change. We also analyzed alignment with BDP2100 goals and objectives.

### **Technical assessment**

This section describes the technical layout of the project as far as information is available. It assesses the technical feasibility of the project. Where possible, the analysis is based on completed feasibility studies. The analysis also draws on established technical experience.

### Linkages to other projects

One of the main principles of ADM is to address challenges in an integrated, holistic manner. Previously, many projects have been developed as standalone projects without considering impacts on and from other related projects. This section analyzes the project relative to other projects, BDP2100 hotspots, and BDP2100 cross-cutting themes. We note where study results may change once information from related projects are factored into the analysis.

### Application of ADM principles

In assessing the proposed projects, we analyze whether the project incorporates the principles of ADM. A project incorporates these principles if:

- It anticipates by using adaptation or development pathways instead of final images
- The project ensures measures undertaken are adequate by connecting short-term decisions to long-term delta needs, such as flood protection and water availability
- It values flexibility so that the project can address uncertainties to prevent over- or under-investment and invest in real needs
- It promotes concerted action by synchronizing public and private investments to a common agenda<sup>163</sup>.

For example, a project should only be implemented after certain tipping points are reached along adaptive pathways, and project implementation should be adapted based on changing exogenous factors. We identify additional measures that can be included to make the project more adaptive and flexible.

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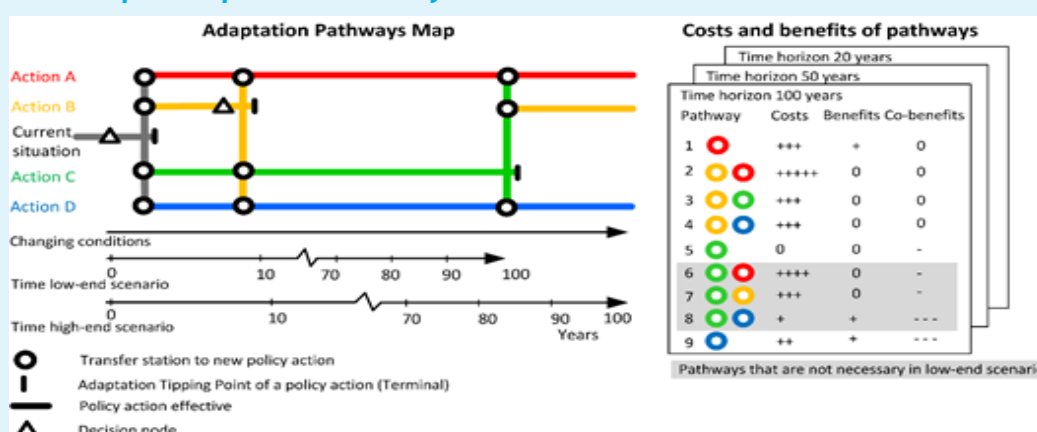
163 <https://www.deltares.nl/en/adaptive-pathways/>

### Box I.1: Brief Introduction to Adaptation Pathways

Applying the ADM approach with adaptation pathways and tipping points will, in principle, lead to robust plans. A robust plan will be successful in a wide variety of plausible future scenarios. It has the flexibility and ability to adapt over time to respond to changing circumstances<sup>164</sup>.

To develop and use the adaptation pathways and tipping points approach, clear policy objectives are needed. Tipping points then relate to the situation when additional measures are required to keep fulfilling the policy objectives. In Bangladesh, no specific policy objectives have yet been formulated that can be used to relate any physical tipping points to the need for additional measures. An example of such a policy is that flood protection in urban areas should be strong enough to withstand 1 in 100-year flood events. Absent these specific policy objectives, adaptation pathways cannot be used to pinpoint one specific project on one specific pathway matching one specific tipping point. Nevertheless, adaptation pathways can still be useful to locate types of projects on corresponding pathways and associated tipping points.

Figure I.1: Sample Adaptation Pathway



Source: <https://www.deltares.nl/en/adaptive-pathways/>

To factor in uncertainties in the planning process, it is necessary to identify scenarios of possible future developments. Interventions can then be identified that will be effective for as broad a range of scenarios as possible. It is possible to develop different combinations of interventions, and the order of implementation of these interventions can change. These different ways of combining and planning interventions are called adaptation pathways.

Adaptation pathways provide different routes to reach the objectives that have been or will be set for Bangladesh. These can be long-term as well as short-term objectives. Many short-term interventions are needed to achieve current objectives. When looking to the objectives in the medium to long-term, additional interventions will be needed.

If one or more additional interventions are needed to continue meeting the objectives, this is called a tipping point. For example, a sea barrier can be designed such that it can cope with a certain amount of sea-level rise. Thus, sea-level rise will be the tipping point for this intervention. In planning agriculture cultivation, the level of salinity of the water supplied to the crops can be one of the tipping points. Before the tipping point is reached, new interventions (such as other crops, migration, or desalinization) should be implemented.

Figure I.1 provides a general overview of adaptation pathways. Action A or Action D can be taken to ensure adaptation to changing conditions in the long-term. It is also possible to choose Action B or Action C, but this means that once their tipping points have been reached, additional measures must be implemented.

164 Developing dynamic adaptive policy pathways: a computer-assisted approach for developing adaptive strategies for a deeply uncertain world, Jan H. Kwakkel & Marjolijn Haasnoot & Warren E. Walker, 2014



### **Linkages to climate change adaptation**

Bangladesh is one of the most climate change-vulnerable countries in the world, and the impact of climate change can significantly affect the effectiveness and relevance of projects. For example, projects related to flood protection and irrigation may be increasingly needed to adapt to rising sea levels and saline intrusion. We assess whether the project scope and design sufficiently cover the impact of climate change.

### **Private sector financing potential**

Given the likely financing constraints, it will be necessary for the Government to widen its sources of financing. Private financing is likely to be critical since there is almost unlimited source of financing available for the right projects from this source. However, private financing for water resources projects is quite challenging in general and especially for a country like Bangladesh, given its nascent PPP market and other issues like lack of capacity, country risks, and so on. We analysed all projects to identify if any of them (or if components of such projects) could be financed privately.

### **Policy and institutional reform**

Simply having adequate financing is not enough to guarantee that a project will be successfully implemented. It is also important to have the right policy and regulatory framework in place, and sufficient institutional capacity within the implementing agencies. This section describes the main implementing agency or agencies for each project. Where there are multiple implementing agencies, we discuss the coordination mechanisms that will be required between the agencies. We describe existing policies and institutions that can facilitate implementation. Where there are capacity or policy gaps, we identify desirable capacity building initiatives and policy or regulatory reforms that will be required to successfully implement the project.

### **Overall project assessment**

Based on all the factors above, we provide an overall assessment of the project's priority and state of readiness. We rank priority and state of readiness as high, medium, or low. Where additional information or work is needed to fully prepare a project for Government review, we note what will be required. We also assess the adequacy of the provided results framework and monitoring and evaluation arrangements. We note where additional arrangements are needed and suggest possible solutions.

### 1.3 Costs and Benefits

Most, but not all, of the projects have estimated costs, as well as quantified estimates of potential project benefits. This information comes mostly from the feasibility studies. For some of the projects, a Development Project Proposal (DPP) has already been prepared, which also includes a costs and benefits component.

#### Costs

Costs generally reflect the capital costs and operation and maintenance (O&M) costs. Most projects have estimated financial and economic costs. Financial costs include estimated capital investment costs. Economic costs reflect public and private costs. They include adjustments to economic values for various economic distortions, such as market imperfections. Deriving economic costs involves estimating an internally consistent set of prices that reflect opportunity costs and societal objectives. These prices are then applied to the project's inputs and outputs. In other words, market prices are adjusted to reflect the shadow prices of all goods and services produced or used in the project.

For the most part, these costs have been derived appropriately. However, not all public costs have been considered. For example, network impacts affecting other areas and projects (upstream or downstream) or markets (bubble effect or crowding out) are ignored. Costs of resettling people have also been left out in many cases, such as CZ 1.6 Integrated Land Reclamation Project of Hatiya-Dhamar Char-Nijhum Dwip and CZ 1.8 West Gopalganj Integrated Water Management Project. Land acquisition costs are also often ignored.

Most importantly, for many of the projects, costs have been assessed in feasibility studies that are considerably outdated. Some feasibility studies were completed more than 10 years ago. These estimates are no longer reliable because the socio-economic environment, technology, and project requirements have changed. Therefore, new cost benefit analyses should be conducted based on current circumstances. A simple updating of inflation-adjusted prices is insufficient.

#### Benefits

Although a variety of benefits are described for each project, usually only agricultural and fisheries production benefits are quantified and valued in monetary terms. This is true even for projects with a DPP. This leads to a general underestimate of total benefits.

Environmental and/or socio-economic benefits other than agricultural and fisheries gains are mentioned (such as transportation), but hardly ever quantified. For example, MR 1.3 Sustainable Restoration of Connectivity of Major Navigation Routes does not quantify benefits from the faster and less expensive transport that major river routes will provide.

Even though agricultural output is by far the most important type of monetized benefit, the quantitative relationship between water supply and agricultural output is often lacking in the analysis. Increasing water availability may broaden participation in agriculture, increase opportunities for women, and benefit flora and fauna in the project area. These benefits are not analyzed or quantified.

In addition, agricultural benefits are often presented as financial revenues, even though the operator and investor do not derive any direct cash flows from project operations. These benefits should instead be regarded as economic benefits.

Cost benefit analyses for many of the projects are also methodologically flawed. In contradiction to what is prescribed in the DPP guidelines, cost benefit analyses for many projects do not include a proper “with” and “without” project comparison. This leads to an overestimate of benefits, especially agricultural ones.

Finally, as with economic costs, benefits in many cases have been assessed based on feasibility studies that are considerably outdated. These also need to be updated with new analysis based on current circumstances.

### Summary of costs and benefits

Table I.1 summarizes the economic costs, benefits, and net present value for each project. Costs and benefits have been updated to 2015 BDT prices for consistency across projects. This update was done using a simple inflation adjustment. However, such scaling is not always appropriate, especially when the original feasibility study is very old. In a country as dynamic as Bangladesh, there are large changes in the socio-economic context over even a few years. Therefore, cost benefit analyses require more comprehensive updates, as explained above.

Table I.1: Economic Costs and Benefits

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Project #	Project Name	PCN Batch	Year	Total Costs (BDT Millions)		Total Costs (USD Millions)		Total Benefits (BDT Millions)		Total Benefits (USD Millions)		NPV (BDT Millions)	NPV (USD Millions)
				(Orig Estimate)	(2015 prices)	(BDT Millions)	(2015 prices)	(Orig Estimate)	(2015 prices)	(USD Millions)	(2015 prices)		
MR 1.1	River Bank Improvement Program	1	2015	62,142	798	138,955	1,784	76,813	76,813	986	-	-	
MR 1.2	Study of Integrated River System Management and Protection of Accreted Land	3	2015	-	-	-	-	-	-	-	-	-	
MR 1.5	Study of Harnessing of Brahmaputra Water	3	2015	-	-	-	-	-	-	-	-	-	
MR 1.6	Development of Chandona-Barasia River Basin System	2	2011	292	421	675	825	383	405	5	-	-	
MR 3.1	Sustainable Restoration of Connectivity of Major Navigation Routes	1	2012	13,254	19,090	15,534	20,379	2,281	1,289	17	-	-	
CZ 1.1	Construction of Ganges Barrage and Ancillary Works	1	2011	156,688	230,811	2,963	323,031	4,147	83,578	1,184	-	-	
CZ 1.3	Char Development and Settlement Project-V	2	2012	803	827	1,393	1,309	590	481	6	-	-	
CZ 1.4	Pre-Feasibility Study for Integrated Management of Drainage Congestion for Greater Noakhali	3	2015	-	-	-	-	-	-	-	-	-	
CZ 1.5	Baseline Study of Tidal River Management	1	2006	446	881	1,214	2,399	31	768	19	-	-	
CZ 1.6	Integrated Land Reclamation Project of Hatiya-Dhamar Char-Nijhum Dwip	2	2013	2,916	3,174	605	658	8	(2,311)	(32)	-	-	
CZ 1.7	Urirchar-Noakhali Cross Dam Project	1	2010	1,441	2,076	3,741	5,144	66	2,300	39	-	-	
CZ 1.8/1.21	West Gopaleani Integrated Water Management Project	1	2012	2,856	3,702	4,278	5,228	67	1,422	20	-	-	
CZ 1.9	Sureswar Flood Control, Drainage and Irrigation Project	1	2012	1,634	1,697	6,665	8,748	105	5,031	83	-	-	
CZ 1.10	Rehabilitation of Polder 36/1	2	2009	688	1,071	1,669	2,622	34	581	20	-	-	
CZ 1.11	Improved Drainage in the Bhabaitha Area	3	2014	9,315	9,914	9,782	10,411	134	467	6	-	-	
CZ 1.26	Development of Water Management Infrastructure in Bhola Island	3	2015	-	-	-	-	-	-	-	-	-	
CZ 1.38	TRM of 7 Beels in Coastal Zone	1	2004	3,356	6,982	6,801	14,943	192	3,446	102	-	-	
UA 1.1	Protection of Rivers System around Dhaka City with Their Ecological Restoration	1	2005	7,848	16,567	13,813	29,159	374	5,965	162	-	-	
UA 1.2	Dhaka Integrated Flood Control Embankment cum Eastern Bypass Road Multipurpose Project	3	2015	3,855	3,855	6,639	6,639	85	2,784	36	-	-	
UA 1.3	Drainage Improvement of Dhaka-Narayanganj-Demra Project (Phase 2)	3	2015	-	-	-	-	-	-	-	-	-	
UA 9.1	Greater Dhaka Integrated Water and Sewage Improvement Project	3	2015	-	-	-	-	-	-	-	-	-	
UA 10.1	Improvement of Drainage Congestion and Flood Control for Chittagong City Corporation Area	2	2015	-	-	-	-	-	-	-	-	-	
HR 2.1/2.2	Village Protection against Wave Action in Haor Area and Improved Water Management in Haor Basins	1	2011	-	-	-	-	-	-	-	-	-	
DP 1.1	North Rajshahi Irrigation Project	2	2012	10,714	13,122	12,368	15,075	194	1,594	25	-	-	
DP 1.2	Revitalization and Restoration of Beel Haldi	2	2015	3,122	3,122	4,367	4,367	56	1,245	16	-	-	
DP 1.4/1.5	Kurigram Irrigation Project	2	2013	-	-	-	-	-	-	-	-	-	
DP 1.4/1.5	Teesta Irrigation Project (Phase-2)	2	2003	3,982	5,863	7,418	7,184	92.23	3,436	17	-	-	
CH 9.2	Water Supply and Environmental Sanitation in Paurashavas under Chittagong Hill Tracts	3	2014	6,603	15,831	21,792	52,246	671	15,189	468	-	-	
CC 1.2	Pre-Feasibility Study for Development of Small-Scale Water Reservoir...	3	2015	-	-	-	-	-	-	-	-	-	

Note: Projects in gray indicate an economic cost benefit analysis has not yet been completed for the project.

Source: Project Concept Notes

### Limitations in updating the cost benefit analysis

A simple inflation adjustment for costs and benefits, as presented in Table 1.1, is insufficient to properly update the original economic feasibility studies. As discussed above and detailed for each project individually in Section 1.6, several issues need to be addressed to provide reliable estimates of the economic value of each project.

First, the changed socio-economic contexts and project circumstances means that projects need to be redefined and updated.

Second, methodological flaws with previous economic analysis also need to be addressed. For example, the methodology for making “with” and “without” comparison of project alternatives needs to be consistent to avoid overstating benefits. Analysis should quantify benefits outside of agricultural production, and appropriate valuation methods need to be applied.

These updates and improvements cannot be done with just the existing project information. Many of the feasibility studies must be completely or at least partially re-done with new research. The examples mentioned below illustrate this constraint:

- The feasibility study for the Dhaka Integrated Flood Control Embankment cum Eastern Bypass Road Multipurpose Project (UA 1.2) was prepared in 2005. The project assumes several economic benefits like reduction in savings in property losses, vehicle operating costs, and time savings. To update these benefit calculations credibly, one would need to examine how the urban profile of the region has changed over this period, forecast the likely traffic in this corridor now, examine how the vehicle mix and volume have changed, and estimate adjusted value of time over this period (related to GDP increase), among others.
- Similarly, the CBA analysis for the North Rajshahi Irrigation Project (DP 1.1) needs to be updated (it was carried out in 2006). The analysis conducted did not cover the ‘without project’ case. To update this study, we will need to first identify how the cropping pattern and intensity in the area has changed in the past 10 years, check if the cultivable area is the same or has increased in this period, ascertain which crops will be grown by the local population with the facility (considering new cultivation techniques and varieties not just the standard paddy as assumed in the original study), and then assess how the project will improve the cropping area, intensity, and value.

It is also not viable to provide any ‘rule of thumb’ calculations for calculating benefits in absence of data as there are no universally acceptable benchmarks for calculating benefits in such instances. Further, many rules of thumb are specific to regions and economies.<sup>165</sup>

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165 [http://www.sampsonresearch.com/linked/rules\\_of\\_thumb\\_for\\_economic\\_multipliers.pdf](http://www.sampsonresearch.com/linked/rules_of_thumb_for_economic_multipliers.pdf)

Therefore, it is not possible to conduct a meaningful cost-benefit analysis with the information currently available. That said, we believe that in many projects, **net economic benefits are likely to be higher than those estimated** in the studies provided to us. This is because:

- Cost estimates in the Economic NPV calculations presented in the table above assume an increase in costs, but the benefits have not been updated for the reasons mentioned. We believe that benefits are also likely to be higher compared to those estimated in the feasibility studies provided. This is because the problems that the projects are designed to solve have generally remained the same or have been exacerbated during the intervening period. For instance, traffic has worsened, which means that bypass projects or road projects will have greater benefits now than a few years ago. Cities have become denser and more crowded and property values have increased significantly, which means that flood protection measures are now more valuable. The Bhabadha area has seen increased flooding in recent years even in drought years which means that the need for the drainage project (CZ 1.11) has increased. Due to the above, the corresponding Economic NPV estimates are quite conservative.
- In some cases, as pointed out above, the projects do not cover all economic benefits that they are likely to accrue. For instance, the projects in the Haor region on improved water management in Haor Basins and village protection against wave Action in Haor Area (HR 2.1 and 2.2) do not consider benefits related to improved navigation in the region due to the projects.

There are a few projects where we have observed that the ‘without project’ scenarios have not been considered in the analysis or where benefit calculations seem optimistic (such as agricultural benefits). However, even in these cases, we do not believe that results will be materially worse than those presented in the table above. This is primarily because the benefits that have been rightly considered for such projects are likely to have increased since the studies were undertaken. For instance, we found that some of the benefit calculations for project UA 1.1 (Protection of Rivers System around Dhaka City with Their Ecological Restoration) may be optimistic. However, the study for this project was carried out in 2004 and since then, water quality in the rivers around Dhaka has significantly worsened. The city is also now significantly more congested. Since the project is expected to improve water quality and navigability of the rivers, it is universally acknowledged that the project is needed now more than ever which should translate into a higher net economic benefit.

Therefore, it is not possible to conduct a meaningful cost-benefit analysis with the information currently available. That said, we believe that in many projects, **net economic benefits are likely to be higher than those estimated** in the studies provided to us. This is because:

- Cost estimates in the Economic NPV calculations presented in the table above assume an increase in costs but the benefits have not been updated for the reasons mentioned. We believe that benefits are also likely to be higher compared to those estimated in the feasibility studies provided to us. This is because the problems that the projects are designed to solve are generally remained the same or have

exacerbated during the intervening period (for instance, traffic has worsened which means that bypass projects or road projects will have greater benefits now compared to benefits calculated a few years back, cities have become denser and more crowded and plus property values have increased significantly which means that flood protection measures are now more valuable, the Bhabadha area has seen increased flooding in recent years even in drought years which means that the need for the drainage project (CZ 1.11) has increased). Due to the above, the Economic NPV estimates are quite conservative.

- In some cases, as pointed out above, the projects do not cover all economic benefits that they are likely to accrue. For instance, the projects in the Haor region on improved water management in Haor Basins and village protection against wave Action in Haor Area (HR 2.1 and 2.2) do not consider benefits related to improved navigation in the region due to the projects.

Admittedly, there are a few projects where we have observed that the ‘without project’ scenarios have not been considered in the analysis or where benefit calculations seem optimistic. However, even in these cases, we don’t believe that results are going to be materially worse than those presented in the table above. This is primarily because the benefits that have been rightly considered for such projects are likely to have increased since the studies were undertaken. For instance, we found that some of the benefit calculations for project UA 1.1 (Protection of Rivers System around Dhaka City with Their Ecological Restoration) may be optimistic. However, the study for this project was carried out in 2004 and since then, water quality in the rivers around Dhaka has significantly worsened and plus the city is now significantly more congested. Since the project is expected to improve water quality and navigability of the rivers, it is universally acknowledged that the project is now needed more than ever—which should translate into a higher net economic benefit). In sum, the current Economic NPV estimates are quite conservative and will likely be higher in the updated feasibility studies.

#### **I.4 Overall Observations**

Of the 34 proposed projects received through the BDP2100 process (detailed in Section I.7), 30 are infrastructure projects, three are knowledge gathering projects, and one is a knowledge gathering and institutional project. Twenty-six projects had enough information to be considered detailed PCNs. Of these, five were eliminated from consideration for the Investment Plan because they are already in advanced stages of consideration for implementation and already had funding secured.<sup>166</sup> Two other pairs of related projects were combined into single projects based on GED’s review of the proposed projects. This resulted in a total of 19 projects for assessment.

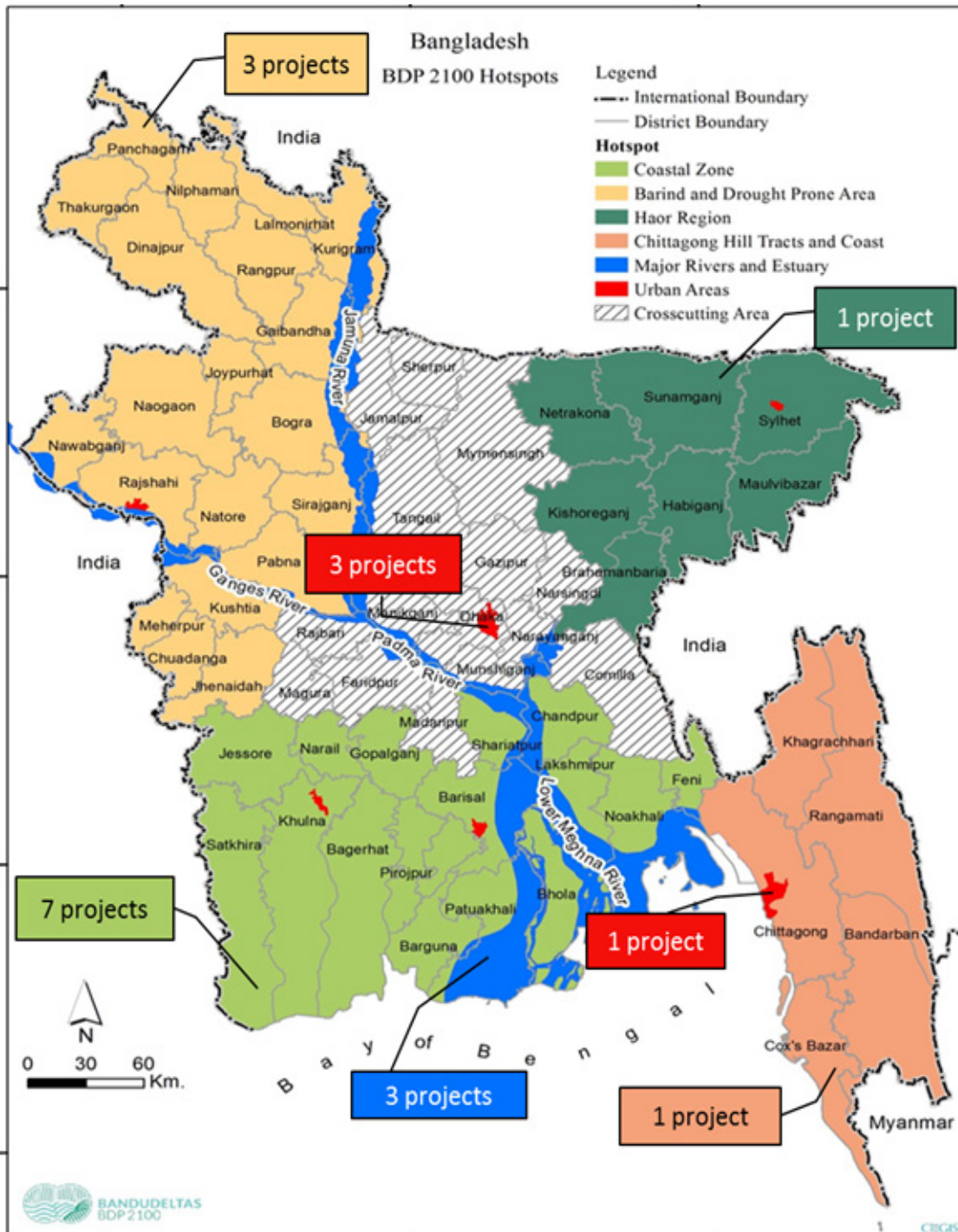
Figure I.2 shows the distribution of 19 assessed projects across BDP2100 regional hotspots.

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<sup>166</sup> GED informed us to remove CC 9.4 and CC 9.5. In our consultations on the projects, we found that CZ 1.9, CZ 1.10, and DP 1.6 are already being implemented and have funding secured.



Figure 1.2: Distribution of Projects by Regional Hotspot



Source: Modified from BDP2100 Main Report Volume 1 DRAFT, June 2016, p. 6



Although the projects are developed and arranged mainly by regional hotspots, the problems they seek to address are all linked to one or more of the following cross-cutting themes:

- Improve flood safety and/or reduce water logging, thus decreasing damages from flooding (such as real estate and food production damages)
- Improve fresh water supply, thus increasing food production and improving the environment
- Improve sanitation and provision of safe drinking water, thus improving the environment and overall health of the population.

These themes focus on improving livelihoods and earning capacities and reducing poverty. This section describes our overall conclusions about the set of projects assessed. Full detailed project assessments are provided in Section I.6.

### All the projects are linked to existing Government policies and initiatives

All proposed projects are aligned with multiple objectives within the Seventh 5-Year Plan. Most are also linked to overall strategies and objectives within the National Water Management Plan, National Water Policy, and National Food Policy, among others. The 26 projects are also linked with the BDP2100 goals, as shown in Table I.2.

**Table I.2: Project Alignment with BDP2100 Goals**

BDP2100 Goal	Number of Related Projects
1. Ensure safety against water and climate change related disasters	18
2. Ensure water security and efficiency of water usages	14
3. Ensure integrated river systems and estuaries management	8
4. Conserve and preserve wetlands and ecosystems	6
5. Develop effective institutions and equitable governance for intra and trans-boundary water resources management	1
6. Achieve functional and optimal use of land and water	10

Because the policies and plans are very comprehensive, covering a multitude of sectors and initiatives, it is not surprising that the proposed projects have strong linkages across many of the existing Government policies and initiatives. This is a positive indication that the proposed projects will have support from Government agencies and stakeholders.

### Projects are feasible from a technical perspective

From a technical perspective, all the projects assessed are feasible. The proposed technical approach in each project is based on proven technologies. The approach is also based on previous experience with similar projects in Bangladesh. However, we recommend extra care in implementing major dredging works, which are heavily influenced by and influence the hydrological and/or geomorphological conditions of the coast and major river systems. These conditions should be sufficiently studied and incorporated in project design. Such projects also need a proper monitoring program because they have a significant impact on a very large area.

## However, many feasibility studies are outdated and incomplete, and do not consider interlinkages among projects

Although projects are feasible from a technical point of view, many of the feasibility studies are outdated. Most projects do not have a current environmental impact assessment (EIA), social impact assessment (SIA), or cost-benefit analysis (CBA). These studies need to be completed or updated to ensure that projects are also feasible from an ecological, environmental, social, and financial point of view. Table 1.3 summarizes the studies available for each project.

**Table 1.3: Summary of Project Studies**

Project	FS	EIA	SIA	CBA
River Bank Improvement Program	Yes (2015)	No	No	Yes (2014)
Development of Chandona-Barasia River Basin System	Yes (2014)	No	No	No
Sustainable Restoration of Connectivity of Major Navigation Routes	Yes (2016)	Yes (2016)	Yes (2016)	No
Construction of Ganges Barrage and Ancillary Works	Yes (2012)	Yes (2012)	Yes (2012)	Incomplete (2011)
Char Development and Settlement Project- V	Yes (2014)	No	No	Yes (2014)
Integrated Land Reclamation Project of Hatiya-Dhamar Char-Nijhum Dwip	Yes (2007)	Yes (2007)	Yes (2007)	No
Urirchar-Noakhali Cross Dam Project	Yes (2014)	Yes (2014)	Yes (2014)	Yes (2014)
West Gopalganj Integrated Water Management Project	Yes (2012)	Yes (2012)	Yes (2012)	No
Improved Drainage in the Bhabadha Area	Yes (2013)	No	No	No
Development of Water Management Infrastructure in Bhola Island	Yes (2015)	Yes (2015)	Yes (2015)	No
Protection of Rivers System around Dhaka City with Their Ecological Restoration	Yes (2004)	Yes (2004)	Yes (2004)	No
Dhaka Integrated Flood Control Embankment cum Eastern Bypass Road Multipurpose Project	Yes (2006)	Yes (2006)	Yes (2006)	No
Drainage Improvement of Dhaka-Narayangonj-Demra Project (Phase 2)	Yes (2009)	Yes (Unknown)	No	Yes (2009)
Improvement of Drainage Congestion and Flood Control for Chattogram City Corporation Area	No	No	No	No
Village Protection against Wave Action in Haor Area and Improved Water Management in Haor Basins	No	No	No	No
North Rajshahi Irrigation Project	Yes (2006)	Yes (2006)	Yes (2006)	No
Revitalization and Restoration of Beel Halti	Yes (2006)	Yes (2006)	Yes (2006)	No
Kurigram Irrigation Project	Yes (2005)	No	No	No
Water Supply and Environmental Sanitation in Paurashavas under Chattogram Hill Tracts	Yes (2009)	No	No	No

Many of the feasibility studies are outdated, with some more than 10 years old. Because Bangladesh has experienced significant geographical, social, and economic changes in this period, these studies should be updated accordingly.

**Box I.2: Challenges Facing Projects (Reasons for Delays)**

The Investment Plan team had extensive consultations with the line ministries that developed these projects to determine the reasons why these projects were never implemented. Common reasons are:

- Lack of funds
- Changes to scope of the project
- Difficulty coordinating across multiple sectors or agencies.

Implementation of 10 of the projects were delayed because of a lack of funding. This emphasizes the need for the Investment Plan to help the Government access additional sources of financing for good projects.

Project scope also changed for seven of the projects. In many cases, the ECNEC or Planning Commission requested changes in the project proposal, and it has taken time to reformulate the projects to address these requests. In other cases, the original feasibility study did not sufficiently consider interlinkages or wider regional impacts. For example, MR 1.6 Development of Chandona-Barasia River Basin System was delayed because the feasibility study did not consider basin-wide impacts.

Coordination issues have also delayed several projects such as UA 1.2 Dhaka Integrated Flood Control Embankment cum Eastern Bypass Road Multipurpose Project, UA 10.1 Improvement of Drainage Congestion and Flood Control for Chattogram City Corporation Area, DP 1.1 North Rajshahi Irrigation Project, DP 1.2 Revitalization and Restoration of Beel Halti including Chalan Beel, and DP 1.4/1.5 Kurigram Irrigation Project.

Some projects had more specific causes for delay. For example, CZ 1.1 Construction of Ganges Barrage and Ancillary Works requires a treaty between the riparian countries, which is currently lacking. UA 10.1 Improvement of Drainage Congestion and Flood Control for Chattogram City Corporation Area is being reconsidered in light of the new Drainage Master Plan that is being developed (expected to be completed by June 2017).

The lack of up-to-date feasibility studies, EIAs, SIAs, and CBAs is a major hindrance to the immediate implementation of proposed projects. This is the reason that many of the proposed projects are evaluated at a low level of readiness in our overall evaluation, as shown in Table I.6.

### Interlinkages with other projects should be strengthened

The feasibility studies underlying the proposed projects have been designed to address the individual project scope. Even if the feasibility study is recent and of good quality, the results may be different if interlinkages with similar projects are considered. GED has raised this issue, leading to a combination of some proposed projects in our assessment<sup>167</sup>.

This process of clustering projects within and across regional hotspots should be further developed. In particular, projects may be linked along the themes of flood safety, water logging, fresh water supply, and water and sanitation services. For example, the Ganges Barrage Project (Coastal Zone) can be linked to the North Rajshahi Irrigation Project (Drought Prone Area). In a broader sense, the Ganges Barrage is linked to all water-related activities in southwestern Bangladesh because the Barrage will affect the amount of water available for ecological, social, and economic developments in this region.

If projects and associated project scopes are developed following an integrated, programmatic approach, the evaluation of overall economic costs and benefits will change.

### Proposed projects are ranked as “short-term” interventions

Of the projects proposed in project concept notes, nearly all have been classified as “short term” interventions in the Delta Plan process. The BDP2100 Draft Main report defines a short term measure as one that will contribute to the vision and goals of BDP2100 under each or most scenarios<sup>168</sup>. A short term project is one in which:

- The direct or indirect benefits are large enough to offset the implementation costs
- The measure can (with some limited guidance and support if needed) be implemented locally
- Implementing the project will increase system flexibility and reduce vulnerability to future uncertainties
- There are co-benefits or at least no hard trade-offs with other policy objectives.

Table I.4 summarizes the main challenges within each of the regional hotspots in Bangladesh. Table I.5 shows how each project addresses some of these hotspot challenges, meets the criteria to be a short-term project, and relates to the adaptive pathways. The detailed project assessments in Section I.6 provide more information on the ADM aspects of the projects. The adaptive pathways are illustrated in I.9. These pathways also demonstrate where each project currently being considered for the Investment Plan falls on the pathway. In the Investment Plan, these adaptive pathways will be further developed for the hotspots in relation to reduction of floods and water logging and ensuring availability of water (quality and quantity).

167 Projects DP 1.4 and DP 1.5 were combined into the Kurigram Irrigation Project. Projects HR 2.1 and HR 2.2 were combined into the Improved Water Management in Haor Basins Project.

168 BDP2100 Draft Main Report, June 2016, BanDuDeltaS, Volume 3 Section 15.2.1 p. 18

To summarize our findings, all proposed projects contribute to one or more of the BDP2100 goals. All projects except the Urirchar-Noakhali Cross Dam Project have a positive Economic Net Present Value (ENPV)<sup>169</sup>. This indicates that over the life of the project, economic benefits exceed economic costs. Furthermore, Bangladesh has experience implementing these types of projects before. Projects like developing or refurbishing polders, embankments, dredging, irrigation, and others are not new to Bangladesh. Institutions such as BWDB have had long-standing experience implementing similar projects. These types of projects all address vulnerabilities to climate change. The projects address one or more of the three main themes of improving flood protection and reducing waterlogging, improving fresh water supply, and improving water and sanitation services. Finally, all the projects are aligned with multiple Government policy objectives and strategies. Implementing one project will not directly hinder achieving other policy objectives.

**Table I.4: Main Challenges within Hotspots**

Hotspot	Main Challenges
Coastal Zone	<ul style="list-style-type: none"> <li>• Cyclonic storms and tidal surges</li> <li>• Water-logging</li> <li>• River bank and coastal erosion</li> <li>• Fresh water availability</li> <li>• Ground water decline</li> <li>• Environmental degradation</li> </ul>
Barind and Drought Prone Areas	<ul style="list-style-type: none"> <li>• Fresh water availability (droughts/water scarcity)</li> <li>• Waterlogging/drainage</li> <li>• Ground water decline</li> <li>• Sanitation</li> <li>• Environmental degradation</li> </ul>
Haor and Flash Flood Areas	<ul style="list-style-type: none"> <li>• Fresh water availability</li> <li>• Flash flood/monsoon flood</li> <li>• Waterlogging/drainage</li> <li>• Environmental degradation</li> <li>• Crop damage by early flash floods</li> </ul>
Chattogram Hill Tracts	<ul style="list-style-type: none"> <li>• Fresh water availability</li> <li>• Drinking water</li> <li>• Sanitation</li> <li>• Flash floods/erosion</li> <li>• Environmental degradation</li> </ul>
River Systems and Estuaries	<ul style="list-style-type: none"> <li>• Flood risk</li> <li>• Fresh water supply</li> <li>• Environmental degradation</li> <li>• Navigation</li> <li>• River bed changes, erosion/accretion</li> </ul>
Urban Areas	<ul style="list-style-type: none"> <li>• Water logging/drainage</li> <li>• Flooding</li> <li>• Fresh water availability</li> <li>• Sanitation</li> <li>• Environmental degradation</li> <li>• Waste and effluent Management</li> </ul>

<sup>169</sup> ENPV estimates have not been completed for MR 1.2, MR 1.5, CZ 1.4, CZ 1.5, CZ 1.38, UA 9.1, UA 10.1, HR 2.1, HR 2.2, DP 1.3, CH 9.2, and CC 1.2.

**Table I.5: Short-Term Ranking of Projects**

Project	Urgent Hotspot Issue(s) Addressed	Short Term Project Criteria				Position in Adaptive Pathway (See Appendix D for diagrammatic representation)
		Positive ENPV	Implementing Experience	Helps Reduce Vulnerability	No Hard Trade-Offs	
<b>River Systems and Estuaries</b>						
River Management Improvement Program	Flood risk Environmental degradation Navigation River bed changes, erosion/accretion	Yes NPV of BDT 76.8 billion in 2015 prices	Yes Bangladesh has significant experience implementing this type of project in the past	Yes Provides safety against flooding for vital infrastructure	Yes Project meets many GoB objectives, as detailed in Section 6	Reconstruction of flood embankments is part of strengthening existing water works, which is at the beginning of the adaptive pathway
Development of Chandana-Barasia River Basin System	Sedimentation at oftakes Flood risk Seasonal dryness	Yes NPV of BDT 405 million in 2015 prices	Yes Bangladesh has significant experience implementing this type of project in the past	Yes Provides safety against climate change related disasters and promotes water security	Yes Project meets many GoB objectives, as detailed in Section 6	Excavating oftake canals of the Chandana River is part of strengthening existing water works, which is at the beginning of the adaptive pathway
Sustainable Restoration of Connectivity of Major Navigation Routes	Navigation Reduced stream and river flows Reduced tidal flow Silting up of oftakes	Yes NPV of BDT 1.3 billion in 2015 prices	Yes Bangladesh has significant experience implementing this type of project in the past	Yes Improves navigability of waterways	Yes Project meets many GoB objectives, as detailed in Section 6	Dredging is part of flood diversion/ flood zoning which is near the beginning of the adaptive pathway
<b>Coastal Zone Hotspot</b>						
Construction of Ganges Barrage and Ancillary Works	Reduced flow during dry season Increased salinity	Yes NPV of BDT 92.2 billion in 2015 prices	Yes Bangladesh has significant experience implementing this type of project in the past	Yes Promotes water security	Yes Project meets many GoB objectives, as detailed in Section 6	Constructing a barrage across the Ganges river is part of upstream retention /regulatory works/ barrage, which is at the beginning of the adaptive pathway

Project	Urgent Hotspot Issue(s) Addressed	Short Term Project Criteria				Position in Adaptive Pathway (See Appendix D for diagrammatic representation)
		Positive ENPV	Implementing Experience	Helps Reduce Vulnerability	No Hard Trade-Offs	
Char Development and Settlement Project V	Flood risk River erosion Accretion	Yes NPV of BDT 481 million in 2015 prices	Yes Bangladesh has significant experience implementing this type of project in the past	Yes Provides safety against flooding	Yes Project meets many GoB objectives, as detailed in Section 6	Structural interventions to manage water and land use is part of protecting existing critical infrastructure and disaster preparedness, which are at the beginning of the adaptive pathway
Integrated Land Reclamation Project of Hatiya-Dhamar Char-Nijhum Dwip	Erosion/Accretion Rehabilitation and Resettlement Flood risk Land reclamation	Yes NPV of BDT 1.5 billion in 2015 prices	Yes Bangladesh has significant experience implementing this type of project in the past	Yes Reduces vulnerability to high waves, salinity, tidal floods and surges and provides resettlement options	Yes Project meets many GoB objectives, as detailed in Section 6	Constructing a cross-dam is part of adaptive design newly reclaimed areas and disaster preparedness, which are at the beginning of the adaptive pathway
Unirchar-Noakhali Cross Dam Project	Land loss due to erosion Food security Land reclamation through accretion	No ENPV of negative BDT 2.5 billion in 2015 prices	Yes Bangladesh has significant experience implementing this type of project in the past	Yes Protects against loss of crop land and promotes food security	Yes Project meets many GoB objectives, as detailed in Section 6	Constructing a cross-dam is part of adaptive design newly reclaimed areas and disaster preparedness, which are at the beginning of the adaptive pathway
West Gopalganj Integrated Water Management Project	Flood risk Lack of irrigation Water logging Salinity intrusion	Yes NPV of BDT 3.1 billion in 2015 prices	Yes Bangladesh has significant experience implementing this type of project in the past	Yes Provides safety against floods, protects crops, and promotes water security	Yes Project meets many GoB objectives, as detailed in Section 6	Constructing embankments and other structures is part of strengthening existing embankments and water works, which is towards the beginning of the adaptive pathway
Improved Drainage Problem in the Bhabadha Area	Water logging Loss of agricultural production	Yes NPV of BDT 1.6 billion in 2015 prices	Yes Bangladesh has significant experience implementing this type of project in the past	Yes Provides safety against severe waterlogging and protects against loss of agricultural production	Yes Project meets many GoB objectives, as detailed in Section 6	Construction of embankment, repair of regulators and excavation of drainage channels is part of strengthening existing embankments and water works, which is at the beginning of the adaptive pathway



Project	Urgent Hotspot Issue(s) Addressed	Short Term Project Criteria				Position in Adaptive Pathway (See Appendix D for diagrammatic representation)
		Positive ENPV	Implementing Experience	Helps Reduce Vulnerability	No Hard Trade-Offs	
Development of Water Management Infrastructure in Bhola Island	Flooding Rising sea levels Land erosion and accretion	Yes NPV of BDT 497 million in 2015 prices	Yes Bangladesh has significant experience implementing this type of project in the past	Yes Provides safety against flooding and river bank erosion	Yes Project meets many GoB objectives, as detailed in Section 6	Construction of embankments and implementing an Early Erosion Warning System are part of protecting existing critical infrastructure and disaster preparedness, which are at the beginning of the adaptive pathway
Urban Areas Hotspot						
Protection of Rivers System around Dhaka with Their Ecological Restoration	Water pollution River encroachment Navigation	Yes NPV of BDT 8.0 billion in 2015 prices	Yes Bangladesh has significant experience implementing this type of project in the past	Yes Prevents environmental degradation and promotes water security through infrastructure interventions	Yes Project meets many GoB objectives, as detailed in Section 6	Connecting rivers to neighboring rivers and restoring surrounding ecosystems is part of protecting vital and vulnerable objects, which is at the beginning of the adaptive pathway
Dhaka Integrated Flood Control Embankment cum Eastern Bypass Road Multipurpose Project	Flood risk Traffic congestion Drainage	Yes NPV of BDT 12.6 billion in 2015 prices	Yes Bangladesh has significant experience implementing this type of project in the past	Yes Provides safety against flooding and reduces vulnerability to traffic congestion	Yes Project meets many GoB objectives, as detailed in Section 6	Constructing embankments and bypass roads are part of flood-proofing infrastructure and disaster plans, which are at the beginning of the adaptive pathway
Drainage Improvement of Dhaka-Narayanganj-Demra Project (Phase 2)	Waste & Effluent Management Water logging	Yes NPV of BDT 2.8 billion in 2015 prices	Yes Bangladesh has significant experience implementing this type of project in the past	Yes Protects against waterlogging	Yes Project meets many GoB objectives, as detailed in Section 6	Improvement of drainage systems is part of improving maintenance drainage system and upgrading the capacity of sewage and drainage systems, both of which are at the beginning of the adaptive pathway



Project	Urgent Hotspot Issue(s) Addressed	Short Term Project Criteria				Position in Adaptive Pathway (See Appendix D for diagrammatic representation)
		Positive ENPV	Implementing Experience	Helps Reduce Vulnerability	No Hard Trade-Offs	
Haor and Flashflood Areas						
Improvement of Sanitation, Drainage, Congestion, and Flood Control for Chattogram City Corporation Area	Waste and Effluent Management Flooding Sanitation	ENPV not available	Yes Bangladesh has significant experience implementing this type of project in the past	Yes Promotes efficient waste and effluent management as well as water security	Yes Project meets many GoB objectives, as detailed in Section 6	Improvement of drainage systems is part of improving maintenance drainage system and upgrading the capacity of sewage and drainage systems, both of which are at the beginning of the adaptive pathway
Village Protection against Wave Action and Improved Water Management	Flash floods Crop damage Damaged infrastructure Environmental degradation	ENPV not available	Yes Bangladesh has significant experience implementing this type of project in the past	Yes Protects crops, livelihoods, and infrastructure against flash floods and wave action	Yes Project meets many GoB objectives, as detailed in Section 6	This intervention is part of strengthening existing water works and disaster preparedness, both of which are at the beginning of the adaptive pathway
Barind and Drought Prone Areas						
North Rajshahi Irrigation Project	Depletion of groundwater table Insufficient rainfall Inadequate irrigation coverage	Yes NPV of BDT 2.0 billion in 2015 prices	Yes Bangladesh has significant experience implementing this type of project in the past	Yes Promotes water security and agricultural productivity by increasing irrigation cover	Yes Project meets many GoB objectives, as detailed in Section 6	Expansion of irrigation and drainage networks is part of strengthening existing water works and groundwater irrigation, which are at the beginning of the pathway
Revitalization and Restoration of Chalan Beel (Beel Halti)	Environmental degradation Navigation Loss of flood plain	Yes NPV of BDT 1.2 billion in 2015 prices	Yes Bangladesh has significant experience implementing this type of project in the past	Yes Protects against floods and environmental degradation; promotes fisheries and preserves biodiversity	Yes Project meets many GoB objectives, as detailed in Section 6	Interventions to improve irrigation, flood management and drainage are part of groundwater irrigation and optimizing agricultural water use, which are at the beginning of the adaptive pathway

Project	Urgent Hotspot Issue(s) Addressed	Short Term Project Criteria				Position in Adaptive Pathway (See Appendix D for diagrammatic representation)
		Positive ENPV	Implementing Experience	Helps Reduce Vulnerability	No Hard Trade-Offs	
Kurigram Irrigation Project	Monsoon flooding, dry season droughts Groundwater decline Food security	Yes NPV of BDT 1.3 billion in 2015 prices	Yes Bangladesh has significant experience implementing this type of project in the past	Yes Promotes agricultural productivity and water security by improving irrigation coverage	Yes Project meets many GoB objectives, as detailed in Section 6	Constructing canals, barrages, and associated works for expanding irrigation coverage is part of optimizing agricultural water use, which is at the beginning of the adaptive pathway
Chattogram Hill Tracts						
Water Supply and Environment Sanitation in Pourashavas under the Chattogram Hill Tracts	Drinking water Sanitation	ENPV not available	Yes Bangladesh has significant experience implementing this type of project in the past	Yes Promotes public health and hygiene by improving water and sanitation systems	Yes Project meets many GoB objectives, as detailed in Section 6	Not applicable

Note that, as mentioned in Table I.6 and the discussion above, many of these projects need updated information and feasibility studies. The actual timing and order of implementation will depend on the additional project preparation work. ADM principles should be considered in the feasibility studies as they are updated. There should be flexibility in implementing specific project components to adjust to changing circumstances.

### All proposed projects are related to climate change adaptation to varying degrees

Climate change adaptation is relevant to all the proposed projects to varying degrees. Projects for which climate change adaptation is particularly important include: flood risk management, irrigation, storm water drainage, and drinking water supply. Sea level rise increases flood risks and saline intrusion into estuaries, rivers, and aquifers. Therefore, flood risk management and irrigation projects are linked to the root problem of sea level rise. Climate change also results in changed precipitation patterns, including the time, place, and intensity of rainfall. This means that drainage systems will need to cope with more intensive storms and larger amounts of water per unit of time. Increasing drainage and sewerage system capacity will also decrease flood risks. Finally, prolonged periods of drought and increased heat will increase water consumption. Water treatment plants that treat both sewage and storm water need to have larger capacity to handle the additional flow.

The proposed project mix mostly favors public and donor financing, but there are some project elements that could be privately financed

Many of the projects that we examined involve large-scale and complex construction tasks like barrages, cross dams, embankments, river restoration, and water reservoirs. These projects are typically not financed through private financing for several reasons: they are complex, they have significant environmental and social risks, and they do not have any direct revenue streams (that is, avenues where users can be charged for services provided). However, several of these projects have elements that could be privately financing. Examples include:

- **Irrigation:** The proposed projects include three large-scale irrigation projects (Rajshahi, Kurigram, Teesta). Further, many of the other projects are designed to increase agricultural production significantly. These projects could be developed under a PPP arrangement. There are international precedents for such projects. Even in Bangladesh, there have been successful precedents in the Barind Area where user-pay principles have been implemented successfully for irrigation projects.
- **Road Projects:** Many of the embankment projects include a road project (such as the Dhaka Integrated Flood Control Embankment cum Eastern Bypass Road Multipurpose Project and the River Bank Improvement Project). This road is likely to generate significant economic benefits for the local population. Therefore, it is possible that some of these roads could be tolled. Even if the toll is too low to cover the entire construction cost, it can help recover part of the construction costs. Bangladesh already has some experience in developing road PPPs. For example, the BDT2.37 billion Dhaka Bypass PPP was approved by the Executive Committee of the National Economic Council (ECNEC) in March 2016<sup>170</sup>.

Other potential areas for PPPs are large-scale fishery projects (since several projects aim to improve fisheries in the region), dredging, and land reclamation.

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170 <http://www.thefinancialexpress-bd.com/2016/03/02/18865>

It is important for the BWDB and other agencies to note that PPPs provide access not only to private financing, but also to private sector efficiencies and innovation. Furthermore, PPPs can help ensure that projects are delivered on time and on budget, and that projects are maintained properly over their lifetime. We therefore urge the Government to consider PPPs, even for projects that cannot fully recover their costs through user charges. PPP projects that may need the Government to provide support through availability payments can still generate savings and efficiencies.

### **Very little information is available on how agencies will fund O&M costs of projects**

In terms of financing, most proposed projects do include some mechanism to finance operations and maintenance. However, there is little information on how the mechanism will work and how financial resources will be secured in the long-term. For example, there are no mentions of revolving funds to guarantee long-term project sustainability. It is unclear if the implementing or responsible agency has the capacity to ensure that investments will have sufficient O&M financing to remain operational and effective. A core issue is implementing a policy of full cost recovery for provision of services such as water and sanitation. These cost recover issues are included in the policy reform program of the Investment Plan.

### **Knowledge gathering projects should be prioritized**

Four proposed projects are knowledge projects. Although these projects were only provided as idea concepts, they are undoubtedly “short term” projects because they address urgent cross-cutting issues. Full project assessments were not completed for these projects because there is not enough detailed information to do so. Nevertheless, we recommend prioritizing these projects because they will help develop and improve the technical quality of the feasibility studies for the proposed infrastructure projects. The four proposed knowledge gathering projects are:

- MR 1.2 Integrated River System Management and Protection of Accreted Land
- MR 1.5 Harnessing of Brahmaputra Water
- CZ 1.4 Integrated Management of Drainage Congestion for Greater Noakhali
- CZ 1.5 Tidal River Management.

The Integrated River System Management and Protection of Accreted Land Project seeks to understand better how rivers respond to anthropogenic and exogenous activities, hydro-morphological changes, sediment management, and interventions related to bank protection, flood management, channelization, and protection of accreted lands. The overall objective of the study is to formulate a master plan for harnessing the river in line with national goals and achievements. The specific goals are to 1) generate knowledge and information on hydrological and socioeconomic processes and integrated river management, and 2) generate insight into policy options, institutional arrangements, and funding potential. The knowledge from this project can be used for the River Bank Improvement Project, Flood and Riverbank Erosion Risk Management Investment Program, Ganges Barrage Project, Sustainable Restoration of 53 Rivers Project, and Harnessing of Brahmaputra Water Project. In general, all river-related projects can also use the results to improve planning, decision-making, and project design.

The Harnessing of Brahmaputra Water Project seeks to study how to rejuvenate the Brahmaputra River; manage sediments; enhance agriculture, fisheries, and navigation; and reduce salinity. This project is interlinked with other proposed projects related to safeguarding water supply for socio-economic activities. It impacts all projects that depend on water from the Brahmaputra River. The results of this study will provide a better understanding of the appropriate interventions to secure water flow from the Brahmaputra River. This will facilitate an ADM approach in future planning because it will provide decision-makers with information on how to design interventions in an adaptable and optimum manner.

The Integrated Management of Drainage Congestion for Greater Noakhali Project is a study to improve and add to information regarding the drainage congestion in the Greater Noakhali area. The knowledge gained will support feasible solutions for drainage and waterlogging problems. The study will also inform implementing agencies about where urgent intervention is necessary, and what kind. It will identify canals that have lost regular flow of water and require dredging due to siltation. This project is linked to the Char Development and Settlement Project Phases IV and V projects in Polder 59/3B and Polder 59/3C, dealing with waterlogging and drainage congestion issues. The knowledge gathered through this project will also support and improve all other infrastructure projects addressing drainage and waterlogging issues in the Coastal Zone and elsewhere.

The Tidal River Management Project seeks to evaluate the environmental and social impacts of tidal river management programs, and to develop a suitable institutional arrangement for the proper management of polders. Based on the outcome of this study, tidal river management programs will be implemented for specific infrastructure projects. This project will support the Char Development and Settlement Project Phase V, Coastal Embankment Improvement Program, Improvement of Drainage Problem in Bhabodaho Area Project, and the Blue Gold Project.

Additional knowledge projects are needed in the project pipeline to ensure that there is a sufficient knowledge base for planning in an ADM way, providing scientific evidence for climate change adaptation initiatives, encouraging private sector participation, and effectively monitoring and evaluating project and program implementation. The success of the Delta Plan depends in large part on having a sufficient knowledge base on which to make the best planning decisions.

Capacity building initiatives are critically needed to ensure successful implementation

The proposed projects list implementing agencies without considering each agency's institutional capabilities and constraints. The projects proposed are large, complex, and capital intensive. Most of the proposed projects involve at least one of seven implementing agencies: Bangladesh Water Development Board (BWDB), Bangladesh Inland Water Transport Authority (BIWTA), Dhaka Water Supply and Sewerage Authority (DWASA), Chattogram Water Supply and Sewerage Authority (CWASA), Department of Public Health Engineering (DPHE), Local Government Engineering Department (LGED), and the Department of the Bangladesh Haor and Wetland Development (DBHWD). Each of these agencies require capacity building initiatives to implement the proposed projects successfully.

- Bangladesh Water Development Board BWDB is responsible for implementing water projects that are larger than 10 square kilometers. The agency has been understaffed in recent years. Implementing the recommendations in the November 2014 Final Report on the Institutional Improvement of BWDB would be an important first step that applies across most the projects. This includes hiring additional staff, providing the necessary training in ADM and integrated water management.
- Bangladesh Inland Water Transport Authority BIWTA is responsible for the development and maintenance of the inland water transport system in Bangladesh. Enhanced coordination between BIWTA, BIWTC, local port authorities, and the organizations under the Ministry of Water Resources are needed for BIWTA to effectively carry out its mandate.
- Dhaka Water Supply and Sewerage Authority DWASA is responsible for water, sanitation, and drainage services in Dhaka City and Narayanganj. Although DWASA has made great strides in improving service quality over the years, additional training and capacity building is needed for DWASA to meet the continuing challenges of improving water services, providing sewerage services, treating wastewater, improving the drainage system, and replacing groundwater use with surface water use.
- Chattogram Water Supply and Sewerage Authority CWASA provides water and drainage services to the second largest city in Bangladesh. Although it is also mandated to manage sewerage services, Chattogram does not yet have a sewer system. Like DWASA, Chattogram has improved services over the years. Additional benefits can come from training in ADM principles, analyzing bio-physical scenarios, and adapting to climate change impacts and challenges such as declining groundwater levels.



- Department of Public Health Engineering DPHE is the lead national agency for providing drinking water supply and waste management in rural and urban areas outside of WASA service areas. Groundwater contamination with arsenic is one of the biggest challenges for DPHE. Additional training and capacity building for DPHE staff, particularly on ADM principles and adaptation to climate change effects.
- Local Government Engineering Department LGED is responsible for implementing infrastructure projects including small-scale water projects that are not otherwise administered by BWDB. To help implement proposed projects, LGED would benefit from a re-examination of staffing needs and recruitment, training on the ADM and integrated water management approach, and capacity building to not only implement, but also monitor and evaluate projects.
- Department of the Bangladesh Haor and Wetland Development DBHWD formulated and is implementing a Haor Master Plan in 2012. Although other agencies such as BWDB, Department of Fisheries, Department of Agricultural Extension, LGED, and Department of Environment and Forestry are involved, projects in the Haor Region will require coordination with DBHWD. The organization would also benefit from capacity building and training in ADM principles and integrated water management.

Because most of the projects have direct links to climate change adaptation, implementing capacity building for climate change related institutions will also facilitate implementation for many projects. This includes strengthening and implementing the Climate Change Resilience Fund, Strategic Program for Climate Resilience, Climate Change Strategy and Action Plan (2009), and climate fiscal cell in the Financial Department of the Ministry of Finance.

Capacity building and coordination mechanisms are needed for individual project implementation, but there are also national-level policy reforms that can facilitate overall project planning and implementation. Capacity building at the agency level will facilitate implementation of national policy reforms. These reforms relate to:

- Integrating water resource and land use management
- Mainstreaming climate change adaptation plans and frameworks
- Integrating ADM principles into public financial management
- Enabling private sector participation.

Actions to implement these reforms will be described in the Investment Plan under the policy reform program.

## **Overall, proposed projects can be considered urgent priority interventions, but additional work is needed before they can be implemented**

Nearly all the proposed projects have been classified as “urgent” interventions under the Delta Plan process. Even though these projects appear consistent with Delta Plan goals, most projects need additional work before they can be prepared for implementation. This is because a large part of the available feasibility studies (including cost benefit analyses) are outdated and have methodological shortcomings, as described above.

Because of these shortcomings, project prioritization and selection may change as more information becomes available and analyses are updated. From a technical perspective, the proposed projects are generally feasible. However, further work must be done to ensure that projects are also ecologically, environmentally, socially, and economically feasible. Up-to-date environmental impact assessments, social impact assessments, and cost-benefit analyses are needed. Therefore, we recommend that the feasibility studies, including cost-benefit analyses, are redone before further steps are taken towards implementing the infrastructure projects.

Table I.1 summarizes our prioritization of projects and assessment of their state of readiness. The table also summarizes the additional work and information required to fully prepare a project for implementation.



**Table I.6: Summary Table of Project Assessments**

Hotspot	Project Type	Project	Implementing Agency	Priority	State of Readiness	Additional Information and Work Required
River Systems and Estuaries	Infrastructure	River Management Improvement Program	BWDB	High	High	<ul style="list-style-type: none"> <li>Suggested renaming to River Bank Management Program</li> </ul>
River Systems and Estuaries	Infrastructure	Development of Chandana-Barasia River Basin System	BWDB	High	Low	<ul style="list-style-type: none"> <li>EIA and SIA</li> <li>Study of the impact on required resettlement and resettlement policy</li> </ul>
River Systems and Estuaries	Infrastructure	Sustainable Restoration of Connectivity of Major Navigation Routes	BIWTA	High	High	<ul style="list-style-type: none"> <li>Updating of river routes that need restoration versus ones that already being restored</li> <li>Integrating lessons from the project “Introduction of Circular Waterways around Dhaka City (2nd Phase)”</li> <li>Morphological and technical assessments of the dredged rivers</li> </ul>
Coastal Zone	Infrastructure	Construction of Ganges Barrage and Ancillary Works	BWDB	High	Low	<ul style="list-style-type: none"> <li>Updated detailed feasibility study</li> <li>Updated ESIA</li> <li>Integration with related sectoral activities and projects</li> <li>Use of a basin wide/basin wise approach, considering regional cooperation and ADM principles</li> </ul>
Coastal Zone	Infrastructure	Char Development and Settlement Project V	BWDB	High, with qualifications*	Low	<ul style="list-style-type: none"> <li>ESIA</li> <li>Study of morpho-dynamic impact and risks</li> <li>Inclusion of land settlement costs in the cost estimation</li> <li>Inclusion of spatial planning and governance in project design</li> </ul>

Hotspot	Project Type	Project	Main Implementing Agency	Priority	State of Readiness	Additional Information and Work Required
Coastal Zone	Infrastructure	Integrated Land Reclamation Project of Hatiya-Dhamar Char-Nijhum Dwip	BWDB	High, with qualifications*	Low	<ul style="list-style-type: none"> <li>Detailed technical and economic feasibility study</li> <li>Study of morpho-dynamic impact and risks</li> <li>Spatial planning and land development considerations</li> <li>Components to address governance and management issues</li> <li>Inclusion of MoA, MoEF, MoFL, MoL, MoS, BWTA, and other related agencies in the planning, design, and implementation of the project</li> </ul>
Coastal Zone	Infrastructure	Urirchar-Noakhali Cross Dam Project	BWDB	High, with qualifications*	Medium	<ul style="list-style-type: none"> <li>Study of morpho-dynamic impact and risks</li> <li>Study of project's effects on salinity</li> <li>Detail of required drainage infrastructure because of this project</li> <li>Inclusion of land settlement costs in the cost estimate</li> <li>Inclusion of spatial planning and governance considerations</li> <li>Updated assessment considering linkages to other projects in the area</li> </ul>
Coastal Zone	Infrastructure	West Gopalganj Integrated Water Management Project	BWDB	High	Medium	<ul style="list-style-type: none"> <li>Study of the necessary institutional framework and economic instruments for sustainable operation and maintenance</li> <li>Incorporation of ADM principles in the project design</li> </ul>

Hotspot	Project Type	Project	Main Implementing Agency	Priority	State of Readiness	Additional Information and Work Required
Coastal Zone	Infrastructure	Improved Drainage Problem in the Bhabadha Area	BWDB	High	Low	<ul style="list-style-type: none"> <li>Updated detailed feasibility study</li> <li>EIA and SIA</li> <li>Assessment of resettlement and crop compensation costs as part of improving the CBA</li> <li>Inclusion in the National Tidal River Management Program</li> <li>Integration with proposed project CZ 1:38 for tidal river management in four Beels</li> <li>Consideration of related projects affecting drainage in the Bhabadah Area</li> </ul>
Coastal Zone	Infrastructure	Development of Water Management Infrastructure in Bhola Island	BWDB	High	Low	<ul style="list-style-type: none"> <li>Updated EIA and SIA</li> <li>CBA</li> <li>Merging of locations 2 and 4 in the project</li> <li>Inclusion of a spatial planning component</li> <li>Integration with other related projects in the Bhola District</li> </ul>
Urban Areas	Infrastructure	Protection of Rivers System around Dhaka with Their Ecological Restoration	BIWTA	High	Low	<ul style="list-style-type: none"> <li>Updated feasibility study</li> <li>Consideration in combination with other related projects to ensure that the project does not ignore other effects</li> </ul>
Urban Areas	Infrastructure	Dhaka Integrated Flood Control Embankment cum Eastern Bypass Road Multipurpose Project	BWDB	High	Medium	<ul style="list-style-type: none"> <li>Updated feasibility study</li> <li>Updated EIA and SIA</li> <li>Updated CBA</li> </ul>

Hotspot	Project Type	Project	Main Implementing Agency	Priority	State of Readiness	Additional Information and Work Required
Urban Areas	Infrastructure	Drainage Improvement of Dhaka-Narayanganj-Demra Project (Phase 2)	B W D B , DWASA	High	Low	<ul style="list-style-type: none"> <li>Updated feasibility study</li> <li>Updated EIA and SIA</li> <li>CBA</li> </ul>
Urban Areas	Infrastructure	Improvement of Sanitation, Drainage, Congestion, and Flood Control for Chattogram City Corporation Area	CWASA	High	Low	<ul style="list-style-type: none"> <li>Feasibility study</li> <li>EIA and SIA</li> <li>CBA</li> <li>Ensuring alignment with the Chattogram WASA Master Plan of 2015</li> </ul>
Haar and Flash Flood Areas	Infrastructure	Village Protection against Wave Action and Improved Water Management	B W D B , DBHWD	High	Medium	<ul style="list-style-type: none"> <li>Updated feasibility study</li> <li>EIA and SIA</li> </ul>
Barind and Drought Prone Areas	Infrastructure	North Rajshahi Irrigation Project	BWDB	High	Low	<ul style="list-style-type: none"> <li>Updated feasibility study, including risk assessment and mitigation measures</li> <li>Updated EIA and SIA, considering integration with the Ganges Barrage</li> <li>Hydro-morphological study</li> <li>Resettlement Action Plan</li> <li>CBA</li> <li>Monitoring and evaluation plan for implementation and O&amp;M</li> <li>Capacity assessment of BWDB as the implementing agency</li> </ul>
Barind and Drought Prone Areas	Infrastructure	Revitalization and Restoration of Chalan Beel (Beel Halti)	BWDB	High	High	<ul style="list-style-type: none"> <li>Updated feasibility study</li> <li>Updated EIA and SIA</li> <li>Study of effects on neighboring Chalan Beel areas</li> <li>Communication program to inform stakeholders</li> </ul>

Hotspot	Project Type	Project	Implementing Agency	Priority	State of Readiness	Additional Information and Work Required
Barind and Drought Prone Areas	Infrastructure	Kurigram Irrigation Project	BWDB	High	Low	<ul style="list-style-type: none"> <li>Updated feasibility study</li> <li>Updated EIA and SIA</li> <li>Draw lessons from the implementation problems for the Dharla Barrage Irrigation Project in Kurigram</li> </ul>
Chattogram Hill Tracts	Infrastructure	Water Supply and Environment Sanitation in Pourashavas under the Chattogram Hill Tracts	DPHE	High	Low	<ul style="list-style-type: none"> <li>EIA and SIA</li> <li>CBA</li> <li>Consideration of issues such as landslides and flash floods</li> </ul>
Additional Proposed Projects						
River Systems and Estuaries	Knowledge	Integrated River System Management and Protection of Accreted Land	BWDB	High	High	
River Systems and Estuaries	Knowledge	Hamessing of Brahmaputra Water	BWDB	High	High	
Coastal Zone	Knowledge	Integrated Management of Drainage Congestion for Greater Noakhali	BWDB	High	High	
Coastal Zone	Knowledge, Institutional	Tidal River Management	BWDB	High	High	
Coastal Zone	Infrastructure	Tidal River Management in Four Beels in the Coastal Area	BWDB	High	Medium	<ul style="list-style-type: none"> <li>Updated feasibility study</li> <li>CBA</li> <li>Consideration of resettlement and crop compensation costs</li> <li>Integration with the “Improved Drainage Problem in the Bhabadha Area” project</li> <li>Involvement of relevant agencies such as BADC, DoF, and DAE</li> </ul>

Hotspot	Project Type	Project	M a i n Implementing Agency	Priority	State of Readiness	Additional Information and Work Required
Urban Areas	Infrastructure	Greater Dhaka Integrated Water and Sewage Improvement Project	DWASA	High	Low	<ul style="list-style-type: none"> <li>• Feasibility study</li> <li>• EIA and SIA</li> <li>• CBA</li> <li>• Review of all project components to ensure that they are not already being implemented</li> <li>• Inclusion of the restoration and revitalization of existing canals in and around Dhaka City as a project component</li> </ul>
Barind and Drought Prone Areas	Infrastructure	Revitalization and Restoration of Hurasagar and Atrai Rivers	BWDB	Medium / High	Low	<ul style="list-style-type: none"> <li>• Feasibility study</li> <li>• EIA and SIA</li> <li>• CBA</li> <li>• Study of interaction with the Teesta Irrigation Project Phase 2 and the Revitalization and Restoration of Beel Halti Project</li> </ul>

\*From a technical point of view, these projects are needed and can be considered high priority interventions. From a strategic point of view, there needs to be additional discussion about whether the Government of Bangladesh should pursue this type of project. Alignment with the final Delta Strategies will be key.

## I.5 Prioritizing Projects for the Investment Plan

Bangladesh needs significant investment to meet its Delta Plan goals. It is likely that the resources available will not be sufficient to meet all its needs. Bangladesh will hopefully aim to expand its financing sources, but it will take a few years to implement all the activities needed to mobilize additional sources of financing from the private sector and climate finance institutions.

Because the Government is unlikely to be able to finance all the projects, it will need to carefully screen its project pipeline to undertake only those that provide the maximum value for money. It will therefore need a prioritization process to select the right projects to develop within available resources. This prioritization process has an additional benefit of inculcating discipline among all line ministries to carefully assess each project and only propose those that have been designed genuinely following a rational decision making approach.

This section provides a prioritization framework for selecting projects to be developed under the Investment Plan. It describes the principles for the framework, details the prioritization methodology, and applies the methodology to the information available for the current project pipeline. Because all batch 1-3 projects have been identified as short-term projects, prioritization has been done on the basis of the NPV and on how these projects answer to the principles of ADM. The latter is important for minimizing the risk of over- or under-investment.

### I.5.1 Principles for Developing the Methodology

The prioritization framework draws from global best practices and uses the results of an intensive stakeholder consultation approach implemented by the BDP2100 program and approved by GED in its current project screening approach. The methodology aims to minimize the opportunity for subjective judgments, but is realistic about the sometimes limited amount of reliable, up-to-date information available.

#### Learn from global precedents and best practices

Project prioritization is not unique to the Investment Plan. All governments face this problem. Many governments have developed methodologies to help them prioritize their investments. I.11 explains how some countries prioritize their projects. Recently, the World Bank also issued a paper suggesting a framework for infrastructure prioritization<sup>171</sup> that presents a multi-criteria decision support tool to prioritize projects. The proposed methodology considers these tools.

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171 An Alternative Approach to Project Selection: The Infrastructure Prioritization Framework, Darwin Marcelo, Cledean Mandri-Perrott, Schuyler House, Jordan Z. Schwartz, World Bank PPP Group, April 2016

### Use current prioritization approaches in Bangladesh

The GED has developed detailed guidelines for drafting Development Project Proposals (DPPs)<sup>172</sup>. The DPP format provides the various criteria to be captured for evaluating any project. Further, the guidelines also explain how to select projects<sup>173</sup> when a choice must be made between alternative projects. The proposed prioritization methodology is aligned with this requirement.

### Minimize subjectivity as much as possible

One of the principle drawbacks of multi-criteria analysis is that many criteria involve subjective assessment, particularly where different criteria need to be assigned weights or where some criteria can only be assessed qualitatively (e.g. how does the project generate wider economic benefits in the country?). Subjective assessment could create disputes between the Commission and the line ministries if they form an important part of the decision to prioritize a project.

It is likely to be impossible to remove all subjectivity in the analysis. Further, expert opinions are valuable while making decisions on complex issues. That said, however, we have proposed a list of measures that are largely objective and quantifiable to avoid subjectivity.

### Be realistic

Prioritization decisions should be based on complete, up-to-date, and objective information. It is unlikely, however, that all required information will be available when needed. Our analysis of the Project Concept Notes (PCNs) suggests that information for many projects is out of date, and costs and benefits calculations for some projects need to be improved. Furthermore, the capacity of line ministries to generate some of the more sophisticated measures is limited (such as project linkages to climate change adaptation programs). The proposed methodology to prioritize the projects presented in Batches 1-3 therefore remains cognizant of this limitation and aims to come to a transparent decision using the available information in an optimum manner.

### 1.5.2 Proposed Methodology

The process to select projects in the first three batches of the BDP2100 and the IP has taken many months. It involved numerous stakeholder consultations by Team A and GED. GED further reviewed the three batches of projects from Team A and indicated that some projects should be combined or excluded from the IP because they were already included in another planning procedure. Due to the above process, all projects shortlisted in the first three batches have broad stakeholder support.

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172 Development Project Proforma/Proposal (DPP) Manual, March 2014

173 Development Project Proforma/Proposal (DPP) Manual, March 2014, Box 19 Case 2-Best Set Decision (p. 42)



The above notwithstanding, we have also discussed these projects with numerous stakeholders, including the sponsor agencies. We have asked the stakeholders what they perceive is important in the selection of the projects for the IP. Further, as we explained in Chapter 4 above, all these projects are short-term projects.

Due to the above, we do not propose to implement a full scale Multi Criteria Analysis approach to prioritize projects received in batches 1-3. We have instead prioritized them based on the criteria given in the DPP manual. These criteria are listed later in the section. Additionally, to reduce the risk of over- or under-investment, we have assessed the projects in light of ADM principles.

Batch 4 projects (see I.8), however, have not undergone any extensive consultations. We, therefore, propose to adopt a Multi-Criteria Analysis to prioritise these projects.

We explain both approaches below. For Batches 1-3, we have undertaken the analysis in this report. Batch 4 prioritization results will be presented as part of the Investment Plant.

### **Prioritizing Batch 1-3 Projects based on NPV**

Having identified that Batch 1-3 projects are generally short-term projects, the GoB needs to decide how best to utilize its limited resources to implement these projects.

Before we prioritize though, we need to ascertain the funding availability and identify the funding gap for these projects. To do this, we calculated total investment needs for the current project pipeline and compared it to the estimated total public expenditure budget.

### **Investment Needs**

To estimate the investment needs, we compiled information on:

- Total project capital expenditure
- Annual operations and maintenance (O&M) costs after implementation
- Construction/capital expenditure period duration

For costs and ENPV that were estimated in previous years, we used inflation numbers from the IMF World Economic Outlook Database for Bangladesh<sup>174</sup> to convert prices into 2015 BDT. All figures used in the analysis are in real 2015 BDT.

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174 <https://www.imf.org/external/pubs/ft/weo/2016/01/weodata/index.aspx>

We divided total capital expenditure by the construction/capital expenditure period duration to arrive at an estimate of annual capital expenditure. We maintained constant O&M costs at the PCN-estimated levels for each period following construction. Non-capital investment projects (such as research studies) have no O&M costs.

We then analyzed each project to identify which project components (if any) could be privately financed. This was based on a review of the project scope, our discussions with private sector bidders in Bangladesh in April and June 2016, and our knowledge of similar PPPs in the region and in other similar countries. The remainder is the estimated amount that must be publicly funded. (Note: We didn't consider climate change adaptation financing for this exercise since we have no rational basis for estimating how much additional financing could be generated from such sources).

Table I.7 over page shows the costs, financing, and ENPV estimates for each project.

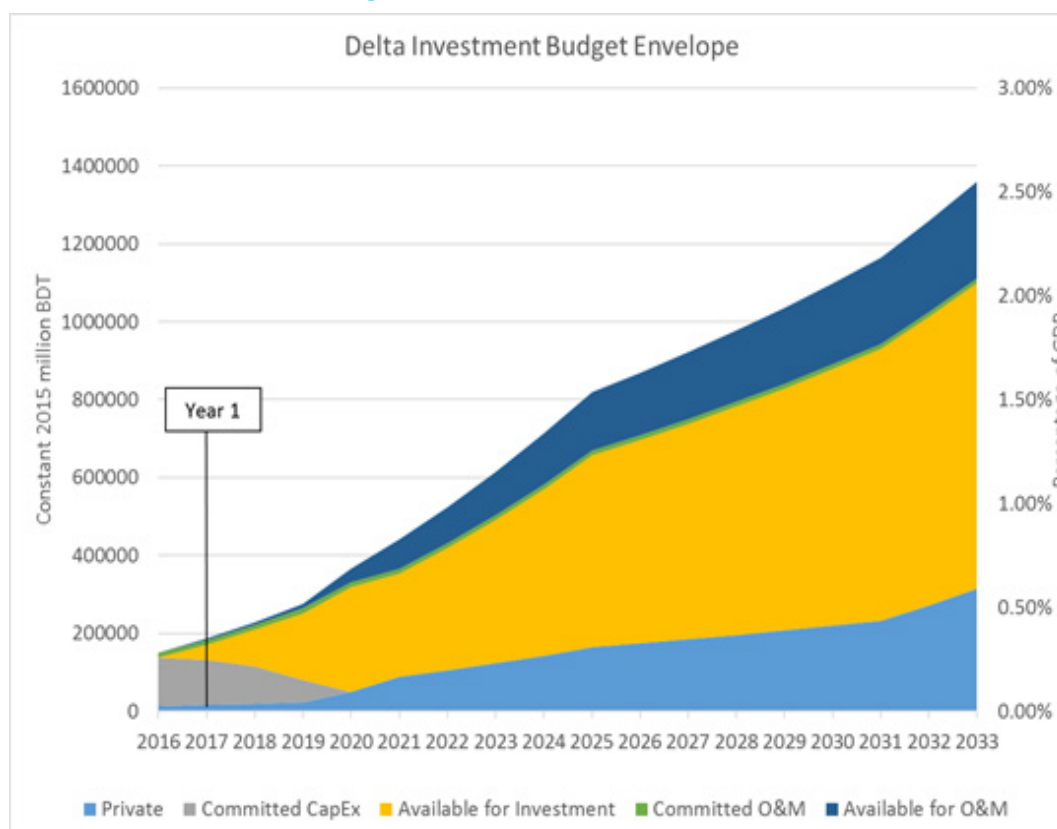
**Table I.7: Project Costs and Assumptions**

Project #	Project Name	TOTAL CAPEX (BDT Millions) (2015 prices)		Private Finance %	CAPEX Public Budget	Construction Period (years)	Annual O&M (BDT Millions) (2015 prices)	NPV (BDT Millions) (2015 prices)
		140,694	461					
MR 1.1	River Bank Improvement Program	140,694	461	30%	98,486	10	4,221	76,813
MR 1.6	Development of Chandona-Barasia River Basin System		461	0%	461	3	11	405
MR 3.1	Sustainable Restoration of Connectivity of Major Navigation Routes	22,948	22,948	0%	22,948	6	688	1,289
CZ 1.1	Construction of Ganges Barrage and Ancillary Works	408,713	367,842	10%	367,842	7	9,904	92,220
CZ 1.3	Char Development and Settlement Project- V	1,138	1,138	0%	1,138	4	23	481
CZ 1.6	Integrated Land Reclamation Project of Hatiya-Dhamar Char-Nijhum Dwip	550	550	0%	550	3	12	1,518
CZ 1.7	Urirchar-Noakhali Cross Dam Project	4,353	4,353	0%	4,353	4	87	(2,516)
CZ 1.8/1.21	West Gopalganj Integrated Water Management Project	2,735	2,735	0%	2,735	3	68	3,068
CZ 1.11	Improved Drainage in the Bhabadha Area	1,557	1,557	0%	1,557	5	42	1,551
CZ 1.26	Development of Water Management Infrastructure in Bhola Island	14,651	14,651	0%	14,651	4	281	497
UA 1.1	Protection of Rivers System around Dhaka City with Their Ecological Restoration	14,788	11,880	20%	11,880	5	141	7,960
UA 1.2	Dhaka Integrated Flood Control Embankment cum Eastern Bypass Road Multipurpose Project	58,060	40,642	30%	40,642	12	372	12,592
UA 1.3	Drainage Improvement of Dhaka-Narayangonj-Demra Project (Phase 2)	5,711	5,711	0%	5,711	5	92	2,784
DP 1.1	North Rajshahi Irrigation Project	19,910	13,937	30%	13,937	6	147	1,952
DP 1.2	Revitalization and Restoration of Beel Hali	4,762	4,762	0%	4,762	4	111	1,245
DP 1.4/1.5	Kurigram Irrigation Project	26,992	18,894	30%	18,894	5	359	1,321

## Public Expenditure Budget

The Draft Delta Plan projects the Government of Bangladesh (GoB) budget allocation for Delta Investment, broken down by recurrent (O&M) investment, non-recurrent (capex) investment, and private investment. The total Delta Investment Budget was based on the current Delta Investment expenditure level of 0.8 percent of GDP, projected using a gradual expansion to 2.5 percent of GDP in 2025 and to 2.6 percent of GDP by 2033. We applied these percentages to GDP growth projections for Bangladesh from the IMF World Economic Outlook Database to calculate the total amount of the public expenditure budget available for the Delta Plan. Figure I.3 shows the estimated public expenditure allocations for the next 15 years.

**Figure I.3: Delta Investment Budget Envelope**



We assumed that 2016 expenditure is fully committed in all categories, and therefore funding for new projects will be available starting in 2017. We assumed that some capital expenditure is already committed and therefore not available for new projects. The amount of committed capital expenditure decreases to zero in 2020. This reflects that the current project pipeline will be replaced by the Investment Plan pipeline over the next few years. We assumed that current commitments for O&M expenses will remain constant in real terms over the 15-year projection period. This reflects the longer horizon of O&M expenses for projects already implemented and currently under construction. We calculated the available budget for BDP 2100 projects by summing the projected total budget, less commitments, for each category.

The current base case calculations show about BDT41.9 billion available for investment and O&M in 2017, increasing rapidly to about BDT300 billion in 2020, then continuing to increase at a slower rate until reaching a steady-state of growth close to GDP parity around 2027.

### Prioritization results

In the initial years, the amount of public funding available is not enough to cover total investment needs for all projects currently proposed in the pipeline. There is an estimated gap of BDT45,107 million in 2017. Starting in 2018, the Delta Investment budget is forecasted to be large enough to cover the current project pipeline needs. However, because additional projects will be developed for the Investment Plan going forward, a gap is likely to persist. Therefore, it is important to have a prioritization methodology to allocate limited resources.

Our methodology first screened out projects for which no feasibility study or ENPV estimate has been completed, as well as those estimated to have a zero or negative ENPV.

Note: Excluding projects with no feasibility study does not mean that these projects should not be included as part of the Investment Plan at any time. It just means that these projects need completed feasibility assessments to be included in the Plan. Furthermore, capacity building, knowledge management, and similar projects do not need a feasibility study. These projects should be implemented as soon as there is funding available, and once the sponsor agencies are reasonably confident that the projects will be beneficial to implementing the Investment Plan.

Considering our estimates of potential private financing available, all the remaining projects can be launched in 2017 and 2018 within the forecasted public budget.

We then prioritized projects to maximize ENPV. To prioritize between projects launched in 2017 and those delayed until 2018, we employed an iterative deductive process. The remaining projects were first ranked per their estimated ENPV. The top projects were then slated for 2017 launch in the resulting rank order until projected 2017 funds were insufficient to launch the next project in the ranking. This provided an initial base-case scenario, with a total ENPV of BDT113 billion and a budget absorption rate of 82 percent.

In the base case, we found that the top-ranked project in terms of ENPV (Project CZ 1.1 – the Ganges Barrage and Ancillary Works) also had a disproportionately high expenditure requirement, exceeding the 2017 budget. This crowded out the ability to implement other projects.

Therefore, we generated additional scenarios to maximize the ENPV of the first group of projects. Table I.8 shows the results of the scenario that maximizes the ENPV for projects launched in 2017. This results in a total ENPV of BDT113 billion.

**Table I.8: Prioritized Projects**

Project Code	Project Name	NPV (Millions BDT)
MR 1.1	River Bank Improvement Program	76,813
UA 1.2	Dhaka Integrated Flood Control Embankment cum Eastern Bypass Road Multipurpose Project	12,592
UA 1.1	Protection of Rivers System around Dhaka City with Their Ecological Restoration	7,960
CZ 1.8/1.21	West Gopalganj Integrated Water Management Project	3,068
UA 1.3	Drainage Improvement of Dhaka-Narayangonj-Demra Project (Phase 2)	2,784
DP 1.1	North Rajshahi Irrigation Project	1,952
CZ 1.11	Improved Drainage in the Bhabadha Area	1,551
CZ 1.6	Integrated Land Reclamation Project of Hatiya-Dhamar Char-Nijhum Dwip	1,518
DP 1.4/1.5	Kurigram Irrigation Project	1,321
MR 3.1	Sustainable Restoration of Connectivity of Major Navigation Routes	1,289
DP 1.2	Revitalization and Restoration of Beel Halti	1,245
CZ 1.26	Development of Water Management Infrastructure in Bhola Island	497
CZ 1.3	Char Development and Settlement Project- V	481
MR 1.6	Development of Chandona-Barasia River Basin System	405
	<b>TOTAL</b>	<b>113,479</b>

This list of prioritized projects is mostly in line with the priority investment projects identified in the Draft Delta Plan, except for the Ganges Barrage and Ancillary Works project.

Note that because many of the costs and ENPV estimates will change as feasibility studies and other studies are updated, the list and order of priority projects is also likely to change. These results only provide an initial indication of how the prioritization process can be applied.

#### Prioritizing Batch 1-3 Projects based on ADM

To assess whether projects fit the concept of ADM, four criteria have been used. Projects are prioritized based on the level to which they meet these four criteria. This prioritization does not address other criteria that might change the priority of these projects. Other criteria may be related to political or social support, and to project readiness.

The prioritization in this report only considers projects from the first three project batches. These projects were approved by GED and referred to the IP team. This assumes that the projects already have sufficient political and social support, and that the project proposals have reached a level of readiness that allows them to be classified as short-term projects. Table I.9 lists the projects included in the prioritization based on ADM principles. Table I.10 lists the projects excluded from the prioritization.

**Table I.9: Batch 1–3 Projects Included in the ADM Prioritization**

Code	Name	Remark
1 MR 1.1	River Bank Improvement Program1	
2 MR 1.6	Development of Chandona-Barasia River Basin System	
3 MR 3.1	Sustainable Restoration of Connectivity of Major Navigation Routes	
4 CZ 1.1	Construction of Ganges Barrage and Ancillary Works	
5 CZ 1.3	Char Development and Settlement Project	
6 CZ 1.6	Integrated Land Reclamation Project of Hatiya-Dhamar Char-Nijhum Dwip	
7 CZ 1.7	Urirchar-Noakhali Cross Dam Project	
8 CZ 1.21	West Gopalganj Integrated Water Management Project	
9 CZ 1.11/CZ 1.38	Improved Drainage in the Bhabadha Area / TRM of 7 Beels in Coastal Zone	
10 CZ 1.26	Development of Water Management Infrastructure in Bhola Island	
11 UA 1.1	Protection of Rivers System around Dhaka City with Their Ecological Restoration	
12 UA 1.2	Dhaka Integrated Flood Control Embankment cum Eastern Bypass Road Multipurpose Project	
13 UA 1.3	Drainage Improvement of Dhaka-Narayangonj-Demra Project (Phase 2)	
14 UA 9.1	Greater Dhaka Integrated Water and Sewage Improvement Project	
15 UA 10.1	Improvement of Drainage Congestion and Flood Control for Chittagong City Corporation Area	
16 HR 2.2/3.1	Village Protection against Wave Action in Haor Area and Improved Water Management in Haor Basins	Combined by GED
17 DP 1.1	North Rajshahi Irrigation Project	
18 DP 1.2	Revitalization and Restoration of Beel Halti	
19 DP 1.3	Revitalization and Restoration of Hurasagar and Atrai rivers	
20 DP 1.4/1.5	Kurigram Irrigation Project (South and North Unit)	Combined by GED
21 CH 9.2	Water Supply and Environmental Sanitation in Paurashavas under Chittagong Hill Tracts	

**Table I.10: Batch 1–3 Projects Excluded from the ADM Prioritization**

Code	Name	Remark
1 MR 1.2	Study of Integrated River System Management and Protection of Accreted Land	study project
2 MR 1.5	Study of Harnessing of Brahmaputra Water	study project
3 CZ 1.4	Pre-Feasibility Study for Integrated Management of Drainage Congestion for Greater Noakhali	study project
4 CZ 1.5	Baseline Study of Tidal River Management	study project
5 CZ 1.9	Sureswar Flood Control, Drainage and Irrigation Project	already financed
6 CZ 1.10	Rehabilitation of Polder 36/1	already financed
7 CZ 1.38	TRM of 7 Beels in Coastal Zone	Combined by GED
8 DP 1.6	Teesta Irrigation Project (Phase-2)	already financed
9 CC 1.2	Pre-Feasibility Study for Development of Small-Scale Water Reservoir	study project
10 CC 9.4	Water Supply, Sanitation, Drainage and Solid Waste Management for Small Paurashavas(2018-2030)	already financed
11 CC 9.5	Water Supply and Sanitation including Faecal Sludge Management in 31 Paurashavas(2018-2030)	already financed

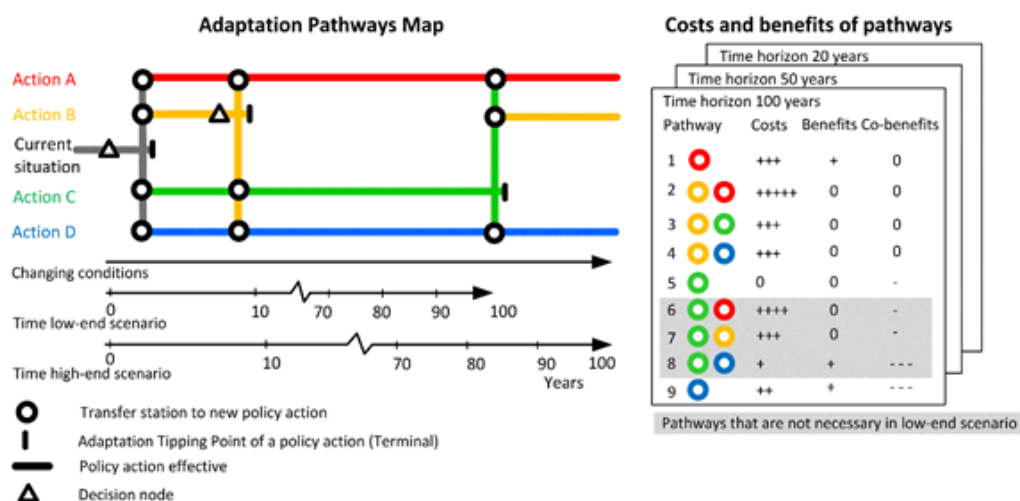
The set of projects is based on assessments made by GED. GED’s assessment led to the exclusion of some projects from the IP because they are already financed. In some cases, GED also combined project proposals. Furthermore, it is important to note that a distinction has been made between infrastructure projects, knowledge projects, and institutional projects. Knowledge and institutional projects are crucial to ensure that the infrastructure projects are planned and implemented in an optimal manner. It is recommended that prioritization of study projects in relation to ADM aligns with the prioritization of infrastructure projects to ensure that there is sufficient information available for sound decision making.



## ADM Criteria for Prioritization

Different pathways can be developed to achieve a certain objective. An example of how these different paths can be developed is given in Figure I.4.

Figure I.4: Adaptive Pathways Example



Source: Based on Deltares: *Coping with the Wickedness of Public Policy Problems: Approaches for Decision Making under Deep Uncertainty*, Kwakel, Haasnoot, Walker *Journal of Water Resources Planning and Management* / Volume 142 Issue 3 - March 2016

Policy objectives related to water quantity and water quality in Bangladesh still need to be quantified. Nevertheless, these pathways can be developed in a qualitative manner, indicating different types of projects and the robustness and the flexibility of these projects in relation to four criteria:

- Robust/flexible in relation to adaptation of the intervention
- Robust/flexible in relation to transition within or between adaptation pathways
- Robust/flexible in relation to technological development
- Robust/flexible in relation to synchronization with developments in other sectors.

For a specific objective at a specific location, costs and benefits of the different pathways can be estimated if the required information is available. However, because we are assessing the priorities of the projects in relation to ADM and on the scale of the Delta, we have scored the projects on the four main criteria of ADM. Based on this ranking, we draw conclusions on their priorities. The projects with the highest scores are more robust and flexible for adaptation. Because of their flexibility and robustness, the risk of destruction of capital is minimal.

To determine the level to which the project proposals meet these four criteria, the following statements were assessed:

- The project can be adapted/scaled up when circumstances require (such as climate change, national objectives, etc.)
- The intervention can be combined with additional measures to increase effectiveness
- The intervention allows for adopting technological innovations after implementation
- The intervention is synchronized with developments in other sectors.

**Projects are scored on the following scale:**

1. Totally incorrect
2. Slightly incorrect
3. Average
4. Slightly correct
5. Totally correct.

Projects are scored based on the information collected in the BDP2100 process, interviews held with many stakeholders, and additional desk study. In addition to the scoring, recommendations are provided to improve the projects design and planning process. For implementation of ADM, it is insufficient to only adapt the projects themselves. The general practices related to project implementation, monitoring, and evaluation should also be adapted. To ensure that projects adapt where possible or to implement additional measures, decision making and procedural (DPP) aspects should allow for flexible project implementation. Furthermore, the monitoring and evaluation structure should be in place to assess the effectiveness of interventions. An optimal allocation of powers is needed to decide in a timely manner the need to take additional steps or to redefine objectives. These aspects will be further elaborated in the Policy Matrix of the Investment Plan.

In I.12, an overview is presented of the scoring of the projects on the ADM criteria. Table I.11 provides an overview of the scores of the proposed projects.

**Table I.11: Summary of Project Scoring**

ADM: Robust/flexible in relation to

		Adaptation of the intervention	Combination with additional measures	Technological development	Synchronization with other developments	Total score	
1	MR 1.1	River Bank Improvement Program1	2	3	4	3	12
2	MR 1.6	Development of Chandona-Barasia River Basin System	2	4	1	2	9
3	MR 3.1	Sustainable Restoration of Connectivity of Major Navigation Routes	5	5	4	3	17
4	CZ 1.1	Construction of Ganges Barrage and Ancillary Works	1	3	2	3	9
5	CZ 1.3	Char Development and Settlement Project	2	3	2	2	9
6	CZ 1.6	Integrated Land Reclamation Project of Hatiya-Dhamar Char-Nijhum Dwip	2	3	2	1	8
7	CZ 1.7	Urirchar-Noakhali Cross Dam Project	2	3	2	2	9
8	CZ 1.8/1.21	West Gopalganj Integrated Water Management Project	4	5	4	3	16
9	CZ 1.11 / 1.38	Improved Drainage in the Bhabadha Area	4	5	4	2	15
10	CZ 1.26	Development of Water Management Infrastructure in Bhola Island	2	4	4	1	11
11	UA 1.1	Protection of Rivers System around Dhaka City with Their Ecological Restoration	2	4	1	2	9
12	UA 1.2	Dhaka Integrated Flood Control Embankment cum Eastern Bypass Road Multipurpose Project	2	2	3	2	9
13	UA 1.3	Drainage Improvement of Dhaka-Narayangonj-Demra Project (Phase 2)	2	3	3	2	10
14	UA 9.1 (20.1)	Greater Dhaka Integrated Water and Sewage Improvement Project	4	4	4	4	16
15	UA 10.1	Improvement of Drainage Congestion and Flood Control for Chittagong City Corporation Area	3	3	2	2	10
16	HR 2.1/2.2	Village Protection against Wave Action in Haor Area and Improved Water Management in Haor Basins	4	4	4	3	15
17	DP 1.1	North Rajshahi Irrigation Project	2	4	3	2	11
18	DP 1.2	Revitalization and Restoration of Beel Halti	2	4	3	3	12
19	DP 1.3	Revitalization and Restoration of Hurasagar and Atrai rivers	4	3	4	3	14
20	DP 1.4/1.5	Kurigram Irrigation Project	2	4	3	2	11
21	CH 9.2	Water Supply and Environmental Sanitation in Paurashavas under Chittagong Hill Tracts	2	3	3	2	10

These scores provide an overview of project priorities based on the ADM principles. Simply listing the projects in a particular order would not do justice to the qualitative methodology. Rather, three groups of projects can be differentiated: those that answer best to ADM, and those that answer least to ADM, and those in between. A total score greater than 11 indicates high compliance with ADM principles. A score of 10 or 11 indicates medium compliance, and a score of less than 10 indicates low compliance. Table I.12 shows the three groups of projects based on the project scoring results.

**Table I.12: Project Prioritization Results**

Project Code	Project Name	Priority Based on ADM Score
MR 1.1 CZ 1.8/1.21 UA 9.1 (20.1)	River Bank Improvement Program West Gopalganj Integrated Water Management Project Greater Dhaka Integrated Water and Sewage Improvement Project Sustainable Restoration of Connectivity of Major Navigation Routes Village Protection against Wave Action in Haor Area and Improved Water Management in Haor Basins Improved Drainage in the Bhabadha Area Revitalization and Restoration of Hurasagar and Atrai rivers Revitalization and Restoration of Beel Halti	High
CZ 1.26 DP 1.1 DP 1.4/1.5 UA 1.3 UA 10.1 CH 9.2	Development of Water Management Infrastructure in Bhola Island North Rajshahi Irrigation Project Kurigram Irrigation Project Drainage Improvement of Dhaka-Narayangonj-Demra Project (Phase 2) Improvement of Drainage Congestion and Flood Control for Chattogram City Corporation Area Water Supply and Environmental Sanitation in Pourashavas under Chattogram Hill Tracts	Medium
MR 1.6 CZ 1.1 UA 1.1 UA 1.2 CZ 1.3 CZ 1.7 CZ 1.6	Development of Chandona-Barasia River Basin System Construction of Ganges Barrage and Ancillary Works Protection of Rivers System around Dhaka City with Their Ecological Restoration Dhaka Integrated Flood Control Embankment cum Eastern Bypass Road Multipurpose Project Char Development and Settlement Project Urirchar-Noakhali Cross Dam Project Integrated Land Reclamation Project of Hatiya-Dhamar Char-Nijhum Dwip	Low

If the recommendations indicated in Section I.12 are considered in the further detailing of the projects, the scores and hence the relative prioritization may change. This is especially true for projects that encompass small scale interventions, but that have not yet provided the planning or level of integration that is needed to adapt projects, adopt additional measures, make use of technological innovation, and ensure optimal synchronization with developments in other sectors. Also, in many cases the current monitoring and evaluation structure is insufficient to ensure that timely steps can be taken to increase the effectiveness and/or efficiency of the interventions.

Hence, the prioritization based on ADM may change as some of the project designs are adapted to increase their level of compliance. However, the level of compliance with the principles of ADM depends largely on the flexibility to change project plans, and whether the responsible agencies have capacity to develop and implement thorough monitoring and evaluation of the effects of the implemented interventions.

This prioritization provides insight on how these project proposals can be improved, and whether there are projects that could better be implemented in a later stage to mitigate the risk of over- or under-investment.

In assessing new project ideas, ADM principles along with other objectives and criteria should be considered to ensure that the selection of projects addresses Bangladesh's pressing needs in an optimal manner.

### Prioritising Batch 4 Projects

We propose using the Multi Criteria Analysis approach for prioritizing Batch 4 projects. Multi-Criteria Analysis (MCA) is an instrument to support and structure the decision-making process. It allows transparent reporting on the process. If weights of criteria and objectives change, the process can be reproduced, taking into account the changed circumstances.

#### **The MCA process can be divided in four phases:**

- Preparation
- Identification
- Scoring
- Discussion.

#### **Preparation includes:**

- Design of the process architecture
- Stakeholder analysis
- Selection of stakeholders to be involved
- Approval of the stakeholders of the process and the involved stakeholders.

#### **Identification includes:**

- Agreeing on the objectives, the sub-objectives, and the criteria
- Identifying the indicators to measure the effect on the criteria
- Agreeing on how to score the effects on the criteria (quantitative, semi-quantitative, or pairwise comparison) and how to determine the effect on a uniform scale to be used for all criteria
- Agreeing on the weight of the criteria and the sub-objectives if needed.

#### **Scoring includes:**

- Gathering data (qualitative or quantitative) on changes in the indicators due to an intervention
- Assessing the effect of an intervention on the criteria
- Scoring the effect on a uniform scale
- Multiplying the score on the uniform scale with the weight of the criterion
- Summing the results of the criteria for a sub-objective
- Multiplying the score of an intervention on a sub-objective with the weight of the sub-objective
- Summing the results of the sub-objectives to come to a score on the objective.

**Discussion includes:**

- Deciding on how the results will be used to come to a decision
- Assessing the sensitivity of the outcome in relation to the weights of the criteria and the sub-objectives
- Using the sensitivity assessment to further discuss the output and decide on how the output will be used.

**The main advantages of performing a MCA are:**

- Integration of a diversity of criteria in a multi-dimensional way that is applicable to a variety of contexts (in this case, projects).
- Straightforward and easy approach in determining attractive and unattractive options.
- Open for discussion and interpretation which allows for a common understanding of the decision problem.
- Supports stakeholder participation in determination of the criteria

**The main disadvantages are:**

- Technocratic character that suggests an accuracy that often does not exist in reality.
- Difficult to make inter-comparisons between projects as each project is scored by its own.
- External experts are sometimes reluctant to share their knowledge and to give values to the criteria.

**Proposed approach for MCA**

For future projects, we will develop a MCA framework that is as objective as possible. Where objective scores cannot be defined, we will apply criteria for pairwise comparison to come to a relative score.

These criteria should address the six objectives of the Delta Plan. The criteria will be defined in close consultation with the stakeholders who will be responsible for planning decisions. Development of the framework will be integrated with the consultations that GED plans to conduct for the Delta Plan.

During these consultations, criteria will be discussed as well as indicators and weights for the MCA. To the extent there is information available, we will apply the framework to the set of initial project ideas from Batch 4. It is important that the framework includes criteria that allow for differentiation between projects and can be scored.

The criteria that are currently used as pass/fail criteria in this prioritization process has been identified together with stakeholders. Therefore, we feel that these criteria should be the basis for the MCA framework because they reflect the views of stakeholders.

Some of the criteria may not allow for objective scoring. Prioritization will therefore have to be done jointly with inputs from the IP team, GED as well as experts from ministries that will be responsible for implementing such projects.

Note that using the MCA to make choices between regions and themes is not something that should be pursued within the scope the IP. The methodology, however, can be used to develop an overview of projects that answer well, passably, and poorly to objectives. NPV and ADM principles can be used to determine if projects are short-, medium-, or long-term. Criteria for infrastructure versus study and institutional capacity projects will likely be different.

### We propose a two phase approach for the MCA:

#### Phase 1: Preparation phase:

- Identify stakeholders for the MCA together with GED
- Develop the stakeholder consultation process together with GED.

#### Phase 2: Consultation and Scoring phase:

- The IP team will first obtain all relevant information (to the extent available) for conducting the MCA.
- The IP team will then will undertake workshops (to convened by GED) to discuss the MCA.
- In case any of the the criteria can be scored objectively, then we will do this based on the information available but will discuss the findings in the workshops
- If the interventions must be scored relatively (on a five-point scale or using pairwise comparison in combination with the AHP methodology), we will discuss them in the workshop with stakeholders. If they are unable to reach a decision in the workshop, we will then request them to submit scores by e-mail following the workshop
- The results will then be collated, compiled and presented in the IP.

### Proposal for criteria

Our advice would be to continue the path prepared by the BDP2100 as the IP should prioritize interventions identified to achieve the objective of BDP2100 and the Delta Vision.

Thus, the main goal of the MCA exercise should be to define up to what level the projects respond to the BDP2100 goals. As an example, for the short term projects we have indicated in our reports that:

- **Goal 1:** Eighteen projects are related to ensuring safety against water and climate change related disasters
- **Goal 2:** Fourteen projects are related to ensuring water security and efficiency of water usages
- **Goal 3:** Eight projects ensure integrated river systems and estuaries management
-



- **Goal 4:** Six projects conserve and preserve wetlands and ecosystems
- **Goal 5:** One of the projects addresses the development of effective institutions and equitable governance for intra and trans-boundary water resources management, and
- **Goal 6:** Ten projects achieve functional and optimal use of land and water

Relative scoring is possible to define the level up to which projects support achieving the BDP2100 Goals.

Another important criterion is up to which level the projects fit the concept of ADM. To score on ADM, we propose using the criteria that were developed by the World Bank in conjunction with a team of national and international consultants:

- Robust/flexible in relation to adaptation of the intervention
- Robust/flexible in relation to transition within or between adaptation pathways
- Robust/flexible in relation to technological development
- Robust/flexible in relation to synchronization with development in other sectors.

**Other criteria that could be included are:**

- Need for policy, regulatory, or institutional reforms needed to successfully implement the project
- Readiness—Does the project have a feasibility study that covers all the above requirements, meets the DPP manual requirements, calculates the project’s Economic NPV following the DPP Manual guidelines, and is not older than one year?
- Criteria related to social acceptability and environmental sustainability could be also be included but these will be very difficult to score objectively without detailed research.

Finally, we would advise strongly to use NPV (if available <sup>175</sup>) as an important criterion. Discussions are needed to decide on how the NPV relates to other objectives and criteria. MCA should not be a decision instrument, but a decision support instrument. Therefore, it can be decided that NPV as a criterion is not to be related at the level of the MCA but is presented separately to decision makers as part of the decision-making process to optimize economic benefits based on budgetary constraints.

**Timeframe**

The timeframe depends on the stakeholder consultation process of the GED. When the preparation and identification phases have been carried out, the gathering of readily available data and relative scoring should not take more than a couple of weeks. Discussions on final scoring is a dynamic process, especially as this relates to projects ideas that still must be further developed. Therefore, we propose to organize a discussion session, prioritize where possible, and document the outcome to ensure that the process can be reproduced when needed.

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175 Many the projects included in Batch 4 do not have an NPV.

## I.6 Detailed Project Assessments

This following tables provide the detailed project assessments for each project, grouped by the six BDP2100 regional hotspots.

### I.6.1 River Systems and Estuaries

#### MR 1.1 River Bank Improvement Program (Phase I, II, and III)

<b>Brief Project Description</b>
<p>Primary objectives of the project are:</p> <ul style="list-style-type: none"> <li>• To improve the socio-economic development in greater Dhaka</li> <li>• To provide safety against floods for vital infrastructure of Dhaka and adjacent areas by strengthening and creating a reliable flood embankment with roadway</li> <li>• To reduce riverbank erosion along 150km of the Jamuna Right Embankment.</li> <li>• Additional specific objectives are:               <ul style="list-style-type: none"> <li>• Rehabilitate the population squatting on existing embankments</li> <li>• Strengthen institutional change within BWDB to provide long-reach stabilization work.</li> </ul> </li> </ul> <p>The project covers the North Central and Central part of the Jamuna Right Embankment (JRE) in the Sirajganj, Bogra, and Gaibandha District. It can be extended to the Kurigram Irrigation projects North and South units in the future. The project aims to be completed in three phases. Phase I (50km priority reach) of the River Bank Improvement Project (RBIP) is situated in the central part of the JRE. It extends from Simla, about 8km upstream of Sirajganj, to Hasnapara, which is 10km upstream of Sariakandi, Bogra. Phase II of the project includes 20km of the Brahmaputra Right Bank (BRE) which extends from upstream of the Jamuna bridge to Simla and 77km upstream from Hasnapara to the Teesta river covering North Central JRE up to Chandipur, Gaibandha. The third phase comprises of a 150km two-lane proposed road extending from the Saidabaad Rail Gate, Sirajganj to Haripur town in Belka Union near Chilmari Port, Kurigram.</p> <p>In the Phase I area, all the original BRE has been eroded due to widening and westward shift of the Jamuna. Phase I involves complete reconstruction of the flood embankment, which has been eroded due to this widening and westward shift. Additionally, the riverbank would be secured against erosion through long guiding revetments that will incorporate current emergency works being built by BWDB. Approximately 18km of new riverbank protection will be provided in addition to strengthening the existing 18km, the remaining areas being shielded by upstream protection.</p> <p>Phase I of the project was proposed to the Executive Committee of the National Economic Council (ECNEC) on 29 October, 2015. ECNEC returned the DPP with a few observations. An updated DPP was then submitted to the Planning Commission. A Project Evaluation Committee (PEC) meeting was held on 1 February, 2016. The project has a high state of readiness and is only awaiting ECNEC approval for implementation.</p>
<b>Problem/Challenges the Project Aims to Address</b>
<p>The Central and North-Central Jamuna Right Embankment north of Jamuna Bridge (150km) protects around 300,000ha of the grain-growing North-western Region from flooding. River bank erosion in this area has continuously displaced the floodplain population since 1973, so that by 2014 more than 100,000 squatters were living on the embankment, of whom nearly half were located in a 50km priority reach. These people have lost their land and livelihood, some having had to relocate up to</p>

seven times. The fear of riverbank erosion and major flooding has a strong negative impact on riparian residents, who generally have high poverty levels, ill health, and crowded low-quality dwellings, with restricted access to civic amenities and roads. The challenge is to stop river-bank erosion and forced retirement of embankments, disrupting the livelihood of the long-established communities.

The project will contribute towards achieving the following BDP 2100 goals:

- 1: safety from floods and climate change related disasters
- 3: sustainable and integrated rivers systems and estuaries management
- 6: optimal and integrated use of land and water resources

#### **Linkages to Existing Policies and Initiatives**

- Links to numerous objectives in the 7th Five Year Plan, including those set out in the following Chapters of Part 2:
  - Administration, Public Institutions and Governance: 1.4
  - Agriculture: 4.2, 4.3, 4.6
  - Environment and Climate Change: 8.3, 8.6
  - Housing and Community Amenities: 9.6
  - Social Protection: 14.4
- Project fits overall strategy of National Water Management Plan (NWMP) and links to all three NWMP immediate objectives:
  - 1. Rational management and wise use of Bangladesh’s water resources
  - 2. People’s quality of life improved by the equitable, safe and reliable access to water for production, health and hygiene
  - 3. Clean water in sufficient and timely quantities for multipurpose use and preservation of the aquatic and water dependent ecosystem.

The project is in line with planned NWMP disaster management interventions such as Large and Small Town Flood Protection (TR007).

- Links to numerous goals in the National Water Management Plan Development Strategy, including:
  - Main River Development (river management for navigation and erosion control)
  - Towns and Rural Areas (water supply and flood protection)
  - Disaster Management (flood proofing, riverbank maintenance and erosion control)
  - Agriculture and Water Management (river maintenance and flood control/drainage)
  - Natural Environment and Aquatic Resources (water management for ecologically sensitive areas and supporting environment measures)
- Applies to overall objectives of Coastal Development Policy and follow-on Strategy Targets/Strategic Priorities (ensuring fresh and safe water availability, safety from man-made and natural hazards, optimizing use of coastal lands, promoting economic growth, sustainable and equitable management of natural resources, improving livelihood conditions, environment conservation), and associated Investment Program.
- Flood protection and proofing are part of the UNDP Coordination of Cyclone Rehabilitation (1991)
- Continues the disaster management goals of the Comprehensive Disaster Management Program
- Links to National Adaption Programme of Action (2005) adaption needs and intervention measures
- Links to objectives of the National Sustainable Development Strategy in areas such as water resource management, disaster management, land/soil, and transport. Specifically mentioned as a proposed intervention under the Water Resources sector.

<ul style="list-style-type: none"> <li>• Links to objectives of the National Water Policy (1999) such as harnessing/development of all forms of surface/groundwater, bringing institutional changes as well as being in line with proposed Government actions under Planning and Management of Water Resources.</li> <li>• Helps to achieve the objectives of several the programmes outlined in the Bangladesh Climate Change Strategy and Action Plan 2009 Annex, principally under the Food Security, Social Protection and Health and Infrastructure pillars/themes.</li> </ul>	
<b>Technical Assessment</b>	
Technical description of project	Phase I of the project includes the construction of a 50km embankment, construction of 18km of new revetments, and upgrading of 18.6km of existing revetments. Several reservoirs and bridges are also included. In the second phase, another 87km embankments will be reconstructed with new revetments along 26km and upgraded revetments along 11.3km. The third phase includes a roughly 150km two-lane road that will extend from the Saidabaad Rail Gate, Sirajganj to Haripur town in Belka Union near Chilmari Port, Kurigram.
Evaluation of project feasibility	From a technical point of view, this solution is feasible. However, when constructing a dike, the effects on adjacent lands (both positive and negative) should be evaluated. A more integrated approach should be identified and implemented, considering environmental, social, and economic effects. Whether the proposed dikes and road are sustainable depends on the hydraulic calculations, the given boundary conditions, and the sustainability of operations and maintenance.
<b>Costs</b>	
Capital costs	In the feasibility study, cost estimates are based largely on international best practice. For Phase 1, 2, and 3 respectively the financial capital costs are calculated at US\$650 million, US\$713 million, and US\$333 million, all in 2014/2015 prices. Total financial capital cost: US\$1,697 million (BDT135,760 million) Total economic capital cost: US\$1,096 million (BDT87,680 million)
O&M costs	In the feasibility study, O&M costs are estimated at a flat 3 percent of the capital cost. Maintenance costs are assumed to commence in the year following completion of investments. Both assumptions seem reasonable, in accordance with international best practice. This leads to the following numbers: Average annual financial O&M costs: BDT4,072 million Average annual economic O&M costs: BDT2,630 million
Evaluation of financial estimates	The economic benefit/cost ratio is calculated at 2.24. Based on the quality of the feasibility study, this number is credible.
Potential environmental costs	The risk of bank erosion elsewhere should be considered. This depends on how the proposed embankment improvements will be done and maintained in practice.
Potential socio-economic costs	Not available
<b>Benefits</b>	
Potential environmental benefits	Not available

<p>Potential socio-economic benefits</p>	<p>The economic benefit/cost ratio is calculated at 2.24. Based on the quality of the feasibility study, this number is credible.</p> <p>The benefits of the project are predominantly socio-economic:</p> <p><b>Phase I</b></p> <ul style="list-style-type: none"> <li>• Prevented erosion loss in year 1: <ul style="list-style-type: none"> <li>– 200ha of land</li> <li>– 1,100 dwellings</li> <li>– 7,000ha of Aman rice completely lost</li> <li>– 4,900ha of land 50 percent lost</li> </ul> </li> <li>• Benefit from no breaches from year 1</li> <li>• Embankment overtopping during high floods from year 6.</li> </ul> <p><b>Phase II</b></p> <ul style="list-style-type: none"> <li>• Prevented erosion loss in year 3: <ul style="list-style-type: none"> <li>– 166ha of land,</li> <li>– 600 houses,</li> <li>– crop loss of 50 percent from 13,300ha of land,</li> <li>– 1,120 animals</li> </ul> </li> <li>• Benefit from no breaches in year 3: additional crop production from 17,500ha and additional fish catch of 3,800MT.</li> </ul> <p><b>Phase III</b></p> <p>Transport benefits of 150km road to improve accessibility to the area and to northern districts, starting in year 10.</p> <p>Other socio-economic benefits:</p> <p>Protection to greater Dhaka allowing further economic development.</p>
<p><b>Linkages to Other Projects</b></p>	
<p>This project stems from the Emergency Cyclone Recovery and Restoration Project. This project is linked to the embankments of Kurigram Irrigation Project in the North and the Pabna Irrigation and Rural Development Project in the South. In the future, it can be extended to the Kurigram Irrigation Projects over a new bridge across the Teesta river. The project also links to FRERMIP (the Flood and Riverbank Erosion Risk Management Investment Program), which will cover from Jamuna Bridge to Chandpur.</p>	
<p><b>ADM Principles</b></p>	
<p>This type of projects will locally decrease flood risk, but interventions will also change the actual behavior (hydraulics) of the river in the upstream area and the downstream section.</p> <p>In addition to upstream and downstream effects, there are uncertainties related to climate change and demographic and economic development of the region. The latter two are especially important for the design of the road and, along with it, the dike. The road will facilitate these demographic and economic developments. It is not clear whether the construction of the dike will allow for an upgrade of the road if needed.</p>	
<p><b>Linkages to Climate Change Adaptation</b></p>	
<p>By stabilizing the embankments in a sustainable way, the resulting flood protection will enhance the safety and livelihoods of a great number of people.</p>	
<p><b>Private Sector Financing Potential</b></p>	
<p>Most of the civil construction on this project involves construction of an embankment, construction of new river bank protection, and upgrading existing protection infrastructure. These costs are not suitable for PPPs because there are no direct revenue streams attached to these projects, and given</p>	

the construction costs and risks involved. Due to this reason, there are hardly any international precedents for PPPs in this area.

The project also involves construction of a 150km long road to improve accessibility to the area and to northern districts. This road is expected to generate significant time savings and other economic benefits. This project could definitely be explored as a PPP, which would enable the government to access private finance for at least part of the project. There are several international precedents for road PPP projects that are developed as part of embankment projects (e.g. Badaun–Ballia Ganga Expressway project in Uttar Pradesh, India).

<b>Policy and Institutional Reform</b>	
Main implementing agencies	Bangladesh Water Development Board (BWDB)
Required coordination mechanisms	Coordination required with LGED, RHD, Department of Agriculture, Department of Fisheries, Department of Environment.
Existing policies/institutions to facilitate implementation	<ul style="list-style-type: none"> <li>• Chapter 8.5 (Part 2) of the Seventh FYP provides that the introduction of Integrated River Management Plan, River Management Improvement and Land development projects on the right Bank of Jamuna at Sirajgonj – Belkuchi will assist in this area.</li> <li>• The Centre for Environmental and Geographical Information System (CEGIS) may assist with implementation.</li> <li>• MoWR Task Force established to develop new institutional framework for WRM may assist with implementation.</li> <li>• The Guidelines for Integrated Planning for Sustainable Water Resources Management set out the institutions and procedures for planning, O&amp;M, participatory M&amp;E, and training for FCD projects.</li> <li>• The general thrust of all recommended actions under the Bangladesh Climate Fiscal Framework 2014 is to facilitate access to climate finance, and to ensure that climate change finance is deployed in the most effective way. So, to the extent that this project seeks to address the impact of climate change, and is of sufficiently high priority, this policy should help to ensure it gets funded. Appendix 2 classifies flood control projects as significantly relevant to climate change mitigation/adaption (second highest ranking)</li> <li>• Bangladesh Climate Change Resilience Fund (BCCRF), Strategic Program for Climate Resilience may assist with implementation</li> <li>• Bangladesh Climate Change Strategy and Action Plan 2009 includes projects like this within its action plan, and accordingly facilitates the project’s implementation (refer to the Annex).</li> <li>• National Environment Committee, National Steering Committee on Climate Change, Inter-Ministerial Disaster Management Committee, National Disaster Management Advisory Committee may each assist with implementation.</li> </ul>
Desirable capacity building initiatives	The PCN states that BWDB capacity is sufficient for executing the project. However, in view of the size of the project and the political sensitivity, the issue of capacity should be reassessed.



Required policy/regulatory reforms	<ul style="list-style-type: none"> <li>• Implementation of the recommendations in the November 2014 Final Report on Institutional Improvement of BWDB</li> <li>• Bangladesh Climate Fiscal Framework 2014 recommends merging the Bangladesh Climate Change Resilience Fund and Bangladesh Climate Change Trust Fund to prevent duplication. It also generally recommends stronger and more integrated climate change planning</li> <li>• The Bangladesh Climate Fiscal Framework 2014 recommends implementing a climate fiscal cell in the FD of MoF</li> </ul>
<b>Overall Project Assessment</b>	
Priority	<p>This project has been identified as a short term project to be carried out before 2030.</p> <ul style="list-style-type: none"> <li>• Direct or indirect benefits offset implementation costs in all delta scenarios: The NPV of this project is estimated to be BDT 81,753 million</li> <li>• Implementing agencies have the knowledge base to implement these types of projects locally (with some limited guidance and support if needed): The PCN states that BWDB capacity is sufficient for executing the project. However, in view of the size of the project and the political sensitivity, the issue of capacity should be reassessed</li> <li>• Implementing the project will reduce vulnerability to future uncertainties such as sea level rise and flooding: The project will have a strong positive effect on flood risk reduction and on improving use of water and land resources. It will therefore support economic development, improve livelihoods, and alleviate poverty in these regions along the river. This is indicated in the first two sections of this project assessment above. The PCN does not indicate up to what level climate change models have been used to estimate changes in discharges, nor up to which return period this intervention will reduce the flood risk. This intervention is needed for flood protection and is required under all Delta Plan scenarios. The only scenario under which this would not be necessary is when the land behind the dikes would not be needed for economic development. This scenario is highly unlikely.</li> <li>• There are no hard trade-offs with other policy objectives. As indicated above under ‘Linkages to Existing Policies and Initiatives,’ this project will answer to many of the objectives that are included in the national and regional strategies.</li> <li>• In view of the above, this project should be considered a short term project. In the elaboration of the project, interventions should be designed such that they can adapt as much as possible to changing circumstances. Trade-offs between increasing the height of dikes and providing more room for the river should be assessed, taking in to consideration objectives of the project and their respective weights.</li> </ul>
State of readiness	<ul style="list-style-type: none"> <li>• Re-naming of the project has been suggested by GED from River Bank Improvement Programme to “River Bank Management Programme”</li> <li>• Phase I of the project is at an advanced level of readiness with a revised DPP submitted to the Planning Commission and a PEC meeting held on 1 February 2016. Only ECNEC approval is needed for implementation.</li> </ul>



Additional information or work required	The actual feasibility study was prepared in 2015. Nevertheless, the project needs to be redesigned based on available studies and ongoing projects. Therefore, the feasibility study has to be updated and should include an EIA and SIA. The CBA is from 2014, hence the numbers need to be updated, but this can be done relatively easily. A further discussion is needed on how the project can align with ADM principles.
Results framework and M&E arrangements	<p>The PCN provides little information on M&amp;E. The logframe of the first batch of the BDP2100<sup>176</sup> projects outline the objectives of the projects, but most objectives have not been made specific or measurable in terms of quality, quantity, and time.</p> <p>A monitoring plan needs to be developed to help implement an asset management and maintenance plan, and to generate sufficient information to adapt to changing circumstances. If monitoring leads to the conclusion that objectives are not being achieved, either the project interventions or the objectives must be adapted to a more realistic level.</p>

**MR 1.6 Development of Chandana-Barasia River Basin System**

Brief Project Description
<p>Chandana-Barasia river system is an offshoot of the Ganges and is dependent on the flow of the Ganges. Due to the diversion of the Ganges waters at Farakka since 1975, the availability and level of water at the Hardinge Bridge point in Bangladesh have drastically fallen. This led to a near cutoff of flow to many of the distributaries of the Ganges in Bangladesh, including Chandana-Barasia river system during dry season. At present there is no canal connecting the right bank of the Ganges and Chandana regulator. As a result, it is not possible to divert the low flow of the Ganges to the Chandana river.</p> <p><b>The main objectives of the project are:</b></p> <ul style="list-style-type: none"> <li>• To increase sweet water flow by dredging/excavation of the off-take canals</li> <li>• To provide irrigation facilities to a gross area of 29,155ha, net 22,050ha for increasing agricultural production</li> <li>• To have a sweet water reservoir into the Chandana-Barasia River for domestic purposes</li> </ul> <p>This project was first conceptualized in 2015. Re-excavation of the Chandana-Barasia River has already been completed as part of another project. This project has been delayed, however, because of a lack of funds and the lack of a basin-wide feasibility study.</p>
<b>Problem/Challenges the Project Aims to Address</b>
<p>In the last two decades, the off-take of the Chandana river has been silted up due to gradual sedimentation, shifting of the courses and changing of landscape. Key problems are:</p> <ul style="list-style-type: none"> <li>• The reduced flow of the Ganges during the dry period leads to the decreased flow in the Chandana River. This results in huge sedimentation at the offtake of the Chandana and downstream.</li> <li>• The river overflows during the monsoon, but its mouth remains dry in the winter.</li> </ul> <p><b>The project seeks to contribute to achieving the BDP2100 goals:</b></p> <ul style="list-style-type: none"> <li>• <b>Goal 1:</b> Ensure safety against water and climate change related disasters</li> <li>• <b>Goal 2:</b> Ensure water security and efficiency of water usages.</li> <li>• <b>Goal 5:</b> Develop effective institutions and equitable governance for intra and trans-boundary water resources management</li> </ul>

176 Bangladesh Delta Plan 2100 Formulation Project, Investment Plan, 14 Log Frames, March 2016

#### Linkages to Existing Policies and Initiatives

- Links to numerous objectives in the 7th Five Year Plan, including those set out in the following Chapters of Part 2:
  - Agriculture: 4.2, 4.3, 4.4, 4.6
  - Environment and Climate Change: 8.3, 8.5
- Project meets objectives/fits overall strategy of the National Water Management Plan (NWMP) and links to all three NWMP immediate objectives:
  - 1. Rational management and wise use of Bangladesh’s water resources
  - 2. People’s quality of life improved by the equitable, safe and reliable access to water for production, health and hygiene
  - 3. Clean water in sufficient and timely quantities for multipurpose use and preservation of the aquatic and water dependent ecosystem.
- Links to numerous goals in the National Water Management Plan Development Strategy, including:
  - Main River Development, Towns and Rural Areas (water supply, flood protection)
  - Agriculture and Water Management (public irrigation development, river maintenance, flood control/drainage)
  - Natural Environment and Aquatic Resources (water management for fisheries, water management for ecologically sensitive areas, supporting environment measures)
- Applies to overall objectives of Coastal Development Policy and follow-on Strategy Targets/Strategic Priorities (ensuring fresh and safe water availability, safety from man-made and natural hazards, promoting economic growth, sustainable and equitable management of natural resources, improving livelihood conditions, environment conservation), and associated Investment Program.
- Links to National Adaption Programme of Action (2005) adaption needs and intervention measures
- Links to National Agricultural Extension Policy key principles and pillars, especially the goal of increasing production.
- Links to objectives of the National Agriculture Policy such as increasing production and developing more efficient irrigation systems.
- Links to objectives of the National Sustainable Development Strategy in areas such as water resource management, disaster management, and agriculture development.
- Links to objectives of the National Water Policy (1999) such as harnessing/development of all forms of surface/groundwater, ensuring water availability as well as being in line with proposed Government actions under Planning and Management of Water Resources, Water and Agriculture.
- Helps to achieve the objectives of a number of the programmes outlined in the Bangladesh Climate Change Strategy and Action Plan 2009 Annex, principally under the Food Security, Social Protection and Health and Infrastructure pillars/themes.
- Links to National Food Policy 2006 Objective 1: Adequate and stable supply of safe and nutritious food and Plan of Action 1.2: Use and management of water resources (increase irrigation coverage, efficient use of irrigation water, reduce dependency on ground water, reduce cost of irrigation water)

<b>Technical Assessment</b>	
Technical description of project	<ul style="list-style-type: none"> <li>• Excavation of the 3620m offtake channel from the Ganges to the Chandana Regulator</li> <li>• Construction of a 5 vent WCS near Baliakandi over the Chandana River for maintaining water level upstream</li> <li>• Construction of one 10 vent WCS downstream of the Dharmohali Regulator (LGED) for creating a reservoir in the Mazurdia Khalupto on the Barasia River</li> <li>• Construction of 11 WCS (1 2-vent &amp; 10 1-vent) at the offtakes of the lateral khals for creating a reservoir in the Chandana–Barasia River</li> </ul>
Evaluation of project feasibility	<p>Technically, this project is feasible. Many similar irrigation projects have been implemented. The feasibility study was published in 2014, but does not include an EIA, SIA, or CBA. These studies should include an analysis of how to cope with developments related to water and land use. This will allow for a design that optimizes costs and benefits and provides sufficient flexibility to adapt to changing circumstances.</p> <p>Increased water availability results in higher crop production and, depending on the design, will also create new opportunities for people who have not had access to this economic sector. Improved navigability increases potential for economic development, and water availability for aquaculture provides new economic opportunities. Women have an important role in agricultural production. Thus, decreasing the uncertainty of water availability will also increase their opportunities. This will depend, however, on water availability at the field level.</p>
<b>Costs</b>	
Capital costs	<p>According to the feasibility study (2011/2012) as reported in the PCN, the estimated capital costs are:</p> <p>Financial: 510 million BDT (2015 prices)  Economic: 443 million BDT (2015 prices)</p> <p>Note: Land acquisition, required for the excavation of the canal off-take, has not been accounted for in these cost figures. Hence, the costs are underestimated.</p>
O&M costs	<p>According to the feasibility study, as reported in the PCN, the estimated annual O&amp;M costs are:</p> <p>Financial: 13 million BDT (not updated, 2013 prices)  Economic: 11 million BDT (2015 prices)</p>
Evaluation of financial estimates	<p>The benefit-cost ratio, as reported in the FS, is 2.31. In the feasibility study and CBA, however, a number of potential impacts on the cost or benefit side are not included: fisheries, navigation, and land acquisition. It is advised to update the feasibility study and CBA to include these impacts.</p>
Potential environmental costs	<p>The project has a focus on excavation work. Yet, there is no plan to manage unplanned earth or spoil dumping, which may create environmental or social conflict in the area.</p>
Potential socio-economic costs	<p>Construction of regulators on the river will stop river traffic movement for more than 100km, from the Ganges offtake to outfall of the Modhumati River. These costs should be accounted for.</p>

<b>Benefits</b>		
Potential benefits	environmental	<ul style="list-style-type: none"> <li>• Tree plantation</li> <li>• Other environmental improvements</li> </ul>
Potential benefits	socio-economic	<ul style="list-style-type: none"> <li>• The main quantified benefit is the projected increase in agricultural production. This additional output is valued at 136 million BDT per year. This impact also triggers employment and income generation. Furthermore, the reservoir may increase fish production, which has not been accounted for.</li> </ul>
<b>Linkages to Other Projects</b>		
<p>The project is linked with:</p> <ul style="list-style-type: none"> <li>• Ganges Barrage Project</li> <li>• West Gopalganj Integrated Water Management Project</li> </ul>		
<b>ADM Principles</b>		
<p>For irrigation projects of this size, it is important to consider both short- and long-term developments, particularly those related to:</p> <ul style="list-style-type: none"> <li>• Climate change (precipitation, evapotranspiration, seasonal variation, river discharge)</li> <li>• Developments upstream of the take-off for the project in relation to the discharge through the Dharla and Dhudkumar rivers, influencing the availability of water</li> <li>• Development of regional and national policies in relation to priorities for water</li> <li>• Development of regional and national priorities and policies within the agricultural sector</li> <li>• Technological development decreasing demands or increasing efficiency of agriculture</li> <li>• Demographic developments and migration patterns</li> <li>• Economic developments and consequential growth of the agricultural sector.</li> </ul> <p>Optimization of the irrigation scheme should include these uncertainties and possible scenarios to ensure that the water system will be able to adapt to changing circumstances.</p> <p>Flexibility in the irrigation scheme design is crucial to prevent over or under investment. The timing of Phase 1 to 3 is also important in that respect.</p> <p>Paying for water to irrigate the fields is not very common in Bangladesh. However, we recommend exploring possibilities for revolving funds to finance the implementation and the operation and maintenance of the irrigation scheme.</p>		
<b>Linkages to Climate Change Adaptation</b>		
<p>This measure fits into the objective of revitalizing river systems, which will ameliorate the river flow and retention of sweet water. By creating a robust and well-connected water network, the country can adapt to or mitigate the impacts of climate change.</p> <p>This project strongly relates to climate change as the water balance will be affected by changes in rainfall patterns. This will affect flood and drought risks, which should be considered when designing the interventions. The irrigation system has to consider the possibility of extended periods with less rain. Also, the operation and maintenance of the project has to take into account these climate change effects.</p> <p>As this project proposal concerns the development of a new irrigation scheme, the dimensions of the system should consider the different climate change scenarios. As such, this is not a project to adapt an existing situation to climate change.</p>		

<b>Private sector financing potential</b>	
<p>This project involves excavation of 3620m off-take channel from Ganges to the Chandana Regulator for carrying water up to the Chandana Regulator and construction of 13 Water Control Structures (WCS). Of the total project cost of 354 million BDT, around 82 million BDT is budgeted for the excavation while the balance is for constructing WCS.</p> <p>There is very strong interest among the developer community in Bangladesh to pursue long term performance based dredging contracts. While dredging does not have a direct revenue stream, such performance based dredging contracts where BIWTA compensates the contractor based on tonnage excavated will help ensure that the channel is dredged on time and on budget and, more importantly, the channel is regularly dredged (maintenance dredging) so that it remains usable for the foreseeable future.</p> <p>PPPs for dredging can also be combined with PPPs for river transport facilities (passenger ferries, freighters etc.) or inland ports which can possibly help recover some of the dredging costs.</p>	
Potential financing sources	<ul style="list-style-type: none"> <li>• Public sector</li> <li>• Private sector</li> </ul>
<b>Policy and Institutional Reform</b>	
Main implementing agencies	Bangladesh Water Development Board (BWDB)
Required coordination mechanisms	Coordination is required with DAE for agricultural development and extension services and Fisheries Department for fisheries development and extension services.
Existing policies/institutions to facilitate implementation	<ul style="list-style-type: none"> <li>• National Water Resources Council may assist with implementation</li> <li>• MoWR Task Force established to develop new institutional framework for WRM</li> <li>• The general thrust of all recommended actions under the Bangladesh Climate Fiscal Framework 2014 is to facilitate access to climate finance, and to ensure that climate change finance is deployed in the most effective way. So, to the extent that this project seeks to address the impact of climate change, and is of sufficiently high priority, this policy should help to ensure it gets funded. Appendix 2 classifies flood control projects as significantly relevant to CC mitigation/adaptation (second highest ranking)</li> <li>• Bangladesh Climate Change Resilience Fund (BCCRF), Strategic Program for Climate Resilience each may assist with implementation</li> <li>• Bangladesh Climate Change Strategy and Action Plan 2009 includes projects like this within its action plan, and accordingly facilitates the project's implementation (refer to the Annex).</li> <li>• National Environment Committee, National Steering Committee on Climate Change, Inter-Ministerial Disaster Management Committee, National Disaster Management Advisory Committee each may assist with implementation</li> </ul>
Desirable capacity building initiatives	In the feasibility study and PCN, no need is expressed for capacity building. However, taken in conjunction with the interlinked projects this is a mega project requiring significant capacity increases from the implementing agencies.

Required policy/regulatory reforms	<ul style="list-style-type: none"> <li>• Implementation of the recommendations in the November 2014 Final Report on Institutional Improvement of BWDB</li> <li>• Bangladesh Climate Fiscal Framework 2014 recommends merging the Bangladesh Climate Change Resilience Fund and Bangladesh Climate Change Trust Fund to prevent duplication. It also generally recommends stronger and more integrated climate change planning</li> <li>• Bangladesh Climate Fiscal Framework 2014 recommends implementing a climate fiscal cell in the FD of MoF</li> </ul>
<b>Overall Project Assessment</b>	
Priority	<p>The priority of this project is high. It will provide for new opportunities and alleviate poverty.</p> <ul style="list-style-type: none"> <li>• Direct or indirect benefits offset implementation costs in all delta scenarios: The NPV of this project is estimated to be BDT 499 million</li> <li>• Implementing agencies have the knowledge base to implement these types of projects locally (with some limited guidance and support if needed): The PCN states that BWDB is the executing agency. The BWDB has the technical capacity to implement an intervention of this type or contract a contractor to carry out the works. However, it is questionable whether the BWDB has sufficient personnel and the financial means to do the quality control for this intervention and to ensure that adequate maintenance will take place for the canal to continue to regulate flow towards the Chandana river. This should be reassessed in the project formulation process, and needed capacity should be secured before implementation of the works.</li> <li>• Implementing the project will reduce vulnerability to future uncertainties such as sea level rise and flooding. The project will have a strong positive effect on the availability of water in the Chandana river. This will allow for irrigation of large areas to increase agricultural production and will increase the certainty for the intake of water for domestic purposes. The works will reestablish a situation where fresh water is available for irrigation and domestic use. The PCN does not provide information in relation to whether climate change has been taken into consideration, nor does it indicate what the effect of the regulator will be downstream if water is being let in the Chandana river during low discharges through the Ganges. Reestablishing a minimum flow in the Chandana river will improve the use of water and land resources in the downstream areas, and will therefore support economic development, improve livelihoods, and alleviate poverty in these regions along the river. This is also stressed in the first two sections of the project assessment above.</li> <li>• There are no hard trade-offs with other policy objectives: The region fed by the Chandana river downstream of the regulator of this project will answer to many of the objectives that are included in the national and regional strategies. However, taking water from the Ganges will affect the discharge through the Ganges, which will affect downstream areas, especially during the dry season. International agreement on discharge through the Ganges should be considered in the decision making.</li> <li>• In view of the above, this project should be considered a short term project. The project will reestablish continuous water availability in the areas downstream of the regulator a situation that was disrupted by the diversion at Farakka in 1975. Trade-offs between increasing availability in the Chandana river and reduction of the discharge through the Ganges should be considered in the decision making. This also should be evaluated considering other projects that affect the discharge through the main system.</li> </ul>



State of readiness	A feasibility study was published in 2014, but this does not include an EIA, SIA, or CBA. These studies still must be done to ensure that the proper decisions are being made. These studies should not only cover effects along the Chandana river, but also effects that will be noticeable in the Ganges.
Additional information or work required	<p>In the feasibility study, more attention should be given to integrating the necessary structural works to allow for using the water for the irrigation scheme and for aquaculture.</p> <p>It is also needed to study the impact of the project on the required resettlement in the region.</p> <p>The DPP needs to be prepared and presented to ECNEC for approval.</p>
Results framework and M&E arrangements	The PCN provides little information on M&E. In the logframe of the second batch of the BDP2100 PCNs, there is information on the goals and purpose of the project, but these are very general and must be made more specific. Criteria on input and output are straightforward, but may not be sufficient for the integrated and adaptive approach that is to be adopted. Criteria have not been made specific in relation to quality and time, and a monitoring plan needs to be developed. This monitoring plan will help to implement an asset management and maintenance plan and to generate sufficient information to adapt to changing circumstances. If monitoring leads to the conclusion that objectives are not being achieved, either the project must adapt to the interventions, or the objectives must be adapted to a more realistic level.



### MR 3.1 Sustainable Restoration of Connectivity of Major Navigation Routes

<b>Brief Project Description</b>
<p>The purpose of this project is to achieve greater economic integration by improved navigability of inland water ways by dredging for smooth and safe plying of cargo and passenger vessels.</p> <p>The specific objectives are:</p> <ul style="list-style-type: none"> <li>• To improve the navigability of 24 river routes by dredging</li> <li>• To open up around 2500km of waterways for smooth and year-round plying of waterways</li> <li>• To increase the water flow of the respective rivers.</li> </ul> <p>The waterway is an important mode of transport in a riverine country like Bangladesh. It is a gift of nature and the cheapest mode of transport. There are still many areas in the country where no other mode of transport is available.</p> <p>In 1963, the total waterway network in Bangladesh was about 24,000km, of which there were 8,000km navigable waterways. When a comprehensive survey was made by DHV and associates Consulting Engineers in 1989, it was found that navigable waterways had reduced to 6,000km. In order to revive the inland waterways network, a capital dredging program is essential.</p> <p>According to GED, the dredging of these 24 rivers is being carried out, but studies on additional dredging activities remain to be done.</p>
<b>Problem/Challenges the Project Aims to Address</b>
<p>The inland waterways network in Bangladesh is gradually deteriorating due to:</p> <ul style="list-style-type: none"> <li>• Reduction of navigation draft as a result of high rate of siltation</li> <li>• Stream flow reduction</li> <li>• Reduction in cross-border flow</li> <li>• Silting up of offtakes</li> <li>• Reduction of tidal volume</li> </ul> <p>As a result, the length of navigable waterways has been drastically decreased in the past decades.</p> <p>It is therefore essential to improve the navigability of waterways for socioeconomic development of the country. Thus the Government of Bangladesh has given high priority to improve and restore the navigation routes. Twenty-four important waterways have been selected to be restored as soon as possible.</p> <p><b>The project will contribute towards achieving a number of BDP2100 goals, specifically:</b></p> <ul style="list-style-type: none"> <li>• <b>Goal 1:</b> safety from floods and climate change related disasters</li> <li>• <b>Goal 3:</b> sustainable and integrated river systems and estuaries management</li> <li>• <b>Goal 6:</b> optimal and integrated use of land and water resources.</li> </ul>
<b>Linkages to Existing Policies and Initiatives</b>
<ul style="list-style-type: none"> <li>• Links to numerous objectives in the 7th Five Year Plan, including those set out in the following Chapters of Part 2:             <ul style="list-style-type: none"> <li>– Agriculture: 4.2, 4.3, 4.6</li> <li>– Transport and Communication: 6.2, 6.3</li> <li>– Environment and Climate Change: 8.6</li> </ul> </li> <li>• Project fits overall strategy of the National Water Management Plan and links to NWMP immediate objectives:             <ul style="list-style-type: none"> <li>– 1. Rational management and wise use of Bangladesh’s water resources</li> <li>– 2. People’s quality of life improved by the equitable, safe and reliable access to water for production, health and hygiene</li> </ul> </li> </ul>

- 3. Clean water in sufficient and timely quantities for multipurpose use and preservation of the aquatic and water dependent ecosystem.

It also links closely with NWMP Programs for the Main Rivers, especially River Dredging for Navigation (MR011)

- Links to numerous goals in the National Water Management Plan Development Strategy, including:
  - Main River Development (river management for navigation and erosion control)
  - Towns and Rural Areas, Disaster Management, Agriculture and Water Management, and Natural Environment and Aquatic Resources (water management for ecologically sensitive areas, supporting environment measures)
- Applies to overall objectives of Coastal Development Policy and follow-on Strategy Targets/ Strategic Priorities (ensuring fresh and safe water availability, safety from man-made and natural hazards, optimizing use of coastal lands, promoting economic growth, sustainable and equitable management of natural resources, improving livelihood conditions, environment conservation), and associated Investment Program.
- Links to National Adaption Programme of Action (2005) adaption needs and intervention measures
- Links to objectives of the National Sustainable Development Strategy in areas such as water resource management.
- Links to objectives of the National Water Policy (1999) such as harnessing/development of all forms of surface/groundwater as well as being in line with proposed Government actions under Planning and Management of Water Resources, Water and Navigation.
- Helps to achieve the objectives of a number of the programmes outlined in the Bangladesh Climate Change Strategy and Action Plan 2009 Annex, principally under the Food Security, Social Protection and Health and Infrastructure pillars/themes.

**Technical Assessment**

<p>Technical description of project</p>	<p>This project comprises the dredging of a series of rivers to increase their navigable length. The decisions on which rivers were to be dredged have changed several times over the last 10 years. According to BIWTA<sup>177</sup>, the total length to be dredged is 904km.</p>
<p>Evaluation of project feasibility</p>	<p>Dredging is a standard and proven way to improve navigability. In addition to dredging, river training works can be considered, or alternative transport systems if natural sedimentation or river morphodynamics would result in too much maintenance dredging. These alternatives are not mentioned in the PCN. Feasibility or other supporting studies are not mentioned in the PCN, however, the DPP published by BIWTA in 2012 is probably based on a feasibility study.</p> <p>Alternatives for dredging river sections will depend on the actual location and specific conditions. They will also depend on the expected sedimentation rates after the capital dredging. The PCN does not provide any information about this.</p>

177 BIWTA. Dhaka, October 2012, DPP for Capital Dredging of 53 River-routes in Inland Waterways (1st Phase: 24 River Routes).

<b>Costs (2015 Prices)</b>		
Capital costs		Capital costs based on BIWTA study (2012): Financial: 26,987 million BDT Economic: 22,129 million BDT
O&M costs		O&M costs based on BIWTA study (2012): Financial: not available Economic: 230 million BDT/year on average
Evaluation of financial estimates		The economic benefit/cost ratio in the updated DPP is calculated at 1.17. However, several observations can be made relating to the failing assessment of part of the benefits and costs of the project (refer to following sections). It is advised to update the feasibility study, considering these issues.  Financial estimates are based on a recast DPP (2009). The main cost component is dredging. It is observed that the dredging capacity of BIWTA will not be sufficient to cope with the scope of the project. This may have an impact on the prices in the dredging market, leading to rising prices or more expensive hiring of foreign equipment.
Potential environmental costs		There is a risk of dumping dredged spoil in unsuitable places. This will cause harmful effects to the environment as well as public health. Furthermore, dredged sections may face increased flood risk and river bank erosion. It seems this was not extensively considered in the DPP, and should be accounted for in an updated impact assessment.
Potential socio-economic costs		There is a risk of overall higher dredging costs, also affecting other projects. Furthermore, the dumping of dredged material may also have socio-economic implications if it hampers site development.
<b>Benefits</b>		
Potential environmental benefits		The updated DPP mentions the potential improvement of the ecological balance of localities. It is not clear what this means, and no quantification has been done.
Potential socio-economic benefits		<b>In the updated DPP several benefits have been listed:</b> <ul style="list-style-type: none"> <li>• The navigability of dead and dying inland waterways (about 2,470km) will be revived for smooth and safe plying of cargo and passenger vessels.</li> <li>• Quick, easy and less expensive transportation of all kinds of goods and passengers</li> <li>• Volume of traffic of cargo through inland waterways will be increased due to minimization of transport cost</li> <li>• Marketing and distribution facilities of input and output of agriculture and industries will be increased which, in turn will have a positive impact on the economy of the country</li> <li>• Irrigation and fishing facilities will be increased.</li> </ul> <p>It is observed that these benefits may be partly overlapping, especially the first three benefits. These all relate to transport</p>

	<p>cost reduction impacts. Potentially this impact may be quite substantial. However, this is not quantified. As is stated in the PCN, this type of impact, given the scope of project, might cause a modal shift in the development process. For this reason, the quantification of economic benefits is complex for this project and questionable in the DPP.</p> <p>Only agricultural benefits have been considered in the quantification, but there may be other sectors which can develop faster (such as inland ports).</p>
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**Linkages to Other Projects**

- UA 1.1: Protection of river systems around Dhaka
- MR 1.1: River Bank Improvement Program
- Ecological Restoration of Four Rivers around Dhaka City
- Flood and Riverbank Erosion Risk Management Investment Program
- All other MR (major rivers) projects, in view of the interconnectivity of the waterways system, ecosystems and river banks

**ADM Principles**

The PCN does not discuss different scenarios with potential developments as basis for the decisions made and interventions described in the PCN. However, needs for navigational routes depend strongly on economic development in the country and how the economic development can best be facilitated. Criteria for deciding where to dredge is unclear, and there are no references to future interventions to adapt to changing circumstances. It is not clear whether a sound analysis of the actual needs and future developments is available at all.

**Linkages to Climate Change Adaptation**

Deepening waterways for navigation is not directly related to climate change. However, the studies must include climate change assessments as climate change will influence the year-round discharges through the rivers and the need for other measures to assure that the water levels are sufficient for navigation.

Improving opportunities for navigation could also be an intervention that could lead to mitigation if the emission of greenhouse gases reduces with the reduction of transport by road, but this information is not available at the moment.

**Private sector financing potential**

This project does not have any private sector financing potential since there are no revenue streams attached to it. Further, we are aware that the World Bank has already offered to finance this project, and the GoB has approved this offer.

**Policy and Institutional Reform**

Main implementing agencies	Bangladesh Inland Water Transport Authority (BIWTA)
Required coordination mechanisms	Ministry of water Resources (MoWR), to engage the organizations under MoWR to provide technical support to BIWTA to implement the project.
Existing policies/institutions to facilitate implementation	<ul style="list-style-type: none"> <li>• Chapter 6.2 of the Seventh FYP provides that the GoB will explore the possibility of working with private sector in speeding up dredging. Chapter 6.2 also provides that special attention will be given to ensuring that there are adequate resources to implement BIWTA’s comprehensive IWT development plan</li> </ul>

Existing policies/institutions to facilitate implementation	<ul style="list-style-type: none"> <li>• River Protection Commission and Chattogram Port Authority may assist with implementation</li> <li>• National Water Resources Council may assist with implementation</li> <li>• MoWR Task Force established to develop new institutional framework for WRM</li> <li>• The general thrust of all recommended actions under the Bangladesh Climate Fiscal Framework 2014 is to facilitate access to climate finance, and to ensure that climate change finance is deployed in the most effective way. So, to the extent that this project seeks to address the impact of climate change, and is of sufficiently high priority, this policy should help to ensure it gets funded. Appendix 2 classifies transport projects as implicitly relevant to climate change mitigation/adaption (fourth highest ranking)</li> <li>• Bangladesh Climate Change Strategy and Action Plan 2009 includes projects like this within its action plan, and accordingly facilitates the project’s implementation (refer to the Annex).</li> <li>• National Environment Committee, National Steering Committee on Climate Change, Inter-Ministerial Disaster Management Committee, National Disaster Management Advisory Committee each may assist with implementation</li> </ul>
Desirable capacity building initiatives	BIWTA dredgers are insufficient and those are to be engaged in maintenance dredging works nearly year-round. Therefore, it is proposed to engage dredgers from outside BIWTA to execute the major dredging.
Required policy/regulatory reforms	<ul style="list-style-type: none"> <li>• Implementation of the recommendations in the November 2014 Final Report on Institutional Improvement of BWDB</li> </ul>
<b>Overall Project Assessment</b>	
Priority	<p>The 24 rivers mentioned in this factsheet are already being dredged. This indicates the priority that is being given now to ensuring there is sufficient capacity for cargo transport via the river network of Bangladesh.</p> <ul style="list-style-type: none"> <li>• Direct or indirect benefits offset implementation costs in all delta scenarios: The NPV of this project is estimated to be BDT 2,793 million</li> <li>• Implementing agencies have the knowledge base to implement these types of projects locally (with some limited guidance and support if needed). BIWTA is responsible for dredging activities. Because dredging takes place at many different locations, BIWTA needs to contract companies to execute the major dredging works. This means that BIWTA should ensure there is sufficient capacity to carry out quality control on the contractors’</li> </ul>

	<ul style="list-style-type: none"> <li>• work. BIWTA is knowledgeable on how to conduct quality control, but it is doubtful whether there is sufficient capacity to perform quality control on all works. Furthermore, more knowledge on morphology, including modelling, is required to ensure that maintenance dredging is being done in an optimum manner.</li> <li>• Implementing the project will reduce vulnerability to future uncertainties such as sea level rise and flooding: The project is mainly focusing on improving navigability of 24 rivers. A SIA and EIA have been carried out. In the CBA, agricultural benefits have been taken in to account. For each of the individual dredging initiatives, further details are needed to assess up to which level these projects will reduce vulnerability. Dredging can reduce flood risks and improve water availability for industry and agriculture, but this needs to be assessed on an individual basis. In the PCN, climate change does not seem to be taken in to account in the planning. Also, economic development and the actual need for river transport is not directly linked to studies on fluvial transport. Therefore, it is not clear whether these interventions are required under all scenarios, but it is indicated that they do answer to immediate needs. Therefore, they will directly and indirectly support economic development. Jobs will be created, and many activities along the river will be facilitated by these interventions. If managed properly, these developments will improve livelihood and alleviate poverty.</li> <li>• There are no hard trade-offs with other policy objectives: Dredging rivers will facilitate economic development and, if taken in to account in the project implementation, also secure water for agriculture, industry, and domestic use. There are no hard trade-offs. However, care should be taken in relation to the quality of the dredged material, how it is used and where it is to be located.</li> <li>• The project has been labeled as a short term project in the Delta Plan process. It seeks to reestablish a situation that existed per a study in 1989. In view of the above, the project is to be carried out on the short term. Environmental and social impacts should be taken in to consideration for all locations where dredging is to take place.</li> </ul>
State of readiness	<p>Many studies have been carried out over the years, and a lot of information is available. However, with the morphological dynamics of the river system, continuous monitoring is needed to ensure that the rivers facilitate transport sufficiently. The state of readiness has to be updated on a continuous basis.</p>
Additional information or work required	<ul style="list-style-type: none"> <li>• The PCN needs redesigning to account for the routes currently under restoration</li> </ul>

	<ul style="list-style-type: none"> <li>• A project titled “Introduction of circular waterways around Dhaka city (2nd phase)” has been implemented. It needs to take lessons from implementation of this project</li> <li>• Morphological and technical assessment of the dredged rivers must be taken into consideration before implementation of such projects</li> <li>• For viability of such projects in the long term, prospects for the involvement of the private sector should also be considered.</li> </ul>
Results framework and M&E arrangements	The PCN provides little information concerning M&E. The BDP2100 PCN Batch 1 log frame presents the goals and purpose of the project, but these are very general and should be developed and refined. Criteria on input and output are straightforward, but may need adjustments for ADM-related design changes. The PCN specifies no criteria for quality and time, and lacks a monitoring plan.

## I.6.2 Coastal Zone

### CZ.1.1 Construction of Ganges Barrage and Ancillary Works

<p><b>Brief Project Description</b></p> <p>The Ganges is one of three major rivers that Bangladesh’s agricultural sector depends on for water. In the dry season, the Ganges discharges less water due to increased water extractions upstream in India.</p> <p>The main objective of the project is to increase the irrigation facilities, restore the ecological balance, and increase the livelihood opportunities of the Ganges Dependent Area (GDA). Specific objectives of the project are:</p> <ul style="list-style-type: none"> <li>• To properly manage use of the water to be available under the Ganges water sharing Treaty of 1996</li> <li>• To increase flow and navigability of rivers and channels dependent on the Ganges</li> <li>• To reduce salinity level of the GDA.</li> </ul> <p>Additional objectives are:</p> <ul style="list-style-type: none"> <li>• To tap hydro-power generation potentials</li> <li>• To reduce drainage congestion of the coastal region</li> <li>• To enhance fisheries production, especially the sweet water fish production</li> <li>• To preserve bio-diversity and forest resources in the Sundarbans</li> <li>• To establish gas-line, electric transmission line and road link and optical fiber cable line over the barrage deck to the SW region</li> <li>• To reduce arsenic contamination of groundwater.</li> </ul> <p>The Ganges Barrage Project is located between latitude 88°01’23” E and 91°1’08” E; and longitude 21°39’00” N and 25°12’48” N. The proposed location of Ganges Barrage is on the Ganges River, 37km upstream of the confluence of the Ganges and the Jamuna, at Upazilla-Pangsha, Dist.-Rajbari.</p> <p>The project was first conceptualized in the 1964 Master Plan, but implementation was delayed because of the absence of a treaty between Bangladesh and India and because of a lack of funds. A feasibility study has since been completed in 2015. A DPP has been submitted to the Planning Commission, and a PDPP has been submitted to the Economic Relations Division for funding from development partners.</p>
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#### **Problem/Challenges the Project Aims to Address**

##### **The Ganges Barrage project contributes to two BDP2100 goals:**

- **Goal 2:** Ensure water security and efficiency of water usages
- **Goal 6:** Achieve optimal use of land and water.

The Ganges river and its distributaries are the only sources of freshwater recharge in the south-west and south-central coastal regions and some portion of the Chalan Beel area. Due to upstream water withdrawal, these rivers have been subjected to drastic reduction in flow during the dry season, resulting in increased saltwater intrusion. The reduced flow and increased salinity affect agriculture, fishery, forestry, navigation, domestic water supply, and industrial development sectors in Bangladesh. A barrage across the Ganges river can help protect livelihoods, manage dwindling water resources, and boost economic growth of the area.

#### Linkages to Existing Policies and Initiatives

- Links to numerous objectives in the 7th Five Year Plan, including those set out in the following Chapters of Part 2:
  - Agriculture: 4.2, 4.3, 4.4, 4.5, 4.6
  - Power and Energy: 5.3
  - Transport and Communication: 6.2
  - Local Government and Rural Development: 7.3
  - Environment and Climate Change: 8.3, 8.4, 8.6
  - Housing and Community Amenities: 9.7
  - Social Protection: 14.3, 14.5
- Links to all three National Water Management Plan (NWMP) immediate objectives:
  - 1. Rational management and wise use of Bangladesh’s water resources
  - 2. People’s quality of life improved by the equitable, safe and reliable access to water for production, health and hygiene
  - 3. Clean water in sufficient and timely quantities for multipurpose use and preservation of the aquatic and water dependent ecosystem.
- Project is included as part of the National Water Management Plan Programs for Main Rivers (MR 003)
- Fits with overall goals/objectives and recommended activities of National Water Management Plan Development Strategy and links to numerous goals in National Water Management Plan Development Strategy, including:
  - Main River Development (river management for navigation and erosion control)
  - Towns and Rural Areas (water supply, flood protection)
  - Agriculture and Water Management (public irrigation development, river maintenance, flood control/drainage)
  - Natural Environment and Aquatic Resources (water management for fisheries, water management for ecologically sensitive areas, supporting environment measures)
- Applies to overall objectives of Coastal Development Policy and follow-on strategy and links to Coastal Development Strategy Targets/Strategic Priorities (safety from man-made and natural hazards, promoting economic growth, sustainable and equitable management of natural resources, improving livelihood conditions), and associated Investment Program
- Continues the disaster management goals of the Comprehensive Disaster Management Program
- In line with policies and proposed activities under the National Adaptation Programme of Action (2005) and links to adaption needs and intervention measures
- Meets objectives/policy aims of National Sustainable Development Strategy (2013) in areas such as water resource management, land/soil, and agriculture development. The project is specifically mentioned as a proposed intervention under the Environment, Natural Resource, and Disaster Management sector
- Meets objectives/policy aims of National Water Policy (1999) such as harnessing/development of all forms of surface/groundwater and is line with proposed Government actions under Planning and Management of Water Resources, Water for Hydropower and Recreation, Water and Navigation

- Helps to achieve the objectives of a number of the programmes outlined in the Bangladesh Climate Change Strategy and Action Plan (2009) Annex, principally under the “Food Security, Social Protection and Health” and “Infrastructure” pillars/themes.
- Aligns with objectives and action plans of the National Food Policy (NFP) 2006, such as:
  - NFP Objective 1: Adequate and stable supply of safe and nutritious food
  - NFP Plan of Action 1.2 Use and management of water resources
  - NFP Plan of Action 3.5: safe drinking water and improved sanitation

**Technical Assessment**

<p>Technical description of project</p>	<p>The Project Concept Note (PCN) describes the main technical activities:</p> <ul style="list-style-type: none"> <li>• <b>Pre-construction work:</b> <ul style="list-style-type: none"> <li>– Preparatory works (e.g. survey and investigation, environmental management planning, land acquisition and compensation)</li> <li>– Preliminary works (e.g. mobilization, site development and facilities, etc.)</li> </ul> </li> <li>• <b>Civil works:</b> <ul style="list-style-type: none"> <li>– Main structures</li> <li>– Railways bridge</li> <li>– Link channels</li> <li>– Drainage channels</li> <li>– River bank protection works</li> <li>– Afflux bund and link roads</li> <li>– Rehabilitation of flood control, drainage, and irrigation sub-projects</li> </ul> </li> <li>• <b>Hydro Power Plant:</b> <ul style="list-style-type: none"> <li>– Mechanical and electrical works of hydro-power generating Plant</li> <li>– Electrical works of 33, 11, and 132KV networks</li> </ul> </li> <li>• <b>Gates and Hoists:</b> <ul style="list-style-type: none"> <li>– Gate equipment, cranes, etc.</li> </ul> </li> <li>• Transport vehicle and equipment</li> <li>• Project Implementation Unit</li> <li>• Operation and maintenance</li> <li>• Engineering and administration</li> </ul>
<p>Evaluation of project feasibility</p>	<ul style="list-style-type: none"> <li>• The “Construction of Ganges Barrage and Ancillary Works” project being pursued in the present PCN is based on a feasibility study completed in 2012. The study was carried out by Development Design Consultants Ltd. (DDC) on behalf of BWDB.</li> <li>• The feasibility study includes an environmental impact analysis and a social impact analysis, but needs to be updated and should also consider recent impact on and trends in hydro-morphology, fishery, biodiversity, ecology, navigation and socio-economy. An updated feasibility study should also include:           <ul style="list-style-type: none"> <li>• Institutional capacity assessment (in depth) of implementing agencies and recommendations for capacity building</li> <li>• Possibility and strategy of cost recovery, especially O&amp;M costs</li> <li>• Proper Cost-Benefit Analysis (CBA) with the latest information and prices</li> <li>• Risk assessment/analysis along with a holistic inventory and assessment of different risks associated with the project and relevant appropriate solutions</li> </ul> </li> </ul>

	<ul style="list-style-type: none"> <li>• Climate change projection to be determined and policy decisions made accordingly</li> <li>• Opportunities for Adaptive Delta Management (ADM)</li> <li>• Exploring mandatory stakeholder participation (including community involvement, PWM) in the project cycle and scope of PPP.</li> </ul>
<b>Costs (2015 prices)</b>	
Capital costs	According to the feasibility study (2012), as reported in the PCN, the estimated capital costs are: Financial: 452,473 million BDT Economic: 341,139 million BDT
O&M costs	According to the feasibility study, as reported in the PCN, the estimated annual O&M costs are: Financial: 10,964 million BDT Economic: 7,964 million BDT
Evaluation of financial estimates	<p>The 2012 feasibility study included a cursory Cost-Benefit Analysis, which calculated an economic benefit/cost ratio of 1.50 for the project. However, the CBA methodology applied is weak per international standards.</p> <p>Agricultural output increases are by far the most important type of benefits, but the study fails to explicitly describe the quantitative relationship between water supply and agricultural output. Indirect impacts and externalities are often not quantified, and alternative solutions to a barrage have not been considered, such as maintaining the unique ecosystem of the Sundarbans.</p> <p>An updated feasibility study should address these concerns in addition to the issues described in the Technical Assessment section.</p>
Potential environmental costs	Construction of the barrage itself may lead to local negative environmental impacts.
Potential socio-economic costs	--

<b>Benefits</b>	
Potential environmental benefits	Sufficient supply of water to the Sundarbans will maintain this unique ecosystem.
Potential socio-economic benefits	<p>The following socio-economic benefits are expected:</p> <ul style="list-style-type: none"> <li>• Increase of agricultural production: 51,956 million BDT per year</li> <li>• Increase of fish production: 8,799 million BDT per year</li> <li>• Increase of forestry production: 6,773 million BDT per year</li> <li>• Hydro power generation: 1,772 million BDT per year</li> <li>• Improved road/transportation cost reduction: 280 million BDT per year</li> <li>• Improvement of navigation route through Mongla-Modhumoti-Gorai and the Ganges river system: 1,692 million BDT per year.</li> </ul> <p>These impacts will also lead to job opportunities and income generation.</p>
<b>Linkages to Other Projects</b>	
<p>The project is specifically linked to the North Rajshahi Irrigation Project and Sureswar Flood Control, Drainage and Irrigation Project. More generally, this project is linked to all water-related activities in the South-Western region of Bangladesh as the barrage will influence the availability of water throughout the region.</p>	
<b>ADM Principles</b>	
<p>This is a large structural work that has a long life cycle and leaves little flexibility for adaptive delta management, since the construction cannot be easily adapted as needed because of changing circumstances related to climate change, water availability, and demand. The construction of a large barrage will therefore imply the risk of over- or under-investment.</p> <p>If it is decided to construct the barrage, then the development scenario for the regions downstream will change drastically. Water availability will increase, and flood risks will decrease downstream, depending on the operational protocol of the barrage. This has to be considered for the planning of interventions in this region.</p> <p>The operational protocol will strongly influence land-use opportunities in the downstream area. The government will have to choose between the different uses of such a large reservoir, for example, prioritizing objectives related to flood risk management, water supply, and hydro power generation.</p>	
<b>Linkages to Climate Change Adaptation</b>	
<p><b>This project</b> aims to mitigate many adverse effects of climate change in a structural manner. It will assure water availability in periods of prolonged drought, it will provide opportunities to mitigate flood risks, it will provide opportunities to decrease salinization in the coastal areas as a result of sea level rise and the reservoir will increase the availability of environmental flow in the South Western region of the country. The construction of the barrage will provide important possibilities for the country to adapt to climate change.</p>	
<b>Private Sector Financing Potential</b>	
<p>This is a fairly large, complex, and sensitive project (politically and environmentally) for Bangladesh. Hence, it will be difficult to develop a PPP specifically for the construction and management of the barrage. That said, this is an integrated project with several sub-components and some of these components could be financed through PPPs. Potential options for involving the private sector in this project:</p>	

**This project** aims to mitigate many adverse effects of climate change in a structural manner. It will assure water availability in periods of prolonged drought, it will provide opportunities to mitigate flood risks, it will provide opportunities to decrease salinization in the coastal areas as a result of sea level rise and the reservoir will increase the availability of environmental flow in the South Western region of the country. The construction of the barrage will provide important possibilities for the country to adapt to climate change.

- The project also includes large hydro-power plant costing BDT7.7 billion. This project could definitely be developed as a PPP. Bangladesh has developed a track record of privately financed power plants and so the country already has a framework for developing such projects using PPPs
- There will be significant tourism opportunities in and around the water reservoir created by the Project. These are ideally suited for PPPs. The government could enter into PPPs for waterfront hotels, recreational ferry services, nature parks, and so on.
- Develop PPPs for large scale irrigation projects (e.g. the West Delta Irrigation Project in Egypt<sup>178</sup> ) in the catchment area. The program could be combined with developing PPPs for fisheries where the private sector can be tapped for financing, constructing, and then operating large-scale fisheries. The government can also earn a revenue share from these projects which can then be used to finance part of the operations and maintenance costs of the barrage. (e.g. there is a successful PPP for organic catfish production in Vietnam<sup>179</sup> )
- Procuring and maintaining transport vehicles and equipment (BDT900 million) could also be outsourced to private sector.

If large scale land accretion is expected due to the Project, there could also be PPPs for land reclamation.

#### Policy and Institutional Reform

Main implementing agencies	Bangladesh Water Development Board (BWDB)
Required coordination mechanisms	Coordination required with a great number of other stakeholders: <ul style="list-style-type: none"> <li>• Ministry of Water Resources</li> <li>• Ministry of Finances</li> <li>• Ministry of Local Government</li> <li>• Power Development Board</li> <li>• Roads and Highways Department</li> <li>• Department of Agriculture Extension</li> <li>• Department of Fisheries</li> <li>• Local Government Engineering Department (LGED)</li> <li>• Bangladesh Agriculture Development Corporation (BADC)</li> <li>• Bangladesh Inland Water Transport Authority (BIWTA)</li> <li>• Ministry of Foreign Affairs</li> <li>• Joint Rivers Commission</li> </ul>
Existing policies/institutions to facilitate implementation	<ul style="list-style-type: none"> <li>• Chapter 4.6 of Part 2 (Managing Water Resources) of the Seventh FYP discusses this particular project and lists actions the GoB will pursue to support it</li> <li>• Signatories to the Ganges Water Treaty 1996 may help facilitate implementation</li> <li>• Project is already part of the implementation plan for the National Water Management Plan (NWMP)</li> <li>• National Water Resources Council can help coordinate implementation (2030 WRG Bangladesh WRM Report)</li> <li>• MoWR Task Force established to develop new institutional framework for WRM</li> <li>• The general thrust of all recommended actions under the Bangladesh Climate Fiscal Framework 2014 is to facilitate access to climate finance, and to ensure that climate change finance is deployed in the most effective way. So, to the extent that this project seeks to address the impact of climate change, and is of sufficiently high priority, this policy</li> </ul>

<sup>178</sup> <http://ppp.worldbank.org/public-private-partnership/ppp-sector/water-sanitation/ppps-irrigation#examples>

<sup>179</sup> [http://pubs.iclarm.net/resource\\_centre/WF\\_1068.pdf](http://pubs.iclarm.net/resource_centre/WF_1068.pdf)

	<p>should help to ensure it gets funded. Appendix 2 classifies coastal barrage projects as being “strongly relevant” to climate change mitigation/adaption (highest ranking)</p> <ul style="list-style-type: none"> <li>• Bangladesh Climate Change Resilience Fund (BCCRF), Strategic Program for Climate Resilience may be of assistance with implementation</li> <li>• Bangladesh Climate Change Strategy and Action Plan 2009 includes projects like this within its action plan, and accordingly facilitates the project’s implementation (refer to the Annex).</li> <li>• National Environment Committee, National Steering Committee on Climate Change, Inter-Ministerial Disaster Management Committee, National Disaster Management Advisory Committee, Inter-Ministerial Disaster Management Committee, National Disaster Management Advisory Committee may be of assistance with implementation</li> </ul>
Desirable capacity building initiatives	In the feasibility study, no capacity building initiatives are mentioned. Considering the many challenges in implementing a project of this scale, we recommend an appraisal of the need for additional capacity within BWDB, especially to operate and maintain the works.
Required policy/regulatory reforms	<ul style="list-style-type: none"> <li>• The November 2014 Final Report on Institutional Improvement of BWDB made recommendations that are not yet implemented.</li> <li>• Bangladesh Climate Fiscal Framework 2014 recommends merging the Bangladesh Climate Change Resilience Fund and Bangladesh Climate Change Trust Fund to prevent duplication. It also generally recommends stronger and more integrated climate change planning</li> <li>• Bangladesh Climate Fiscal Framework 2014 recommends implementing a climate fiscal cell in the Finance Division of the Ministry of Finance</li> </ul>
<b>Overall Project Assessment</b>	
Priority	<ul style="list-style-type: none"> <li>• Priority is high—water management and land use opportunities strongly depend on whether the barrage will be implemented or not.</li> <li>• Direct or indirect benefits offset implementation costs in all delta scenarios: The NPV of this project is estimated to be BDT 83,578 million</li> <li>• Implementing agencies have the knowledge base to implement these types of projects locally (with some limited guidance and support if needed): The PCN does not provide information on the whether the capacity of the BWDB is sufficient. In view of the size of the project and the political sensitivity, the issue of capacity should be reassessed.</li> <li>• Implementing the project will reduce vulnerability to future uncertainties such as sea level rise and flooding: The Ganges Barrage will make it possible to regulate the flow through a large part of the fluvial system. A suitable operational protocol will decrease the uncertainty of water availability in large parts of the south-west and south-central coastal regions, and some portion of the Chalan Beel area. This will facilitate development of agriculture, fishery, forestry, navigation, domestic water supply, and industrial development sectors in Bangladesh. If properly managed, the project will have a strong positive effect on flood risk reduction and on improving use of water and land resources. It will therefore support economic development,</li> </ul>



	<p>improve livelihoods, and alleviate poverty in these regions along the river. The PCN does not specify whether climate change models have been used to estimate changes in discharges and international agreements between Bangladesh and India will strongly affect the effectiveness of the project. As indicated, a project like the Ganges Barrage will have significant environmental, social, and economic effects. It will be a long-term investment and is not flexible when considering the uncertainties related to climate change, demographic development, technical innovation, and outcomes of international agreements on discharges through the Ganges. Smaller projects along the river that facilitate regulation of discharges through the system would provide more flexibility, but these have other trade-offs when considering complexity, effectiveness, operation and maintenance, and required investments.</p> <ul style="list-style-type: none"> <li>• There are no hard trade-offs with other policy objectives: The project is expected to have significant negative social and environmental effects as well. If not mitigated properly, these effects are hard trade-offs and are being weighted against the many positive effects of the construction of the Barrage.</li> </ul> <p>In view of the above, this project is labeled as a short term project in the Delta Plan. Construction of the barrage will only be effective if there is sufficient inflow in the system. If agreements with riparian states guarantee the required inflow, the project will support economic development for the many sectors in the region that depend on the availability of water, affecting around one-third of the population of the country.</p>
State of readiness	The BDP2100 team must update the feasibility study before taking the next step. This is due to the changes that have taken place in the location of the reservoir, the barrage, and the downstream areas since the 2012 study.
Additional information or work required	<ul style="list-style-type: none"> <li>• Update the detailed feasibility study</li> <li>• Integrate plans with relevant sectoral activities/projects</li> <li>• Prioritize effective regional cooperation</li> <li>• Follow a Basin Wide/Basin Wise approach for design and implementation</li> <li>• Fully address ADM principles in design and planning</li> </ul>
Results framework and M&E arrangements	<p>The PCN provides only general information regarding M&amp;E. Most objectives have not been made specific or measurable in relation to quality, quantity, and time.</p> <p>To support effective asset management and maintenance, the BDP2100 team must develop a monitoring plan. This monitoring plan will also help to generate sufficient information to adapt to changing circumstances.</p> <p>If monitoring leads to the conclusion that objectives are not being achieved, either the project must be adapted, or the objectives adjusted to a more realistic level.</p> <p>Evaluations should account for the effects of outside as well as barrage-related factors on measured criteria.</p>

### CZ 1.3 Char Development and Settlement Project–V

<p><b>Brief Project Description</b></p> <p>The overall objective of the project is to protect the inhabitants of newly accreted chars in the Noakhali District from erosion, floods, and surges, and ultimately to reduce the poverty and hunger of poor people living there. To accomplish this, the project will provide both climate-resilient infrastructure and access to legal land titles for informal claimants.</p> <p><b>Further specific objectives include:</b></p> <ul style="list-style-type: none"><li>• Extension of economic activities</li><li>• Access to safe water, health, and sanitation facilities</li><li>• Access to education and legal aid services</li><li>• Important lessons on disaster management.</li></ul> <p>The project is a continuation of the Char Development and Settlement Projects (I–IV). It proposes to initiate a Char Development and Settlement Project (CDSP) in the Noakhali District. The CDSP would be a multi-sectoral and multi-agency development program, with a distinct role for agencies of the Government of Bangladesh (GoB) and for other agencies such as NGOs and private partners. <b>The program will operate in the following fields:</b></p> <ul style="list-style-type: none"><li>• Water management</li><li>• Internal infrastructure</li><li>• Land settlement</li><li>• Agriculture</li><li>• Livestock</li><li>• Fisheries</li><li>• Social Forestry—defined as the organized involvement of the rural poor in all stages of forestry activities from planning to harvesting. The purpose of social forestry is to ensure that the economic, ecological, and social benefits of forestry activities are inclusive of those living below the poverty line.</li></ul> <p>In addition to the above sectoral program, the project will include specific components for social and livelihood concerns, and for governance and capacity issues. This integrated approach follows the principles of Integrated Coastal Zone Management, as shown in the Coastal Zone Policy of Bangladesh. A feasibility study is currently being conducted.</p>
<p><b>Problem/Challenges the Project Aims to Address</b></p> <p>New land formed by natural hydro-morphological dynamics is usually unprotected against floods. People living on these lands face insecure livelihood and impoverishment due to river erosion. The interventions would improve and secure lives, properties, and livelihoods of the people.</p> <p>Part of an ongoing char development and settlement program, CDSP-IV would undertake three feasibility studies for char development projects in the Noakhali District, part of the dynamic coastal zone of Bangladesh. The interventions proposed will contribute to the overall objective of CDSP: to reduce poverty and hunger for poor people living on the newly accreted coastal chars.</p> <p><b>The project aims at contributing towards achieving the following BDP 2100 goals:</b></p> <ul style="list-style-type: none"><li>• Goal 1: Ensure safety against water and climate change related disasters</li><li>• Goal 2: Enhance water security and efficiency of water usages</li><li>• Goal 3: Ensure integrated river systems and estuaries management.</li></ul>

### Linkages to Existing Policies and Initiatives

- Links to numerous objectives in the 7th Five Year Plan, including those set out in the following Chapters of Part 1:
  - Promoting Pro-Poor and Inclusive Growth: 2.1, 2.7, 2.8
  - Poverty and Inequality Reduction: 4.2

#### And of Part 2:

- Public Administration/Institutions/Governance:1.4
  - Agriculture: 4.3, 4.6
  - Local Government and Rural Development: 7.2, 7.3
  - Environment and Climate Change: 8.3, 8.5, 8.6
  - Housing and Community Amenities: 9.3
  - Education and Technology: 11.2
  - Social Protection: 14.5
- Project meets objectives/targets/strategies in National Policy for Safe Water Supply & Sanitation (1998) such as “facilitating access of all citizens to basic level of services in water supply and sanitation” (Objective A) and ensuring sanitary latrine within easy access of every urban household through technology options ranging from pit latrines to water borne sewerage (Target IV)
  - Project meets objectives/fits overall strategy of National Water Management Plan (NWMP) and links to NWMP immediate objectives:
    - 2. People’s quality of life improved by the equitable, safe and reliable access to water for production, health and hygiene
    - 3. Clean water in sufficient and timely quantities for multipurpose use and preservation of the aquatic and water dependent ecosystem.
    - Also fits in with implementation programs aimed at disaster management and environment/aquatic resources
  - Fits with overall goals/objectives and recommended activities of National Water Management Plan Development Strategy and links to specific goals including:
    - Towns and Rural Areas (Water supply, sanitation, flood protection)
    - Disaster Management
    - Agriculture and Water Management (River maintenance, flood control/drainage)
    - Natural Environment and Aquatic Resources (Water management for fisheries, water management for ecologically sensitive areas, supporting environment measures)
  - Links to overall objectives and strategies of National Sanitation Strategy
  - Applies to overall objectives of Coastal Development Policy and follow-on Strategy, including Targets/ Strategic Priorities (Ensuring fresh and safe water availability, safety from man-made and natural hazards, optimizing use of coastal lands, promoting economic growth, sustainable and equitable management of natural resources, improving livelihood conditions, environment conservation), and associated Investment Program
  - Provides protection and hazard reduction from flood surges as recommended in the Coordination of Cyclone Rehabilitation (1991), UNDP
  - Continues the disaster management goals of the Comprehensive Disaster Management Program
  - In line with policies and proposed activities under the National Adaptation Program of Action (2005) and links to adaption needs and intervention measures

<ul style="list-style-type: none"> <li>• Meets objectives/policy aims of National Sustainable Development Strategy (2013) in areas such as forests/biodiversity, land/soil, and natural disasters and climate change</li> <li>• Meets objectives/policy aims of National Water Policy (1999) such as harnessing/development of all forms of surface/groundwater and is in line with proposed Government actions under Planning and Management of Water Resources</li> <li>• Helps to achieve the objectives of a number of the programs outlined in the Bangladesh Climate Change Strategy and Action Plan 2009 Annex, principally under the “Food Security, Social Protection and Health”, “Comprehensive Disaster Management”, and “Infrastructure” pillars/themes</li> <li>• In line with National Food Policy 2006 Objective 1: Adequate and stable supply of safe and nutritious food; NFP Plan of Action 2.1: Agricultural disaster management (enhance disaster preparedness)</li> </ul>	
<b>Technical Assessment</b>	
Technical description of project	<p>The project includes a series of structural interventions to manage water and land use:</p> <ul style="list-style-type: none"> <li>• Sluices to control water movement</li> <li>• Embankments including a sea dyke and interior dykes</li> <li>• Excavation of channels</li> <li>• Construction of a WMG Building</li> <li>• Construction of roads, bridges, and culverts</li> <li>• Various activities to improve forestry, agriculture and fishery.</li> </ul> <p>The budget also provides for social facilities like multi-purpose cyclone shelters, deep tube wells for water supply, latrines, public toilets, and rain water harvesting installations. Budget allotments are also included for O&amp;M during construction.</p>
Evaluation of project feasibility	<p>From a technical point of view, this project is feasible. However, the institutional and financial framework must be strengthened to ensure the required operation and maintenance of the interventions.</p> <p>Spatial planning to coordinate the Chars is important to ensure optimal use of the area reclaimed.</p>
<b>Costs (2015 Prices)</b>	
Capital costs	<p>As reported in the FS/PCN:</p> <ul style="list-style-type: none"> <li>• Financial: 1,185 million BDT</li> <li>• Economic: 954 million BDT</li> </ul>
O&M costs	<p>As reported in the FS/PCN:</p> <ul style="list-style-type: none"> <li>• Financial: 24.1 million BDT/year</li> <li>• Economic: 20.0 million BDT/year</li> </ul>
Evaluation of financial estimates	<p>The economic benefit-to-cost ratio as reported in the feasibility study and adjusted in the PCN is 1.58. In interpreting this number, consider that:</p> <ul style="list-style-type: none"> <li>• The CBA method applied in the feasibility study in general is up to standard</li> <li>• The main benefits valued in the CBA relate to income generation resulting from increased agricultural output</li> <li>• Several indirect benefits have not been quantified, but may contribute substantially to the overall benefit volume. For example, secured land ownership will enhance social security of the char population and investment on land for productive use</li> </ul>

	<ul style="list-style-type: none"> <li>The CBA does not consider the impacts of other project proposals relating to char development or connecting them to the mainland (cross dams).</li> </ul> <p>It is advised that these issues be considered in more detail in an update of the CBA.</p>
Potential environmental costs	--
Potential socio-economic costs	--
<b>Benefits</b>	
Potential environmental benefits	--
Potential socio-economic benefits	<p>The primary quantified benefits relate to the projected increase in the output of agriculture and fisheries. This will lead to increased employment and income. The value of these benefits has been estimated at 375 million BDT (2015).</p> <p>Other relevant benefits have been identified, but not quantified:</p> <ul style="list-style-type: none"> <li>Improved road communication, leading to reduced transport costs and better market access</li> <li>Improved physical infrastructures provide safety and security to the lives and property of the people of the char land, like the construction of cyclone shelter with a school building</li> <li>Land settlement activities providing legal title to land will give the char population security over land, the main asset in char area. Secured land ownership will enhance social security of the char population and investment on land for productive use</li> </ul>
<b>Linkages to Other Projects</b>	
<p>The current CDSP-IV includes three study programs, two of which have already been completed. The DPP of the CDSP-V may be developed based on findings from the three studies. Other linkages include:</p> <p><b>Ongoing:</b></p> <ul style="list-style-type: none"> <li>Polder 59/3B project, which drains through the study area</li> <li>Char Nangulia of CDSP-IV.</li> </ul> <p><b>Proposed:</b></p> <ul style="list-style-type: none"> <li>Urirchar Noakhali Cross-Dam Project</li> <li>Integrated Land Reclamation Project of Hatiya-Dhamar Char-Nijhum Dwip</li> </ul>	
<b>ADM Principles</b>	
<p>According to the World Bank internal definition, Adaptive Delta Management:</p> <ul style="list-style-type: none"> <li>Anticipates by using adaptation or development pathways (subsequent decision pathways) instead of final images</li> <li>Ensures adequate sufficient measures by connecting short-term decisions to long-term delta needs such as flood protection and water availability</li> <li>Values flexibility so it can address uncertainties to prevent over- or underinvestment and invest in real needs</li> </ul>	

- Promotes concerted action: synchronize public and private investments to a common agenda. By itself, this project does not adhere to ADM. However, this project is part of an ongoing initiative to adapt to the population growth in Bangladesh. It does not anticipate future population growth but addresses the existing pressure to provide the growing population with land and livelihood.

The PCN does not mention alternatives or different development scenarios. Climate Change, economic development, demographic development, and technological innovation are all important drivers that could influence the design and the planning of this project.

This project is at particular risk of violating the second and third principles of ADM in that it includes the construction of new polders. As has been seen, existing polders pose many challenges to sustainable operation and maintenance, leading to high risk of cost recovery failure. The rationality for constructing additional polders has yet to be substantiated.

#### Linkages to Climate Change Adaptation

This project can be designed in a climate-robust way by investing in flood protection, flood proofing and flood preparedness.

#### Issues to be addressed are:

- Whether it would be feasible to artificially heighten the area of new reclaimed land behind the mangrove forest to a level that cannot be flooded
- Whether these remote chars and islands can be self-sustaining in times of a disaster
- The poor adaptability of polders to climate change. There will be no adaptation capabilities once the polders are constructed. Therefore, this part of the project is less suitable for the climate change thematic program.

#### Private Sector Financing Potential

Of the total project cost of 868 million BDT (excluding contingencies), nearly 600 million BDT are for water management infrastructure like sluice gates, dykes and canals. These costs are not suitable for private financing given the construction risks and also since, most importantly, there are no direct revenue streams attached to these assets. Further, among other cost items, are costs like developing a cyclone shelter (BDT 80 million) as well developing forest land (BDT 41.5 million) which are also not suitable for private financing.

It is possible that some of the related initiatives like developing fisheries or agricultural facilities could be developed using PPPs, but the costs of these initiatives are quite small (between 4-5 million BDT). Unless the project sizes are increased or if the projects are combined with other similar projects, PPP may not be viable for these initiatives as well.

#### Policy and Institutional Reform

Main implementing agencies	Bangladesh Water Development Board (BWDB)
Required coordination mechanisms	Coordination is required with the following organizations: 1. DAE will be involved in the agricultural extension program 2. DOF will be involved in the fishery development program. 3. LGED will be involved in the rural infrastructure development program. 4. MoL will be involved in the settlement and land title of ownership program. 5. DPHE will be involved in drinking water and sanitation program. 6. Forest Department will be involved in social forestry development program 7. LGI may advice for local level participatory water management.



Existing policies/institutions to facilitate implementation	<ul style="list-style-type: none"> <li>• In the Seventh FYP, Chapter 4.5 (Part 2) outlines several measures designed to promote agriculture in newly-accreted coastal land (research, introduction of salt-resistant crops, intercropping etc).</li> <li>• In the Seventh FYP, Chapter 8.6 (Part 2) recommends classifying newly-accreted land as “Common Property Resources” to be managed by the vulnerable poor community.</li> <li>• MoWR Task Force established to develop new institutional framework for WRM</li> <li>• The Guidelines for Integrated Planning for Sustainable Water Resources Management set out the institutions and procedures for planning, O&amp;M, participatory M&amp;E, and training for FCD projects</li> <li>• The general thrust of all recommended actions under the Bangladesh Climate Fiscal Framework 2014 is to facilitate access to climate finance, and to ensure that climate change finance is deployed in the most effective way. So, to the extent that this project seeks to address the impact of climate change, and is of sufficiently high priority, this policy should help to ensure it gets funded. Appendix 2 classifies coastal protection projects as being “strongly relevant” to climate mitigation/adaption</li> <li>• Bangladesh Climate Change Resilience Fund (BCCRF) and the Strategic Program for Climate Resilience may both assist with implementation</li> <li>• Bangladesh Climate Change Strategy and Action Plan 2009 includes projects like this within its action plan, and accordingly facilitates the project’s implementation (refer to the Annex)</li> <li>• National Environment Committee, National Steering Committee on Climate Change, Inter-Ministerial Disaster Management Committee, and National Disaster Management Advisory Committee may together assist with implementation.</li> </ul>
Desirable capacity building initiatives	<ul style="list-style-type: none"> <li>• BWDB is a resourceful agency regarding flood control and drainage improvement activities, but it needs up-to-date training for staff in the field of participatory water management activities.</li> </ul>
Required policy/regulatory reforms	<ul style="list-style-type: none"> <li>• Review and align food security with agricultural and water resource management policies</li> <li>• Implementation of the recommendations in the November 2014 Final Report on Institutional Improvement of BWDB</li> <li>• Bangladesh Climate Fiscal Framework 2014 recommends merging the Bangladesh Climate Change Resilience Fund and Bangladesh Climate Change Trust Fund to prevent duplication. Also generally recommends stronger and more integrated climate change planning</li> <li>• Bangladesh Climate Fiscal Framework 2014 recommends implementing a climate fiscal cell in the Finance Department of MoF.</li> </ul>
<b>Overall Project Assessment</b>	
Priority	<p>This project is perceived by many as high priority.</p> <ul style="list-style-type: none"> <li>• Direct or indirect benefits offset implementation costs in all delta scenarios. The NPV of this project is estimated to be BDT 723 million</li> <li>• Implementing agencies have the knowledge base to implement these types of projects locally (with some limited guidance and support if needed). BWDB has extensive experience with Char development.</li> </ul>



	<p>If many projects are being implemented at the same time, it becomes questionable if the BWDB has sufficient personnel to manage all projects.</p> <ul style="list-style-type: none"> <li>Implementing the project will reduce vulnerability to future uncertainties such as sea level rise and flooding: The project can be designed such that there is low vulnerability to future uncertainties. Sea level rise is to be included in the planning. It is indicated that the project will provide room for the existing population and not for the expected population growth. There is a dire need for extra land to be developed.</li> <li>There are no hard trade-offs with other policy objectives: The project will not have hard trade-offs with other policy objectives. However, this project is one of the initiatives to construct new polders. Experience with existing polders shows that there are many challenges to sustainable operation and maintenance, leading to high risk of cost recovery failure. The rationality for constructing additional polders has yet to be substantiated.</li> </ul> <p>In the Delta Plan, this initiative has been labeled as a short term project as the expected outcome of the project outweighs the risk. However, it may be more sensible to start with the rehabilitation of existing polders instead of creating new polders that will face the same challenges as existing polders. By starting with rehabilitation of existing polders, lessons learned can be used to find sustainable methods (institutionally, technically, and socio-economically) to build, operate, and maintain better polders.</p>
State of readiness	<p>A feasibility study was published in 2014. This study does not include an Environmental Impact Analysis or a Social Impact Analysis. These are required before proceeding to implementation. Furthermore, as indicated below, other studies are recommended to ensure that effects are properly understood and the project is integrated in a sustainable development of the Char.</p>
Additional information or work required	<p>It is important to understand the morphodynamic impact of reclamation projects. Land reclamation and polder construction change the flow of water and sediment, which changes the pattern of erosion and accretion in the surrounding area. Since the area is so dynamic, there is always a risk that the project itself will exacerbate erosion problems in unforeseen ways.</p> <p>Existing land is generally more valuable than new land, which takes many years before it can be cultivated. Thus, the expected benefits of the project are delayed while the morphodynamic risks to valuable existing land are immediate and ongoing. These risks are not addressed in the PCN.</p> <p>Natural sedimentation gradually decelerates as land height increases. If embankments are constructed too soon (i.e. when the land level is still below high tide levels), then the new land will be vulnerable to sea level rise, extreme events, etc. This is a serious risk, because the new land is likely to be occupied soon, which means that people will start living on</p>

	<p>dangerous land. Funding agencies should consider these risks carefully before deciding to invest, as they could be blamed when a flood occurs. The PCN does not mention this risk or how to control it.</p> <p>Other work to be done as part of the ongoing feasibility study is:</p> <ul style="list-style-type: none"> <li>• Include land settlement costs in the cost estimation</li> <li>• Include spatial planning and governance components</li> <li>• Incorporate findings from the CDSP-IV evaluation report in designing the project.</li> </ul>
Results framework and M&E arrangements	The PCN provides little information concerning M&E. The BDP2100 Batch 3 log frame presents the Goals and Purpose of the project, but these are very general and should be developed and refined. Criteria on input and output are straightforward, but may need adjustments for ADM-related design changes. The PCN specifies no criteria for quality and time, and lacks a monitoring plan.

### **CZ 1.6 Integrated Land Reclamation Project of Hatiya-Dhamar Char-Nijhum Dwip**

<b>Brief Project Description</b>	
<p>The purpose of the project is to stimulate socio-economic development relevant for the local communities on the islands of Hatiya, Nijhum Dwip, and Damar Char.</p> <p>The specific objectives of the project are:</p> <ul style="list-style-type: none"> <li>• To reclaim land through construction of a cross-dam between Hatiya and Nijhum Dwip</li> <li>• To resettle people rendered landless by river-erosion, and to boost agriculture and fish production encompassing matured land by construction of peripheral dyke in Nijhum Dwip excluding forest area.</li> </ul> <p>By constructing a 1250-meter cross-dam, new land is expected to materialize due to natural sedimentation in the enclosed areas. Once certain areas have silted up sufficiently, the construction of embankments encompassing matured land is foreseen to protect the new land.</p> <p>The Hatiya Nijhum Dwip Cross-Dam project is situated in Hitiya Upazila of Noakhali District of Bangladesh. The gross area of the project is 9007 hectare (present) and net cultivable area is 2323 hectare. The total population of the project area is estimated at approximately 22,000 (year 2006) with a population density of 244. Total households number is about 4475, of which 40 percent and 37 percent rely on fish and crop agriculture respectively.</p> <p>The idea for this project dates back many years. The Meghna Estuary Study (1997) and a BWDB taskforce identified 19 cross dam projects, one of which is the Hatiya-Dhamar Char-Nijhum Dwip project. A feasibility study and Project Concept Paper (PCN) were prepared in the late 1990s, but environmental groups raised concerns regarding the possible negative impacts of the project on the existing hydro-morphology and ecological situation surrounding the Nijhum Dwip area. The Planning Commission responded by conducting a new feasibility study accounting for the geo-physical impacts of the cross-dam.</p> <p>The project team then prepared a new PCN based on the recommendations of the updated Feasibility Study and in accordance with the Environment Conservation Rules of 1997. This updated PCN was submitted to the Planning Commission. The most recent feasibility study is from 2007, but the projected costs and benefits have been updated to 2015 price levels.</p>	

### Problem/Challenges the Project Aims to Address

Bangladesh is a Delta formed by three great rivers (the Ganges, Brahmaputra and Meghna), and one of the most densely populated countries in the world. The study area is located in the lower Meghna estuary a dynamic system of coastal waterways. The estuary covers a gross area of about 11,000km<sup>2</sup> and has a population of 1.6 million people. The Government of Bangladesh (GoB) sees land reclamation as one way to accommodate the rapidly growing population and to stimulate agriculture production. In 1998, a survey known as the Meghna Estuary Study (MES) showed 19 locations in the area where cross-dams built across narrow, shallow waterways to trap sediment can be constructed for reclamation purposes. The Hatiya-Nijhum Dwip Cross-Dam is a priority among the 19 potential sites. GoB is planning to implement this project to help accommodate land-eroded destitute people and increase the land available for agriculture production in the estuary.

The surrounding area of the Nijhum Dwip and Hatiya Islands is vulnerable to high waves, salinity, tidal floods and surges. These forces can be detrimental to life and property, agriculture, fisheries, and human development activities. People rendered landless by erosion in the north of Hatiya take shelter on the BWDB embankment and on nearby or newly accreted lands. They do this both illegally and legally, with risk to their lives and property. The GoI proposes to resettle these landless and distressed people on new reclaimed lands, and to accelerate the reclamation process by construction of the cross-dam.

The project will contribute to achieving a great number of BDP 2100 goals:

- Goal 1: Ensure safety against water and climate change related disasters
- Goal 2: Enhance water security and efficiency of water usage
- Goal 3: Ensure sustainable and integrated river systems and estuaries management
- Goal 4: Conserve and preserve wetlands and ecosystems and promote their wise use
- Goal 6: Achieve optimal and integrated use of land and water resources.

### Linkages to Existing Policies and Initiatives

- Links to numerous objectives in the 7th Five Year Plan, including those set out in the following **Chapters of Part 2**
  - Agriculture: 4.3, 4.4, 4.6
  - Climate Change and Environment: 8.5
- Project fits overall strategy of the National Water Management Plan (NWMP) and links to **NWMP immediate objectives:**
  - 2. People's quality of life improved by the equitable, safe and reliable access to water for production, health and hygiene
  - 3. Clean water in sufficient and timely quantities for multipurpose use and preservation of the aquatic and water dependent ecosystem.

It also aligns with implementation programs aimed at environment/aquatic resources.

- Fits with overall goals/objectives and recommended activities of National Water Management **Plan Development Strategy, including:**
  - Main River Development (River management for navigation and erosion control)
  - Towns and Rural Areas, Agriculture and Water Management, and Natural Environment and Aquatic Resources (Water management for fisheries, water management for ecologically sensitive areas, supporting environment measures)
- Applies to overall objectives of Coastal Development Policy and follow-on strategy, and links to Coastal Development Strategy Targets/Strategic Priorities (Ensuring fresh and safe water availability, safety from man-made and natural hazards, optimizing use of coastal lands, promoting economic growth, sustainable and equitable management of natural resources, improving livelihood conditions, environment conservation) and associated Investment Program

<ul style="list-style-type: none"> <li>• In line with policies and proposed activities under the National Adaptation Programme of Action (2005). Addresses adaptation needs and intervention measures.</li> <li>• Links to National Agricultural Extension Policy agenda, key principles, and pillars, especially the goal of “increasing production”.</li> <li>• Meets objectives/policy aims of National Agriculture Policy (1999) such as increasing production and developing more efficient irrigation systems.</li> <li>• Links to objectives of the National Sustainable Development Strategy in areas such as land/soil, agriculture development, and natural disasters and climate change.</li> <li>• Meets objectives/policy aims of National Water Policy (1999) such as harnessing/development of all forms of surface/groundwater and is aligned with proposed Government actions under Planning and Management of Water Resources, Water and Fisheries.</li> <li>• Helps to achieve the objectives of a number of programmes outlined in the Bangladesh Climate Change Strategy and Action Plan (2009) Annex, principally under the “Food Security, Social Protection and Health” and “Infrastructure” pillars/themes.</li> <li>• Links to National Food Policy 2006 Objective 1: Adequate and stable supply of safe and nutritious food</li> <li>• Meets objectives/policy aims of National Sustainable Development Strategy (2013)</li> </ul>	
<b>Technical Assessment</b>	
Technical description of project	<p><b>Main Cross-Dam:</b></p> <ul style="list-style-type: none"> <li>• Length of Cross-Dam: 1250m</li> </ul> <p><b>Earthworks:</b></p> <ul style="list-style-type: none"> <li>• Embankment Sea-dyke: 14.40km</li> <li>• Embankment Marginal-dyke: 10.20km</li> <li>• Internal Closure Dam: 10</li> <li>• New Link Canal and Re-excavation of Creeks: 17.514km</li> </ul> <p><b>Structures:</b></p> <ul style="list-style-type: none"> <li>• Drainage Cum Flushing Sluice (1 Vent: 1.50 m X 1.80m): 4</li> </ul> <p>Land Acquisition: 102.96ha</p>
Evaluation of project feasibility	<p>The project is technically feasible, but faces challenges to its sustainability. Polders such as the cross-dam and its accompanying embankments need constant maintenance to prevent waterlogging and ensure the safety of occupants.</p> <p>Lessons learned from the difficulties faced by existing polders around the country must be incorporated to improve operation and maintenance. We recommend a focus on rehabilitating existing polders rather than creating new ones. This rehabilitation process will lead to new understanding of the technical, institutional, and financial techniques available to sustainably manage polders.</p>
<b>Costs (2006 Prices)</b>	
Capital costs	<p>The project feasibility study was completed in 2007. Although the technique of land reclamation through cross-dam construction remains valid, the context of the problem and its related costs and benefits might have changed significantly.</p> <p>Financial: 550.44 million BDT (2006 prices) Economic: 496.498 million BDT (2006 prices)</p>
O&M costs	<p>Note: there has been no update from 2006 to 2015 prices.</p> <p>Financial: 11.85 million BDT Economic: 10.69 million BDT</p>

Evaluation of financial estimates	Economic benefit/cost ratio calculated in the feasibility study is 2.73. It is observed that this number is not very meaningful, due to the following restrictions: <ul style="list-style-type: none"> <li>No update has taken place since 2006 of costs and benefits (nature, volume, price index)</li> <li>The CBA considers only agricultural output as quantified benefits.</li> <li>The CBA does not explicitly compare the ‘With Project’ and ‘Without Project’ scenarios for agricultural benefits. This may result in overstatement of agricultural productivity increases attributable to the project.</li> <li>Agricultural benefits are presented in the feasibility study as financial revenues, even though the operator and investor do not derive any direct cash flows from project operations. These benefits should be regarded as economic benefits.</li> </ul>
Potential environmental costs	Adverse consequences on areas upstream, such as reduced drainage capacity.
Potential socio-economic costs	Resettlement of population is required, implicating at least temporary socio-economic costs. Other locations for char development (closer to Noakhali mainland) may be more efficient.
<b>Benefits</b>	
Potential environmental benefits	The main environmental benefits are related to: <ul style="list-style-type: none"> <li>Reduced soil salinity within the protected areas</li> <li>Facilitated sedimentation due to intervention, resulting in reclaimed land</li> <li>Expected suitability of reclaimed land for extension of existing mangrove vegetation.</li> </ul>
Potential socio-economic benefits	The main quantified and monetized benefits relate to the increase in agricultural and fishery production, leading to better employment opportunities and income generation. The calculated value of this benefit is 244 million BDT annually. The following additional benefits are mentioned, without quantification: <ul style="list-style-type: none"> <li>Transportation cost reductions</li> <li>Development of tourism following the expansion of the mangrove area</li> </ul>
<b>Linkages to Other Projects</b>	
This project is linked with the Polder 73/1A & 73/1B projects on Hatiya. The Urirchar-Noakhali Cross-Dam Project and the Char Development and Settlement Project – Phase V have similar objectives regarding land reclamation and flood protection.	
<b>ADM Principles</b>	
According to the World Bank internal definition, Adaptive Delta Management: <ul style="list-style-type: none"> <li>Anticipates by using adaptation or development pathways (subsequent decision pathways) instead of final images</li> <li>Ensures adequate sufficient measures by connecting short-term decisions to long-term delta needs such as flood protection and water availability</li> <li>Values flexibility so it can address uncertainties to prevent over or underinvestment and invest in real needs</li> </ul>	

- Promotes concerted action: synchronize public and private investments to a common agenda.

This project is at particular risk of violating the second and third principles of ADM in that it includes the construction of new polders. As has been seen, existing polders pose many challenges to sustainable operation and maintenance, leading to high risk of cost recovery failure. The rationality for constructing additional polders has yet to be substantiated.

The PCN does not mention the two alternative locations assessed in the original feasibility study, or how they were evaluated in relation to different development scenarios. No attempt at designing subsequent decision pathways has been made.

Important drivers that could influence the design and the planning of this project include climate change, economic development, demographic development, and technological innovation.

#### **Linkages to Climate Change Adaptation**

This project can be designed in a climate robust way by investing in flood protection, flood proofing, and flood preparedness.

Issues to be addressed in the detailing of these projects are:

- Whether it would be feasible to artificially heighten the area of new reclaimed land behind the mangrove forest to a level that cannot be flooded
- Whether these remote chars and islands can be self-sustaining in times of a disaster
- The poor adaptability of polders to climate change. There will be no adaptation capabilities once the polders are constructed. Therefore, this part of the project is less suitable for the climate change thematic program.

#### **Private Sector Financing Potential**

Internationally, there are several PPP precedents for building dams as well for a few precedents for land reclamation PPPs. So, in theory, BWDB could consider PPPs for developing this project. However, in practice, it is likely to be quite complex to develop this project as a PPP. This is principally because this is an environmentally complex project. Activists have already halted the project once in the late 1990s following which the project was redesigned extensively. This redesign notwithstanding, it is quite possible that the private sector may still not be willing to invest considering the environmental risks.

The above notwithstanding, the project is expected to generate significant growth in agricultural and fisheries. For example, about 1170, 2700, and 5008ha of land area is expected to be available for agriculture practices after 10, 20 and 30 years respectively, cropping intensity could be increased by about 79 percent within the protected areas due to flood control and drainage improvement, paddy production could be increased by about 2385 metric tons, non-paddy production could be increased by about 930 metric tons within the protected areas, and fish production from capture and inshore fisheries areas will be increased by about 31500 metric tons.

All of these activities are typically led by the private sector formally or informally. Considering the potential benefits to the private sector from this project, there are two potential options for involving the private sector in this project:

- BWDB could look to develop PPPs for large scale irrigation projects (e.g. the West Delta Irrigation Project in Egypt<sup>180</sup>) in the newly developed area. The irrigation PPP could ensure that the private sector is fully vested in adequate operations and maintenance of the coastal embankments once



<p>constructed. However, the PPP can only be developed once the construction work for the embankment has been completed successfully because private sector partners are unlikely to be willing to enter into a long term partnership until they are certain that the crops will be protected.</p> <ul style="list-style-type: none"> <li>The program could be combined with developing PPPs for fisheries where the private sector can be tapped for financing, constructing, and then operating large-scale fisheries. The government can also earn a revenue share from these projects which can then be used to finance part of the operations and maintenance costs of the embankment. (e.g. there is a successful PPP for organic catfish production in Vietnam<sup>181</sup>).</li> </ul>	
Policy and Institutional Reform	
Main implementing agencies	Bangladesh Water Development Board (BWDB)
Required coordination mechanisms	Coordination required with Department of Forestry and Ministry of Land. A CDSP or similar project will be introduced to resettle landless people and improve their livelihood in new reclaimed lands.
Existing policies/institutions to facilitate implementation	<ul style="list-style-type: none"> <li>Chapter 4.6 (Part 2) of the Seventh FYP provides that a “Delta Commission” will be formed to implement the BDP2100, including land reclamation from the sea and rivers. This Chapter also notes that the planned river channelization program will facilitate land reclamation and riverbank protection.</li> <li>Proposed Delta Commission, CEGIS may assist with implementation</li> <li>MoWR Task Force established to develop new institutional framework for WRM</li> <li>The general thrust of all recommended actions under the Bangladesh Climate Fiscal Framework 2014 is to facilitate access to climate finance, and to ensure that climate change finance is deployed in the most effective way. So, to the extent that this project seeks to address the impact of climate change, and is of sufficiently high priority, this policy should help to ensure it gets funded. Appendix 2 classifies coastal barrage projects as being “strongly relevant” to climate change mitigation/adaption (highest ranking)</li> <li>Bangladesh Climate Change Resilience Fund (BCCRF), Strategic Program for Climate Resilience may each be able to assist with implementation</li> <li>Bangladesh Climate Change Strategy and Action Plan 2009 includes projects like this within its action plan, and accordingly facilitates the project’s implementation (refer to the Annex)</li> <li>National Environment Committee, National Steering Committee on Climate Change, Inter-Ministerial Disaster Management Committee, National Disaster Management Advisory Committee, Inter-Ministerial Disaster Management Committee, National Disaster Management Advisory Committee may each be able to assist with implementation.</li> </ul>
Desirable capacity building initiatives	--

181 [http://pubs.iclarm.net/resource\\_centre/WF\\_1068.pdf](http://pubs.iclarm.net/resource_centre/WF_1068.pdf)



Required reforms	<p>policy/regulatory</p> <ul style="list-style-type: none"> <li>• Implementation of the recommendations in the November 2014 Final Report on Institutional Improvement of BWDB</li> <li>• Bangladesh Climate Fiscal Framework 2014 recommends merging the Bangladesh Climate Change Resilience Fund and Bangladesh Climate Change Trust Fund to prevent duplication. It also generally recommends stronger and more integrated climate change planning</li> <li>• Bangladesh Climate Fiscal Framework 2014 recommends implementing a climate fiscal cell in the FD of MoF.</li> </ul>
<b>Overall Project Assessment</b>	
Priority	<p>This project is perceived by many as high priority.</p> <ul style="list-style-type: none"> <li>• Direct or indirect benefits offset implementation costs in all delta scenarios: The NPV of this project is estimated to be BDT 776 million</li> <li>• Implementing agencies have the knowledge base to implement these types of projects locally (with some limited guidance and support if needed): BWDB has extensive experience with Char development. If many projects are being implemented at the same time, however, it becomes questionable if the BWDB has sufficient personnel to manage all projects.</li> <li>• Implementing the project will reduce vulnerability to future uncertainties such as sea level rise and flooding: The project can be designed such that there is low vulnerability to future uncertainties. Sea level rise is to be included in the planning. It is indicated that the project will provide room for the existing population and not for the expected population growth. It does not provide room for a growing population, but answers to the existing dire need for extra land to be developed.</li> <li>• There are no hard trade-offs with other policy objectives: The project has no hard trade-offs with other policy objectives. However, this project is one of the initiatives to construct new polders, while experience with existing polders indicate that there are many challenges to sustainable operation and maintenance, leading to high risk of cost recovery failure. The rationale for constructing additional polders has yet to be substantiated.</li> </ul> <p>Although the project can be considered short term, it may be more sensible to start with the rehabilitation of existing polders instead of creating new polders that will face the same challenges. By starting with rehabilitation, lessons learned can be used to find sustainable methods (institutionally, technically, and socioeconomically) to build, operate, and maintain better polders.</p>
State of readiness	<p>Reference is made to a feasibility study dated 2007. The hydrodynamic conditions will have changed in the last ten years, so an update is necessary. In general, it is tricky to interfere with morphological dynamics in situations like these with very high natural dynamics. Unpredictability is inherent to dynamic systems and should be addressed in the PCN (which currently presents only absolute numbers).</p>

<p>Additional information or work required</p>	<p>It is important to understand the morphodynamic impact of reclamation projects. Land reclamation and polder construction change the flow of water and sediment, which changes the pattern of erosion and accretion in the surrounding area. Since the area is so dynamic, there is always a risk that the project itself will exacerbate erosion problems in unforeseen ways.</p> <p>Existing land is generally more valuable than new land, which takes many years before it can be cultivated. Thus, the expected benefits of the project are delayed while the morphodynamic risks to valuable existing land are immediate and ongoing. These risks are not addressed in the PCN.</p> <p>Natural sedimentation gradually decelerates as land height increases. If embankments are constructed too soon (i.e. when the land level is still below high tide levels), then the new land will be vulnerable to sea level rise, extreme events, etc. This is a serious risk, because the new land is likely to be occupied soon, which means that people will start living on dangerous land. Funding agencies should consider these risks carefully before deciding to invest, as they could be blamed when a flood occurs. The PCN does not mention this risk or how to control it.</p> <p>Other work to be done:</p> <ul style="list-style-type: none"> <li>• Include Spatial Planning and Land Development components</li> <li>• Address Governance and Management issues</li> <li>• Include other relevant agencies such as MoA, MoEF, MoFL, MoL, MoS (BIWTA), etc, during planning, design, and implementation stages of the project</li> <li>• Conduct a detailed technical and economic feasibility study before implementation.</li> </ul>
<p>Results framework and M&amp;E arrangements</p>	<p>The PCN provides little information concerning M&amp;E. The BDP2100 Batch 1 log frame presents the Goals and Purpose of the project, but these are very general and should be developed and refined. Criteria on input and output are straightforward, but may need adjustments for ADM-related design changes. The PCN specifies no criteria for quality and time, and lacks a monitoring plan.</p>

## CZ 1.7 Urir Char-Noakhali Cross-dam Project

Brief Project Description
<p><b>The main objectives of the project are:</b></p> <ul style="list-style-type: none"> <li>• Reclamation of land through construction of cross-dam between Urir Char and the Noakhali mainland</li> <li>• Provision of a road connection between Urir char and the Noakhali mainland which provides easy transport of goods and persons and easy and quick access in both directions in case of flooding or cyclones</li> </ul> <p><b>Additional indirect project objectives are:</b></p> <ul style="list-style-type: none"> <li>• Re-settle landless people on the newly accreted land</li> <li>• Introduce/increase agriculture production on the newly accreted land.</li> </ul> <p>The Bangladesh Water Development Board (BWDB) commissioned three studies to assess the potential for additional land reclamation in the Meghna Estuary: The Land Reclamation Project (LRP), the Meghna Estuary Study (MES), and the Estuary Development Program (EDP). Based on the LRP and the MES findings, the BWDB Task Force made a priority list of 19 potential cross-dam sites with the objective to accelerate the natural processes of land accretion. The EDP study recommended three potential cross-dam sites in the Sandwip-Urir Char-Noakhali zone. Among them, BWDB chose the cross-dam connecting Urir Char and the Noakhali mainland to be constructed first.</p> <p>There have been many studies exploring opportunities for land reclamation in the Meghna Estuary for agricultural and habitation purposes. Two cross-dams have already been constructed, one in 1956-57 and the other in 1964. The success of these cross-dams has encouraged the Government of Bangladesh (GoB) to pursue similar projects in this area.</p>
Problem/Challenges the Project Aims to Address
<p>The loss of agricultural land to river erosion, infrastructure construction, and housing is a major concern for Bangladesh. The reduction in productive farmland threatens not only food security for the growing population, but also affects provision of basic services including housing for the population.</p> <p>From 1976 to 2000, Bangladesh lost 13,413ha per year of cropland. This rate increased to 68,760ha per year from 2000 to 2010 (SRDI, 2013). The loss is especially alarming as food security is already a primary concern for Bangladesh. Loss of land due to river erosion creates a social and national problem for the country. Farmers rendered landless by erosion lose both their residence and their livelihood. To address this, GoB plans to resettle landless and distressed people on newly reclaimed lands accreted through physical intervention such as cross-dams.</p> <p>Land accretion and erosion is a continuous and gradual natural process in the Meghna Estuary region. Approximately 1 billion tons of sediment is transported to the Bay of Bengal through the lower Meghna River. This gives rise to natural accretion in the shallow water areas of the Meghna Estuary. In this way, about 9km<sup>2</sup> of land at the mouth of the Bay of Bengal may be naturally reclaimed every year. Structural intervention can accelerate the rate of land reclamation.</p> <p><b>The project contributes to the following BDP 2100 goals:</b></p> <ul style="list-style-type: none"> <li>• Goal 1: Ensure safety against water and climate change related disasters</li> <li>• Goal 3: Ensure integrated river systems and estuaries management</li> </ul>
Linkages to Existing Policies and Initiatives
<ul style="list-style-type: none"> <li>• Links to numerous objectives in the 7th Five Year Plan, including those set out in the following Chapters of Part 2: <ul style="list-style-type: none"> <li>– Agriculture: 4.3, 4.4, 4.6</li> <li>– Transport and Communication: 6.2</li> </ul> </li> </ul>

<ul style="list-style-type: none"> <li>- Local Government and Rural Development: 7.3</li> <li>- Environment and Climate Change: 8.5</li> <li>• Project fits overall strategy of National Water Management Plan (NWMP), including all three immediate objectives: <ul style="list-style-type: none"> <li>- 1. Rational management and wise use of Bangladesh’s water resources</li> <li>- 2. People’s quality of life improved by the equitable, safe and reliable access to water for production, health and hygiene</li> <li>- 3. Clean water in sufficient and timely quantities for multipurpose use and preservation of the aquatic and water dependent ecosystem.</li> </ul> </li> <li>• Fits with overall goals/objectives and recommended activities of National Water Management Plan Development Strategy, including: <ul style="list-style-type: none"> <li>- Main River Development (river management for navigation and erosion control)</li> <li>- Towns and Rural Areas, Agriculture and Water Management, and Natural Environment and Aquatic Resources (water management for fisheries, water management for ecologically sensitive areas, supporting environment measures)</li> </ul> </li> <li>• Applies to overall objectives of Coastal Development Policy and follow-on Strategy Targets/Strategic Priorities (ensuring fresh and safe water availability, safety from man-made and natural hazards, optimizing use of coastal lands, promoting economic growth, sustainable and equitable management of natural resources, improving livelihood conditions, environment conservation), and associated Investment Program.</li> <li>• In line with policies and proposed activities under the National Adaptation Programme of Action (2005).</li> <li>• Links to National Agricultural Extension Policy agenda, key principles, and pillars, especially the goal of “increasing production”.</li> <li>• Meets objectives/policy aims of National Agriculture Policy (1999) such as increasing production and developing more efficient irrigation systems.</li> <li>• Meets objectives/policy aims of National Sustainable Development Strategy (2013) in areas such as land/soil, agriculture development, and transport.</li> <li>• Meets objectives/policy aims of National Water Policy (1999) such as harnessing/development of all forms of surface/groundwater and is line with proposed Government actions under Planning and Management of Water Resources.</li> <li>• Helps to achieve the objectives of many the programmes outlined in the Bangladesh Climate Change Strategy and Action Plan 2009 Annex, principally under the “Food Security, Social Protection and Health” and “Infrastructure” pillars/themes.</li> </ul> <p>Links to National Food Policy 2006 Objective 1: Adequate and stable supply of safe and nutritious food, and NFP Plan of Action 1.2: Use and management of water resources (increase irrigation coverage, efficient use of irrigation water, reduce dependency on ground water, reduce cost of irrigation water)</p>	
<b>Technical Assessment</b>	
Technical description of project	The Urir Char – Noakhali Cross-Dam (UCNCD) will be constructed in the Bamni channel between Noakhali and Urir Char to enhance the autonomous processes of accretion in the area between Urir char and the mainland from Noakhali.

	<p>The cross-dam will close off the tidal channel between Urir Char and Noakhali, enhancing the accretion on both sides of the dam. This accretion will develop immediately after the factual closure of the channel. The cross-dam will also provide a road connection between Urir Char and the Noakhali mainland. The total length of the cross-dam is about 10km, constructed in an area of moderate tidal motion. Currently, at low tide, the channel between Noakhali and Urir Char can be crossed on foot.</p> <p>Building materials used will include local wood, geo bags, concrete blocks, geo-textile, hard rocks/boulders, gabions, and sand.</p>
Evaluation of project feasibility	<p>From a technical point of view, this project is feasible. The studies show that construction of a cross-dam will lead to autonomous land accretion as planned. However, this project also requires other structural and non-structural interventions to ensure that objectives will be achieved.</p> <p>The project team must assess the social and economic aspects of coordinating settlement, land use, and operation and maintenance before proceeding with implementation.</p>
<b>Costs</b>	
Capital costs	<p>According to the feasibility study (2013/2014), as reported in the PCN, the estimated capital costs are:</p> <p>Financial: 3,822.3 million BDT (not updated, 2013 prices) Economic: 3,670 million BDT (2015 prices)</p>
O&M costs	<p>According to the feasibility study, as reported in the PCN, the estimated annual O&amp;M costs are:</p> <p>Financial: 76.45 million BDT (not updated, 2013 prices) Economic: 73.40 million BDT (2015 prices)</p>
Evaluation of financial estimates	<p>The original Cost-Benefit Analysis is of limited quality. Some benefits have not been quantified or estimated. Missing estimates include transportation benefits, benefits of erosion reduction, and land productivity increases over time. Moreover, the 'without Project' scenario has not been assessed in detail, especially regarding agricultural benefits. For these reasons the outcomes of CBA should be interpreted with some care.</p> <p>The economic benefit-cost ratio in the PCN, based on adjusted and re-assessed costs and benefits of the original CBA, is 0.21. This means the project is not economically feasible based on the benefits of agricultural output. The PCN concludes that land accretion projects may must be evaluated differently to account for the social and economic benefits of settling landless people.</p> <p>Most of the adjustments and observations made in the PCN seem logical. However, the specific location of proposed land accretion should be considered, as assessments of other proposed projects show a positive benefit-cost ratio, such as the Urir Char-Sanwip Cross-Dam Project (b/c ratio 2.73).</p>
Potential environmental costs	<p>Depending on execution, erosion may be induced in unintended places. This carries both environmental and socioeconomic costs.</p>

Potential socio-economic costs	Depending on execution, erosion may be induced in unintended places. This carries both environmental and socioeconomic costs.	
<b>Benefits</b>		
Potential environmental benefits		<ul style="list-style-type: none"> <li>The current erosion taking place on the Noakhali side near the cross-dam will be stopped by the land accretion.</li> </ul>
Potential socio-economic benefits		<ul style="list-style-type: none"> <li>The cross-dam will enhance the processes of siltation in the area between Urir Char and the mainland at Noakhali. The current prediction is that this enhancement will result in a land accretion of roughly 7,000ha in addition to the roughly 3,000ha expected to develop if no cross-dam were built.</li> <li>The total land accretion of 10,000ha of which an estimated 60 percent will be arable land, would make 6,000ha available for landless households. At an allocation of 3 acres per family—enough to provide a good livelihood—this would accommodate 4,500 landless households. Total value of projected agricultural output is assessed in the feasibility study at 7,966 million BDT.</li> <li>The cross-dam will enhance the local socio-economic situation by creating a permanent connection to the mainland for the people living in Urir Char. The road connection will provide access to markets, education, health, and other facilities. This connection will also improve the security situation, including evacuation routes in case of threats of flooding or cyclones.</li> </ul>
<b>Linkages to Other Projects</b>		
<p>This project is linked with the Urir Char-Sanwip Cross-dam Project addressing similar issues and using the cross-dam accretion method. This project is also linked with the Polder 59/3B and Polder 59/3C Projects addressing waterlogging and drainage congestion issues.</p> <p>Furthermore, this project is linked to all other polder and char development projects as these address similar challenges and have overlapping objectives. These projects must be assessed together, using an integrated program approach.</p>		
<b>ADM Principles</b>		
<p>Per the internal World Bank definition, Adaptive Delta Management:</p> <ul style="list-style-type: none"> <li>Anticipates by using adaptation or development pathways (subsequent decision pathways) instead of final images;</li> <li>Ensures adequate sufficient measures by connecting short-term decisions to long-term delta needs such as flood protection and water availability;</li> <li>Values flexibility so it can address uncertainties to prevent over or underinvestment and invest in real needs; and</li> <li>Promotes concerted action: synchronize public and private investments to a common agenda.</li> </ul> <p>By itself, this project does not adhere to ADM. However, this project is part of an ongoing initiative to adapt to the population growth in Bangladesh. It does not anticipate future population growth, but addresses the existing pressure to provide the growing population with land and livelihood.</p> <p>This project is particularly at risk of violating the second and third principles of ADM in that it includes the construction of new polders. As has been seen, existing polders pose many challenges to sustainable operation and maintenance, leading to high risk of cost recovery failure. The rationality for constructing additional polders has yet to be substantiated.</p>		



<p>The PCN does not mention alternatives or different development pathways, but planners are pursuing concerted action by coordinating with related public projects.</p>		
<p>No potential private financing has been discussed even though revolving funds are needed to assure sustainable operation and maintenance.</p>		
<p><b>Linkages to Climate Change Adaptation</b></p>		
<p>This project can be designed in a climate-robust way by investing in flood protection, flood proofing and flood preparedness.</p> <p>Issues to be addressed are:</p> <ul style="list-style-type: none"> <li>• Whether it would be feasible to artificially heighten the area of new reclaimed land to a level that cannot be flooded</li> <li>• Whether Urir Char can be self-sustaining if a disaster makes the cross-dam road impassible</li> <li>• Whether the chosen location provides the best return on investment considering the full range of social and economic costs and benefits.</li> <li>• The poor adaptability of polders to climate change. There will be no adaptation capabilities once the polders are constructed. Therefore, this part of the project is less suitable for the climate change thematic program.</li> </ul>		
<p><b>Private Sector Financing Potential</b></p>		
<p>As with other similar projects that we have analysed, a cross dam project like this one, is not well suited for PPPs. In this project in particular, the key beneficiaries of the land accretion are likely to be landless households the project estimates total land accretion of 10,000 ha, of which 60 percent is considered arable land, all of which will be made available to 4500-9000 such households. While this approach has tremendous social benefits, the output generated by these households are likely to be consumed by them mostly (i.e. subsistence farming), so the farms are unlikely to generate significant economic surplus which could be translated into financial returns for a private developer.</p> <p>That said, government could look at PPPs that are not paid by user charges or fees but through other measures like availability payments. For instance, the project envisages a road connection between Urir char and the Noakhali mainland which derives various benefits such as easy transport of goods and persons, easy and quick access in both directions in case of threats of flooding or cyclones. This road could be developed and operated under an availability payment PPP (the project details provided do not state the cost of building this road).</p>		
<p><b>Policy and Institutional Reform</b></p>		
Main implementing agencies		Bangladesh Water Development Board (BWDB)
Required coordination mechanisms		Coordination required with Department of Forestry and Ministry of Land. A CDSP or similar project will be introduced to resettle landless people and improve their livelihood in new reclaimed lands.
Existing policies/institutions to facilitate implementation		<ul style="list-style-type: none"> <li>• Chapter 4.6 (Part 2) of the Seventh FYP provides that a “Delta Commission” will be formed to implement the BDP2100, including land reclamation from the sea and rivers. This Chapter also notes that the planned river channelization program will facilitate land reclamation and riverbank protection.</li> <li>• Proposed Delta Commission, CEGIS may assist with implementation</li> <li>• National Water Resources Council may assist with implementation</li> <li>• MoWR Task Force established to develop new institutional framework for WRM</li> </ul>



	<ul style="list-style-type: none"> <li>• The general thrust of all recommended actions under the Bangladesh Climate Fiscal Framework 2014 is to facilitate access to climate finance, and to ensure that climate change finance is deployed in the most effective way. So, to the extent that this project seeks to address the impact of climate change, and is of sufficiently high priority, this policy should help to ensure it gets funded. Appendix 2 classifies coastal protection projects as being “strongly relevant” to CC mitigation/adaption</li> <li>• Bangladesh Climate Change Resilience Fund (BCCRF), Strategic Program for Climate Resilience may assist with implementation</li> <li>• Bangladesh Climate Change Strategy and Action Plan 2009 includes projects like this within its action plan (refer to the Annex).</li> <li>• National Environment Committee, National Steering Committee on Climate Change, Inter-Ministerial Disaster Management Committee, National Disaster Management Advisory Committee may each be able to assist</li> </ul>
Desirable capacity building initiatives	<p>BWDB has extensive experience with dam and polder projects, and should have the capacity to make qualified staff available to supervise the works.</p> <p>Because this project is in a remote area vulnerable to cyclones, the BWDB is responsible for establishing and maintaining a warning and flood preparedness system for all personnel involved in the execution of works.</p>
Required policy/regulatory reforms	<ul style="list-style-type: none"> <li>• Implementation of the recommendations in the November 2014 Final Report on Institutional Improvement of BWDB</li> <li>• Bangladesh Climate Fiscal Framework 2014 recommends merging the Bangladesh Climate Change Resilience Fund and Climate Change Trust Fund to prevent duplication. It also generally recommends stronger and more integrated climate change planning</li> <li>• The Bangladesh Climate Fiscal Framework 2014 recommends implementing a climate fiscal cell in the FD of MoF</li> </ul>
<b>Overall Project Assessment</b>	
Priority	<p>This project is perceived by many as high priority.</p> <ul style="list-style-type: none"> <li>• The NPV of this project is estimated to be BDT -2,632 million</li> <li>• Implementing agencies have the knowledge base to implement these types of projects locally (with some limited guidance and support if needed): BWDB has extensive experience with Char development. If many projects are being implemented at the same time, it becomes questionable if the BWDB has sufficient personnel to manage all projects.</li> <li>• Implementing the project will reduce vulnerability to future uncertainties such as sea level rise and flooding. The project can be designed such that there is low vulnerability to future uncertainties. Sea level rise is to be included in the planning. It is indicated that the project will provide room for the existing population and not for the expected population growth. It does not provide room for a growing population, but answers to the existing dire need for extra land to be developed.</li> </ul>

	<ul style="list-style-type: none"> <li>• There are no hard trade-offs with other policy objectives: The project has no hard trade-offs with other policy objectives. However, this project is one of the initiatives to construct new polders, while experience with existing polders indicate that there are many challenges to sustainable operation and maintenance, leading to high risk of cost recovery failure. The rationality for constructing additional polders has yet to be substantiated.</li> </ul> <p>In view of the above, most specifically the negative NPV, it is more sensible to start with the rehabilitation of existing polders instead of creating new polders that will face the same challenges. By starting with rehabilitation, lessons learned can be used to find sustainable methods (institutionally, technically, and socioeconomically) to build, operate, and maintain better polders.</p>
State of readiness	<p>A feasibility study was published in 2014. This study does include an Environmental Impact Analysis, a Social Impact Analysis, and a CBA. As indicated below, further studies are recommended to help integrate the project into a larger program for the sustainable development of the Char. A DPP is currently under process, and a PDPP has been submitted to the Economic Relations Division for development partner funding.</p>
Additional information or work required	<p>It is important to understand the morphodynamic impact of reclamation projects. Land reclamation and polder construction change the flow of water and sediment, which changes the pattern of erosion and accretion in the surrounding area. Since the area is so dynamic, there is always a risk that the project itself will exacerbate erosion problems in unforeseen ways.</p> <p>Natural sedimentation gradually decelerates as land height increases. If embankments are constructed too soon (i.e. when the land level is still below high tide levels), then the new land will be vulnerable to sea level rise, extreme events, etc. This is a serious risk, because the new land is likely to be occupied soon, which means that people will start living on dangerous land.</p> <p>Also, the effects of the intervention on salinity and required infrastructure for drainage are to be detailed.</p> <p>Other work to be included:</p> <ul style="list-style-type: none"> <li>• Land settlement in the cost estimation</li> <li>• Spatial planning and governance components</li> <li>• Linkages with other projects (agriculture, infrastructure, spatial planning, etc.) in the area.</li> </ul>
Results framework and M&E arrangements	<p>The PCN provides little information concerning M&amp;E. The BDP2100 Batch 1 log frame<sup>182</sup> presents the goals and purpose of the project, but these are very general and should be developed and refined. Criteria on input and output are straightforward, but may need adjustments for ADM-related design changes. The PCN specifies no criteria for quality and time, and lacks a monitoring plan.</p>

## CZ 1.8 (CZ 1.21) West Gopalganj Integrated Water Management Project

<p><b>Brief Project Description</b></p> <p><b>The purpose of the project is to:</b></p> <ul style="list-style-type: none"><li>• Protect the area against flash floods</li><li>• Increase agricultural production</li></ul> <p><b>Specific objectives are to:</b></p> <ul style="list-style-type: none"><li>• Provide irrigation facilities for use in the dry season</li><li>• Increase surface water available for irrigation</li><li>• Reduce soil salinity</li><li>• Expand drainage facilities</li><li>• Prevent disruption of fish habitat from flooding.</li></ul> <p>The West Gopalganj Integrated Water Management Project will improve drainage and irrigation capacity, implement flood control measures, and develop an integrated water management plan in the West Gopalganj area. The area covers 62,000ha and has been divided into six polders. For each of these polders, a dedicated mix of structural and non-structural measures are proposed. The polders could be treated as individual projects within an integrated program, but the PCN addresses the whole set of projects as a single project.</p> <p>The Madaripur Beel Route (MBR), Madhumoti, Kumar, and Barasia rivers surround the project area and define the general hydrological characteristics of the area. The river Modhumoti flows along the southern and western part of the project area; the MBR and Kumar flow along the eastern and northern part. These rivers are also interconnected by a network of minor rivers and khals, and linked with low-pocket areas known as Beels.</p> <p>The project was first conceptualized in 2010. Phase I of the project is ongoing and is expected to be completed in June 2017. A feasibility study for Phase II is being conducted.</p>
<p><b>Problem/Challenges the Project Aims to Address</b></p> <p>The problems addressed include:</p> <ul style="list-style-type: none"><li>• Insecure livelihood for residents of the area</li><li>• Standing crops vulnerable to floods and saline water intrusion</li><li>• Inadequate drainage and irrigation facilities.</li></ul> <p>Land elevation in the project area is very close to sea level, causing slow drainage. As a result, most of the area remains under water throughout the monsoon season. Additionally, scarcity of irrigation water during the dry season prevents productive use of the land.</p> <p>The crops cultivated on the periphery of the depression pockets are vulnerable to early floods due to accumulated rain water and flash floods from the peripheral rivers. In certain areas, spring tide salinity intrusion through the MBR also damages standing crops prior to harvest. Finally, due to the slow drainage during the post monsoon, the farmers cannot simply plant rice crops earlier to avoid the floods.</p> <p>The present irrigation system depends on both surface and ground water using Low Lift Pumps (LLPs), Shallow Tube Wells (STWs), and Deep Tube Wells (DTWs).</p> <p>The project will contribute to the following BDP 2100 goals:</p> <ul style="list-style-type: none"><li>• Goal 1: Ensure safety against water and climate change related disasters</li><li>• Goal 2: Enhance water security and efficiency of water usage</li></ul>

### Linkages to Existing Policies and Initiatives

- Links to numerous objectives in the 7th Five Year Plan, including those set out in the following Chapters of Part 2:
  - Agriculture: 4.2, 4.3, 4.4, 4.6
  - Environment and Climate Change: 8.3, 8.5
  - Social Protection: 14.4
- Project meets objectives/fits overall strategy of the National Water Management Plan (NWMP), including all three NWMP immediate objectives:
  - 1. Rational management and wise use of Bangladesh’s water resources
  - 2. People’s quality of life improved by the equitable, safe and reliable access to water for production, health and hygiene
  - 3. Clean water in sufficient and timely quantities for multipurpose use and preservation of the aquatic and water dependent ecosystem.
- Links to numerous goals in National Water Management Plan Development Strategy including:
  - Towns and Rural Areas (Water supply, flood protection)
  - Agriculture and Water Management (Public irrigation development, river maintenance, flood control/drainage)
  - Natural Environment and Aquatic Resources (Water management for ecologically sensitive areas, supporting environment measures)
- Applies to overall objectives of Coastal Development Policy and follow-on strategy and links to Coastal Development Strategy Targets/Strategic Priorities (Safety from man-made and natural hazards, promoting economic growth, sustainable and equitable management of natural resources, improving livelihood conditions), and associated Investment Program.
- Flash flood disaster protection component is in line with UNDP Coordination of Cyclone Rehabilitation (1991)
- Continues the disaster management goals of the Comprehensive Disaster Management Program
- Links to National Adaption Programme of Action (2005) adaption needs and intervention measures
- Links to National Agricultural Extension Policy agenda, key principles, and pillars, especially the goal of “increasing production”.
- Links to objectives of the National Agriculture Policy (1999) such as increasing production and developing more efficient irrigation systems
- Links to objectives of the National Sustainable Development Strategy (2013) in areas such as water resource management, land/soil, and agriculture development. Specifically mentioned as a proposed intervention under Environment, Natural Resource, and Disaster Management sector.
- Links to objectives of the National Water Policy (1999) such as harnessing/development of all forms of surface/groundwater and is in line with proposed Government actions under Planning and Management of Water Resources, Water for Hydropower and Recreation, Water and Navigation.
- Helps to achieve the objectives of a number of the programmes outlined in the Bangladesh Climate Change Strategy and Action Plan 2009 Annex, principally under the Food Security, Social Protection and Health and Infrastructure pillars/themes.

In line with National Food Policy 2006 Objective 1: Adequate and stable supply of safe and nutritious food; and NFP Plan of Action 1.2: Use and management of water resources (increase irrigation coverage, efficient use of irrigation water, reduce dependency on ground water, reduce cost of irrigation water)

<b>Technical Assessment</b>	
Technical description of project	<p>A series of technical interventions are planned:</p> <p><b>Embankments:</b></p> <ul style="list-style-type: none"> <li>• Along existing village road: 48.5km</li> <li>• Along existing Upazilla road: 41.3km</li> <li>• Existing highway: 5.2km</li> <li>• Submergible: 9.2km</li> </ul> <p>Khal re-excavation: 200.000km River Bank Protection: 1.5km</p> <p><b>Structures:</b></p> <ul style="list-style-type: none"> <li>• Large size (9-15m opening with boat Pass): Nos 0</li> <li>• Medium size (3m opening with Boat Pass): Nos 4</li> <li>• Standard BWDB (1.5m opening): Nos 16</li> <li>• Repair of Existing Structures: Nos 2</li> </ul> <p>Required Land Acquisition: 108.00 ha</p>
Evaluation of project feasibility	<p>To prepare a comprehensive flood and drainage management project for the area, a BWDB team defined and evaluated eight potential intervention scenarios (A-1 to A-8) for their initial feasibility study, performing simulations to assess the different options. Based on this study, the team recommended proceeding with option A-8.</p> <p>From a technical point of view, the planned interventions are feasible. However, the mid- and long-term success of these projects do not depend on technical feasibility, but on socioeconomic feasibility. The feasibility study has not considered institutional arrangements or other non-structural measures, which will be a key part of the integrated water management plan. The study also neglects both the cost recovery of the interventions and the operation and maintenance costs. These factors are crucial for sustainability of the project. An updated feasibility study should address these issues as well as potential negative impact on the Madaripur Beel Route.</p>
<b>Costs (2015 Prices)</b>	
Capital costs	<p>According to the feasibility study (2010/2011), as reported in the PCN, the estimated capital costs are:</p> <p>Financial: BDT 2,716.9 million Economic: BDT 2,075.8 million</p>
O&M costs	<p>According to the feasibility study, as reported in the PCN, the estimated annual O&amp;M costs are:</p> <p>Financial: BDT 67.9 million Economic: BDT 61.26 million</p>
Evaluation of financial estimates	<p>The calculated benefit-cost ratio in the feasibility study is 2.60. However:</p> <ul style="list-style-type: none"> <li>• The CBA considers only agricultural output as quantified benefits.</li> <li>• The CBA does not explicitly compare the ‘With Project’ and ‘Without Project’ scenarios for agricultural benefits. This may result in overstatement of agricultural productivity increases attributable to the project.</li> <li>• Agricultural benefits are presented in the feasibility study as financial revenues, even though the operator and investor do not derive any direct cash flows from project operations. These benefits should be regarded as economic benefits.</li> </ul>

Potential environmental costs	Although not mentioned in the feasibility study, aquatic habitats may decrease due to extension of the flood-free area and improvement of the drainage system.
Potential socioeconomic costs	Resettlement of population is required, implying at least temporary socioeconomic costs.
<b>Benefits</b>	
Potential environmental benefits	The irrigation works will reduce the risk of accumulation of harmful ingredients like arsenic and iron on topsoil due to irrigation from subsurface water sources. The project will also mitigate the increasing salinity in the peripheral rivers, including Madaripur Beel. These potential benefits have not been quantified.
Potential socioeconomic benefits	The quantified socioeconomic benefits relate to agricultural output. Crop production will increase with a value of BDT556 million per year. Other potential benefits include: <ul style="list-style-type: none"> <li>• Reduction of irrigation cost by 30 to 40 percent by more use of surface water for irrigation</li> <li>• Improvement of fisheries via fish migration routes and breeding grounds</li> <li>• Improvement of roads, leading to lower transport costs and better market accessibility.</li> </ul> An updated feasibility study should include quantified estimates of these impacts.
<b>Linkages to Other Projects</b>	
<p><b>The project is related to the following ongoing projects:</b></p> <p><b>BWDB Projects:</b></p> <ul style="list-style-type: none"> <li>• Alfadanga Boalmari Scheme</li> <li>• Bhutiar Beel Drainage Scheme</li> <li>• Fatiker Khal System</li> <li>• Madaripur Beel Route System</li> <li>• Purulia Charbhatpara Scheme</li> <li>• Tarail Pachuria Scheme Polders 2 and 4</li> <li>• West Gopalganj Scheme Polders 2a and 4</li> </ul> <p><b>LGED Projects:</b></p> <ul style="list-style-type: none"> <li>• Ramkrishnapur DR Subproject</li> <li>• Kaliadaha Subproject</li> <li>• KhodarKhal Subproject</li> <li>• Gobra FCD Subproject</li> <li>• Charboira-Chargobra- Bhatia K.</li> </ul> <p><b>Other Proposed Projects:</b></p> <ul style="list-style-type: none"> <li>• Ganges Barrage</li> <li>• Development of Chandana-Barasia River Basin System</li> </ul>	

Interlinkages between these projects must be studied in to more depth to mitigate or compensate for potential adverse effects.

Thematic links include any projects aimed at flood protection or improving drainage and irrigation.

**ADM Principles**

**Adaptive Delta Management:**

- Anticipates by using adaptation or development pathways (subsequent decision pathways) instead of final images;
- Ensures adequate sufficient measures by connecting short-term decisions to long-term delta needs such as flood protection and water availability;
- Values flexibility so it can address uncertainties to prevent over or underinvestment and invest in real needs; and
- Promotes concerted action: synchronize public and private investments to a common agenda.

Changes in several important drivers would influence the design and the planning of this project. These include climate change, economic development, demographic development, and technological innovation. Therefore, the project design must consider:

- The probable scenarios related to these important drivers
- Upstream and downstream effects
- Institutional context
- Integration with related projects.

However, considering the actual challenges in relation to water quality and water quantity these interventions will strongly improve livelihood and alleviate poverty if managed properly. The project design should be reconsidered taking in to consideration the ADM principles to ensure that there will be no under or over investment and to optimize the effectiveness of the project in relation ot other developments that have to take place in the region.

**Linkages to Climate Change Adaptation**

This project is vulnerable to two direct effects of climate change: (1) rising sea levels, and (2) variations in the patterns and intensity of rainfall. Both have an impact on siltation, flooding patterns, and drainage capacity. Changes in rainfall patterns also affect irrigation requirements.

Therefore, planned interventions must be designed both technically and institutionally to adapt to these effects of climate change.

This project should be considered for inclusion in the Bangladesh Climate Change Strategy and Action Plan 2009

**Private Sector Financing Potential**

This project is not suitable for private financing because there are no revenue streams attached to it.

**Policy and Institutional Reform**

Main implementing agencies	Bangladesh Water Development Board (BWDB)
Required coordination mechanisms	<p>The project team must coordination with relevant institutions including:</p> <ul style="list-style-type: none"> <li>• WARPO</li> <li>• LGED</li> <li>• DoE</li> <li>• District administration</li> <li>• Local bodies</li> <li>• WMO</li> <li>• DoAE.</li> </ul> <p>These institutions represent the existing institutional framework within which the project would be implemented and managed.</p>



Existing policies/institutions to facilitate implementation	<ul style="list-style-type: none"> <li>• National Water Resources Council may assist with implementation</li> <li>• MoWR Task Force established to develop new institutional framework for WRM</li> <li>• The Guidelines for Integrated Planning for Sustainable Water Resources Management set out the institutions and procedures for planning, O&amp;M, participatory M&amp;E, and training for FCD projects</li> <li>• The general thrust of all recommended actions under the Bangladesh Climate Fiscal Framework 2014 is to facilitate access to climate finance, and to ensure that climate change finance is deployed in the most effective way. So, to the extent that this project seeks to address the impact of climate change, and is of sufficiently high priority, this policy should help to ensure it gets funded. Appendix 2 classifies coastal protection projects as being “strongly relevant” to climate change mitigation/adaption (highest ranking)</li> <li>• Bangladesh Climate Change Resilience Fund (BCCRF), Strategic Program for Climate Resilience each may assist with implementation</li> <li>• Bangladesh Climate Change Strategy and Action Plan 2009 includes projects like this within its action plan, and accordingly facilitates the project’s implementation (refer to the Annex)</li> <li>• National Environment Committee, National Steering Committee on Climate Change, Inter-Ministerial Disaster Management Committee, National Disaster Management Advisory Committee each may assist with implementation.</li> </ul>
Desirable capacity building initiatives	The feasibility study does not mention capacity building. However, parts of the project require substantial resources, such as the construction of roads and embankments. We therefore recommend assessing the need for additional capacity within BWDB or other lead agencies before proceeding.
Required policy/regulatory reforms	<ul style="list-style-type: none"> <li>• Implementation of the recommendations in the November 2014 Final Report on Institutional Improvement of BWDB</li> <li>• Bangladesh Climate Fiscal Framework 2014 recommends merging the Bangladesh Climate Change Resilience Fund and Climate Change Trust Fund to prevent duplication. Also, generally recommends stronger and more integrated climate change planning</li> <li>• Bangladesh Climate Fiscal Framework 2014 recommends implementing a climate fiscal cell in the FD of MoF</li> </ul>
Overall Project Assessment	
Priority	<p>Project priority is high due to the urgent need to protect livelihoods and alleviate poverty in the area.</p> <ul style="list-style-type: none"> <li>• Direct or indirect benefits offset implementation costs in all delta scenarios: The NPV of this project is estimated to be BDT 3,336 million</li> <li>• Implementing agencies have the knowledge base to implement these types of projects locally (with some limited guidance and support if needed): BWDB has extensive experience with these types of projects</li> </ul>

	<p>However, if many projects are being implemented at the same time, it becomes questionable if the BWDB has sufficient personnel to manage all projects. For this project, it is extremely important that there is efficient coordination between the different organizations involved. A strong local organization should be set up to ensure effective implementation and operation and maintenance. Without a strong local organization, the sustainability of this project will be at risk.</p> <ul style="list-style-type: none"> <li>Implementing the project will reduce vulnerability to future uncertainties such as sea level rise and flooding: As indicated above, the region already has to cope with insecure livelihood for residents of the area, with vulnerability of standing crops to floods and saline water intrusion and with inadequate drainage and irrigation facilities. Interventions are proposed to reduce these existing risks. It is not indicated in the PCN whether these design specifics also consider climate change effects in relation to sea level rise or changes in precipitation and discharge patterns. These should be considered in the further planning and design of this proposed project. Other ADM principles have not been taken in to consideration and should be included in further planning as well. Including these principles will further the positive effects and sustainability of the project.</li> </ul> <p>The project has no hard trade-offs with other policy objectives. In view of the above, with the necessary changes in the project design, this initiative can be classified as a short term project.</p>
State of readiness	<p>In 2012, a feasibility study for the “West Gopalganj Integrated Water Management Project” was conducted by Design Planning Management Consultants Ltd., in association with Kranti Associates Ltd. and CEGIS. The study included an Environmental Impact Analysis and a Social Impact Analysis.</p> <p>Technically, this project is ready for construction. However, the institutional and financial framework required for sustainable implementation is weak.</p>
Additional information or work required	<p><b>More work is needed to:</b></p> <ul style="list-style-type: none"> <li>Clarify the allocation of long-term responsibilities</li> <li>Ensure responsible parties have the human and financial capacity for sustainable operation and maintenance</li> <li>Align technical design and institutional measures with ADM principles.</li> </ul>
Results framework and M&E arrangements	<p>The PCN provides little information concerning M&amp;E.</p> <p>The project’s log frame presents the goals and purpose of the project, but these are very general and should be developed and refined.</p> <p>Building blocks of a monitoring plan have been provided but should be strengthened, especially regarding asset management and maintenance.</p> <p>Criteria on input and output are straightforward, but may need adjustments for ADM-related design changes.</p>

## CZ 1.11 Improved Drainage in the Bhabadha Area

Brief Project Description	
Project Objectives	<p><b>Main objectives of the project are:</b></p> <ul style="list-style-type: none"> <li>To reduce drainage congestion and floods by several river management interventions</li> <li>To rehabilitate the Bhabadha regulator to increase drainage capacity</li> <li>To involve the local community in the project to make it more effective and beneficial for them.</li> </ul> <p><b>Specifically, the project will:</b></p> <ul style="list-style-type: none"> <li>Construct an embankment along the river</li> <li>Install or repair regulators at the outfalls of drainage channels</li> <li>Excavate drainage channels to clear blockage</li> <li>Allow natural tidal movement into embanked low-lying beels, using a Tidal River Management approach for sediment management and increased tidal prism</li> <li>Restore the Hamkura river.</li> </ul> <p><b>The project contributes to three BDP 2100 goals:</b></p> <ul style="list-style-type: none"> <li>Goal 1: Ensure safety against water and climate change related disasters;</li> <li>Goal 2: Enhance water security and efficiency of water usages;</li> <li>Goal 6: Achieve optimal use of land and water.</li> </ul>
Background	<p>The southwest region of Bangladesh is characterized by numerous morphologically active tidal rivers. These rivers provide the main drainage network for coastal polders and low-lying beels.</p> <p>Polder development has restricted tidal flows in the districts of Jessore and Khulna. Thus, polder areas have been suffering from waterlogging and drainage congestion for decades. This waterlogging has caused large-scale environmental, social, and economic degradation.</p> <p>To solve this longstanding waterlogging problem, the Bangladesh Water Development Board implemented the Khulna-Jessore Drainage Rehabilitation Project (KJDRP) from 1994 to 2002. During the KJDRP, local stakeholders introduced the concept of Tidal River Management (TRM). TRM involves the temporary designation and sedimentation of beels within a polder to allow for increased tidal flows in the area. Thus, the project substantially removed the congestion, resulting in more agricultural production and socio-economic development.</p> <p>During the dry season of 2005, the landowners of the Beel Kedaria Tidal Basin closed the Bhabodaha regulator, blocking tidal flows to the beels. They did this to protect crops that they had cultivated on a portion of land inside the tidal basin. Thus, there was no tidal movement into the Beel Kedaria Tidal Basin, causing drainage congestion in the surrounding area.</p>
<b>Problem/Challenges the Project Aims to Address</b>	
<p>The immediate problems are severe waterlogging and a substantial loss of agricultural production in the Bhabodaha area.</p> <p>The challenge of making project outcomes sustainable is less urgent, but equally important. The destruction of the Bhabodaha regulator was intentional, triggered by social and economic conditions</p>	

resulting from the technical and environmental situation. As such, an effective solution must address these social and economic conditions in addition to technical and environmental aspects.

#### Linkages to Existing Policies and Initiatives

- Links to numerous objectives in the 7th Five Year Plan, including those set out in the following Chapters of Part 2:
  - Agriculture: 4.2, 4.3, 4.6
  - Environment and Climate Change: 8.5, 8.6
  - Housing and Community Amenities: 9.6
- Project fits overall strategy of the National Water Management Plan (NWMP) and links to all three NWMP immediate objectives:
  - Rational management and wise use of Bangladesh’s water resources
  - People’s quality of life improved by the equitable, safe and reliable access to water for production, health and hygiene
  - Clean water in sufficient and timely quantities for multipurpose use and preservation of the aquatic and water dependent ecosystem
- Links to numerous goals in National Water Management Plan Development Strategy, including:
  - Main River Development (river management for navigation and erosion control)
  - Towns and Rural Areas (flood protection)
  - Agriculture and Water Management (public irrigation development, river maintenance, flood control/drainage)
  - Natural Environment and Aquatic Resources (water management for ecologically sensitive areas, supporting environment measures)
- Applies to overall objectives of Coastal Development Policy and follow-on Strategy Targets/Strategic Priorities (ensuring fresh and safe water availability, safety from man-made and natural hazards, optimizing use of coastal lands, promoting economic growth, sustainable and equitable management of natural resources, environment conservation), and associated Investment Program
- Links to National Adaption Programme of Action (2005) adaption needs and intervention measures
- Links to objectives of the National Sustainable Development Strategy in areas such as disaster management and land/soil
- Links to objectives of the National Water Policy (1999) such as harnessing/development of all forms of surface/groundwater as well as being in line with proposed Government actions under Planning and Management of Water Resources, Stakeholder Participation
- Helps to achieve the objectives of a number of the programmes outlined in the Bangladesh Climate Change Strategy and Action Plan 2009 Annex, principally under the Food Security, Social Protection and Health and Infrastructure pillars/themes
- Links to National Food Policy 2006 Plan of Action 2.1: Agricultural disaster management (enhance disaster preparedness).

#### Technical Assessment

Technical description of project	<p>Project plans follow standard procedure for relieving drainage congestion. Specifically, the team will:</p> <ul style="list-style-type: none"> <li>• Construct an embankment along the river</li> <li>• Install or repair regulators at the outfalls of drainage channels</li> <li>• Excavate drainage channels to clear blockage</li> </ul>
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	<ul style="list-style-type: none"> <li>Allow natural tidal movement into embanked low-lying beels, using a Tidal River Management approach for sediment management and increased tidal prism</li> <li>Restore the Hamkura river.</li> </ul>
Evaluation of project feasibility	Technically, this project is feasible. Long-term sustainability will depend on the institutional and financial capacity of the Bangladesh Water Development Board (BWDB) to operate and maintain the installed facilities.
<b>Costs (2015 prices)</b>	
Capital costs	According to the feasibility study (2009/2010), as reported in the PCN, the estimated capital costs are: Financial: 1527.7million BDT Economic: 1304.4 million BDT
O&M costs	According to the feasibility study, as reported in the PCN, the estimated annual O&M costs are: Financial: 41.1 million BDT Economic: 32.7 million BDT
Evaluation of financial estimates	<p>The PCN calculates the economic benefit-cost ratio at 2.45, based on the original feasibility study. In assessing this value, the following issues should be kept in mind:</p> <ul style="list-style-type: none"> <li>The CBA does not clearly establish the ‘without project’ scenario for agricultural benefits. As a result, the study may have overstated the agricultural productivity increases attributable to the project</li> <li>Some benefits are presented in the CBA report as financial revenues, even though the operator/investor does not derive any direct cash flows from project operations. These benefits should be regarded as economic benefits</li> <li>The CBA does not explicitly account for indirect costs resulting from project activities, such as partial loss of production of the beel for 5-6 seasons.</li> </ul> <p>Thus, the economic benefit-cost ratio may be rather overstated.</p>
Potential environmental costs	The feasibility study and PCN refer to negative environmental impacts of the project, but it is not clear what these impacts are. It seems that the project would have mostly positive environmental impacts, such as less waterlogging, better drainage, and less stagnation of pollution (not quantified).
Potential socio-economic costs	No cost has been included for TRM land requisition e.g., crop compensation to land owners. This has previously given rise to social conflicts resulting in non-fulfilment of TRM targets. The proposed project should include cost of crop compensation for affected land owners/users.
<b>Benefits</b>	
Potential environmental benefits	Less stagnation of pollution (not quantified).
Potential socio-economic benefits	<p>The project aims to reclaim a net area of 61,380ha of waterlogged land for agriculture.</p> <p>This will lead to an estimated increase in agricultural output of 15,190 million BDT (2015 prices), triggering employment and alleviating poverty.</p>

<b>Linkages to Other Projects</b>	
<ul style="list-style-type: none"> <li>• The project is integrated with the CZ 1.5 Tidal River Management project.</li> <li>• The project has linkages with Khulna Jessore Drainage Rehabilitation project (KJDPR), S-W rehabilitation Project, Chenchuri Beel Project, Blue Gold, Bhutiar beel Project and the upcoming South West Area Integrated Development Project.</li> <li>• Other BDP2100 project proposals in the coastal zone area also feature drainage or irrigation intended to stimulate agricultural output. These projects should be coordinated within a broader programmatic approach.</li> <li>• Other related projects include CDSP 5, CEIP I and II, Blue Gold Program, and the Asian Development Bank’s coastal cities project.</li> </ul>	
<b>ADM Principles</b>	
<p>The project as planned is a structural measure that in itself does not incorporate “subsequent decision pathways.” However, flood protection and water availability are core elements of the intervention, making it inherently connected to long-term delta needs.</p> <p>Furthermore, as part of a larger national program on tidal river management, the project fits well as one step among diverging development pathways. As part of such a program, this and other structural interventions can be made more adaptive by using techniques and materials that allow for flexibility of scale and dimension.</p> <p>The project is presented as a public investment project, though there may be opportunities for private participation in the operation and maintenance phase.</p>	
<b>Linkages to Climate Change Adaptation</b>	
<p>Several of the project’s key challenges are exacerbated by climate change. Altered rainfall patterns will increase risks of waterlogging and drought, and rising sea levels strongly influence the erosion and sedimentation processes.</p> <p>As such, this project should be considered for inclusion in the Bangladesh Climate Change Strategy and Action Plan 2009, which promotes projects related to food security, disaster management, maintenance of existing assets.</p>	
<b>Private Sector Financing Potential</b>	
<p>This project is not suitable for private financing. There are no revenue streams attached to it and also there are not many precedents for PPPs in similar projects.</p>	
<b>Policy and Institutional Reform</b>	
Main implementing agencies	Bangladesh Water Development Board.
Required coordination mechanisms	Coordination required with WMOs, WMGs, WMF, LGIs DAE, DOF, LGED etc.
Existing policies/institutions to facilitate implementation	<ul style="list-style-type: none"> <li>• Chapter 4.6 (Part 2) of the Seventh FYP notes that (i) a systematic river dredging and riverbank protection strategy will be followed and (ii) the coastal zone will be treated as a special zone</li> <li>• According to Chapter 4.6 of the Seventh FYP, World Bank, ADB, JICA (and other similar institutions), private sector parties may assist with implementation</li> <li>• The Ministry of Water Resources Task Force established to develop new institutional framework for WRM may assist with implementation</li> </ul>



		<ul style="list-style-type: none"> <li>• The Guidelines for Integrated Planning for Sustainable Water Resources Management set out the institutions and procedures for planning, O&amp;M, participatory M&amp;E, and training for FCD projects</li> <li>• The general thrust of all recommended actions under the Bangladesh Climate Fiscal Framework 2014 is to facilitate access to climate finance, and to ensure that climate change finance is deployed in the most effective way. So, to the extent that this project seeks to address the impact of climate change, and is of sufficiently high priority, this policy should help to ensure it gets funded. Appendix 2 classifies coastal protection projects as strongly relevant to CC mitigation/adaption (highest ranking)</li> <li>• The Bangladesh Climate Change Resilience Fund (BCCRF), Strategic Program for Climate Resilience may assist with implementation</li> <li>• The Bangladesh Climate Change Strategy and Action Plan 2009 includes projects like this within its action plan, and accordingly facilitates the project's implementation (refer to the Annex)</li> <li>• National Environment Committee, National Steering Committee on Climate Change, Inter-Ministerial Disaster Management Committee, National Disaster Management Advisory Committee may each assist with implementation</li> </ul>
Desirable initiatives	capacity building	<p>The PCN and feasibility study both lack an in depth capacity assessment of the BWDB as the implementing agency. This is a complex project, requiring social as well as technical organization and coordination.</p> <p>We recommend an assessment of BWDB capacity to determine what level of support might be needed.</p>
Required reforms	policy/regulatory	<ul style="list-style-type: none"> <li>• The November 2014 Final Report on Institutional Improvement of BWDB made recommendations that are not yet implemented.</li> <li>• Bangladesh Climate Fiscal Framework 2014 recommends merging the Bangladesh Climate Change Resilience Fund and Bangladesh Climate Change Trust Fund to prevent duplication. Also generally recommends stronger and more integrated climate change planning</li> <li>• Bangladesh Climate Fiscal Framework 2014 recommends implementing a climate fiscal cell in the Finance Division of the Ministry of Finance</li> </ul>
<b>Overall Project Assessment</b>		
Priority		<p>This is a high priority project, but requires an updated feasibility study before proceeding.</p> <ul style="list-style-type: none"> <li>• Direct or indirect benefits offset implementation costs in all delta scenarios: The NPV of this project is estimated to be BDT 1,555 million</li> <li>• Implementing agencies have the knowledge base to implement these types of projects locally (with some limited guidance and support if needed): BWDB has extensive experience with these types of projects. However, it is questionable whether BWDB has sufficient personnel to manage all projects. The project requires extensive coordination between many different organizations that are to be involved. A strong local organization should be set up to ensure effective implementation, especially operation and maintenance.</li> </ul>



	<ul style="list-style-type: none"> <li>• Implementing the project will reduce vulnerability to future uncertainties such as sea level rise and flooding: Waterlogging in the Bhabadha area has caused large-scale environmental, social, and economic degradation. The project aims to improve drainage. Interventions are proposed to answer to reduce existing risks. It is not indicated in the PCN whether these design specifics also consider climate change effects in relation to sea level rise or changes in precipitation and discharge patterns. These should be considered in the further planning and design of this proposed project. Other ADM principles have not been taken in to consideration and should be included in further planning as well. Including these principles will further the positive effects and sustainability of the project.</li> <li>• The project has no hard trade-offs with other policy objectives.</li> </ul> <p>In view of the above, with the necessary changes in the project design, this initiative can be classified as a short term project.</p>
State of readiness	This project proposal is based on a feasibility study published in 2010. This feasibility study must be updated before proceeding.
Additional information or work required	<ul style="list-style-type: none"> <li>• Update the feasibility study: <ul style="list-style-type: none"> <li>– Include an Environmental Impact Analysis</li> <li>– Include a Social Impact Analysis</li> <li>– Account for other non-technical aspects of Tidal River Management interventions</li> <li>– Revisit and strengthen the Cost-Benefit Analysis</li> <li>– Evaluate the costs of resettlement and crop compensation paid to land owners and users</li> <li>– Assess options for the disbursement arrangements of compensation.</li> </ul> </li> <li>• Integrate the project with the National Tidal River Management (TRM) program.</li> <li>• Assess the need for additional restoration of channels linking to surrounding beels and tidal basins.</li> <li>• Consider other projects that influence or will be influenced by improving the drainage of the Bhabodaha Area. This includes projects under implementation by other agencies (BWDB, LGED, BADC, etc);</li> <li>• Consider renaming the project, “Addressing waterlogging and flooding in the Bhabodaha area through improved drainage and TRM.”</li> </ul>
Results framework and M&E arrangements	<p>There is a log frame in place from the Batch 2 PCNs indicating the goals, the purpose, the outputs, and the required inputs of the project. This has been detailed to some extent, but criteria could be made more concrete and measurable. An effective results framework should also:</p> <ul style="list-style-type: none"> <li>• Establish institutional arrangements for monitoring and evaluation (M&amp;E)</li> <li>• Establish time horizons to monitor whether activities have been initiated and to evaluate progress periodically</li> <li>• Clarify how recommendations coming from M&amp;E will lead to redefining objectives or identifying additional interventions.</li> </ul>

## CZ 1.26 Water Management Infrastructure in Bhola District, Location 4

<b>Brief Project Description</b>
<p>The purpose of the project is to safeguard location 4 on the East coast of Bhola near Dalautkhan from impacts of climate change. The project will protect the area from bank-shifting and erosion to help safeguard local livelihoods. The project's early warning system will contribute to poverty reduction by reducing the extent of loss of property.</p> <p><b>Overall objective of the project is:</b></p> <ul style="list-style-type: none"><li>• Protect the Location 4 area from flooding, storm surges, salinity, erosion and loss of land due to sea level rise.</li><li>• Develop an Erosion Early Warning System for the Bhola district.</li></ul> <p><b>The project has three specific components:</b></p> <ul style="list-style-type: none"><li>• River bank protection</li><li>• Embankment construction</li><li>• Design and implementation of an Early Erosion Warning System (EEWS) during the construction and O&amp;M phases of the project.</li></ul>
<b>Problem/Challenges the Project Aims to Address</b>
<p><b>Main problems to be addressed are:</b></p> <ul style="list-style-type: none"><li>• Substantial erosion in the northern and eastern parts of Bhola island</li><li>• Limited erosion and accretion in the west along the Tetulia river</li><li>• Flooding due to embankment breaching</li><li>• Geological subsidence and sea level rise.</li></ul> <p>Bhola is an island (90km long and 10-25km wide) in the delta of Bangladesh with major environmental and poverty problems. The island is situated in one of the poorer parts of the country and is characterized by subsistence agriculture and fishing. It is surrounded by major branches of the Lower Meghna, which carries the combined flow of the Ganges, Brahmaputra and Meghna Rivers. The area has become overpopulated due to the large numbers of settlers attracted by its fertile soil.</p> <p>Bhola is also highly vulnerable to river bank erosion and flooding. The river morphology along the Island's east coast in particular has reached a magnitude requiring major civil works to "reinforce embankments." However, reinforcing embankments is only a temporary solution. A longer-term approach to river bank protection is now of the highest priority. Without proper river bank protection, investments in embankment construction or other water management infrastructure will be wasted.</p> <p>To mitigate these problems, a multi-criteria analysis was carried out to select the highest-priority location for an intervention that could be undertaken within the available budget. Based on this analysis, two target areas were selected: Location 1 in the Northeast of Bhola island and Location 4 on the East coast of Bhola near Dalautkhan.</p> <p>This project aims to safeguard Location 4 from future flooding and to protect it from erosions. An intervention at Location 1 will be financed by ORIO and GoB.</p> <p>The project will directly contribute to BDP 2100 Goal 1: ensuring safety from floods and climate change related risks.</p>

### Linkages to Existing Policies and Initiatives

- Links to numerous objectives in the 7th Five Year Plan, including those set out in the following Chapters of Part 2:
  - Agriculture: 4.6
  - Environment and Climate Change: 8.5, 8.6
  - Social Protection: 14.4
- Project fits overall strategy of the National Water Management Plan (NWMP) and links to all three NWMP immediate objectives:
  - 1. Rational management and wise use of Bangladesh’s water resources
  - 2. People’s quality of life improved by the equitable, safe and reliable access to water for production, health and hygiene
  - 3. Clean water in sufficient and timely quantities for multipurpose use and preservation of the aquatic and water dependent ecosystem.
- Links to numerous goals in National Water Management Plan Development Strategy, including:
  - Towns and Rural Areas (water supply, flood protection)
  - Agriculture and Water Management (public irrigation development, river maintenance, flood control/drainage)
  - Natural Environment and Aquatic Resources (water management for ecologically sensitive areas, supporting environment measures)
- Applies to overall objectives of Coastal Development Policy and follow-on Strategy Targets/Strategic Priorities (ensuring fresh and safe water availability, safety from man-made and natural hazards, sustainable and equitable management of natural resources, environment conservation), and associated Investment Program.
- Continues the disaster management goals of the Comprehensive Disaster Management Program
- Links to National Adaption Programme of Action (2005) adaption needs and intervention measures
- Links to objectives of the National Sustainable Development Strategy (2013) in areas such as water resource management, disaster management, and land/soil.
- Links to objectives of the National Water Policy (1999) such as harnessing/development of all forms of surface/groundwater as well as being in line with proposed Government actions under Planning and Management of Water Resources.
- Helps to achieve the objectives of a number of the programmes outlined in the Bangladesh Climate Change Strategy and Action Plan 2009 Annex, principally under the Food Security, Social Protection and Health, Comprehensive Disaster Management, and Infrastructure pillars/themes.
- Links to National Food Policy 2006 Plan of Action 2.1: Agricultural disaster management (enhance disaster preparedness)

### Technical Assessment

<p>Technical description of project</p>	<p>The project will cover the preparation, procurement, implementation, and operation and maintenance of structural and nonstructural works including embankments, monitoring, information analysis, etc.</p> <p>The Erosion Early Warning System will be used for monitoring purposes during construction of river bank protection components. For O&amp;M, the EEWS will be used for the whole island. In a later stage, the EEWS can be expanded for use throughout Bangladesh. The EEWS will be embedded within the BWDB organization and can also be used in other locations.</p>
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Evaluation of project feasibility	From a technical point of view, this project is feasible. However, socio-economic and cultural aspects have not been considered in the PCN. These aspects must be assessed before proceeding, as the intervention will likely impose involuntary costs on some of the local population.
<b>Costs</b>	
Capital costs	The PCN is based on the original, recent ORIO feasibility study (2014). Financial: 13,766 million BDT (2014 prices) Economic: 11,092 million BDT (2014 prices)
O&M costs	Financial: Year 5 - 29: between 245 and 300 million BDT per year Economic: Year 5 - 29: between 256 and 316 million BDT per year
Evaluation of financial estimates	The calculated economic benefit-cost ratio in the feasibility study is 1.05. The CBA in the feasibility study is generally of good quality. However, the PCN observes that the agricultural benefits may be overestimated, as these have been included starting from year 1 and for the whole area. This may not be the case in practice.
Potential environmental costs	None
Potential socio-economic costs	The project may require land acquisition and/or resettlement of people. These costs are not considered in the feasibility study.
<b>Benefits</b>	
Potential environmental benefits	<ul style="list-style-type: none"> <li>Prevention of predicted erosion of coastal land for 25 years from project completion.</li> </ul>
Potential socio-economic benefits	<ul style="list-style-type: none"> <li>Prevention of annually recurring flood damage in the project area for a period of 25 years</li> <li>Accretion of new land, mainly to the south of Bhola (this may be accelerated by construction of cross dams, offering new opportunities for subsistence farming).</li> <li>Incremental agricultural production associated with the expected shift in cropping pattern from the current (without project) situation to the future (with project) situation as farmers diversify into more high value crops and/or undertake more intensive cultivation as a result of reduced erosion/flood risk.</li> </ul> <p>These above mentioned benefits have been quantified and monetized in the feasibility study.</p> <p>Furthermore, the project will contribute to:</p> <ul style="list-style-type: none"> <li>Improved livelihood through increased investment in housing, schools, roads, water supply and sanitation, etc.</li> <li>Improved employment opportunities in agriculture, processing, trading, and transportation of products</li> <li>Fewer erosion victims leading to fewer landless households</li> </ul>
<b>Linkages to Other Projects</b>	
<ul style="list-style-type: none"> <li>Part of a larger project to develop water management infrastructure in six vulnerable locations. Five locations are already being undertaken as individual projects with Government funding.</li> <li>Coastal Embankment Improvement Project, Urirchar-Noakhali Cross Dam Project, CDSP.</li> </ul>	

<ul style="list-style-type: none"> <li>• The EEWS will be embedded within the BWDB organization and can also be used in other locations.</li> <li>• Integrated Land Reclamation Project of Hatiya-Dhamar Char-Nijhum Dwip</li> </ul>	
<b>ADM Principles</b>	
<p>This project adheres to ADM principles by its clear focus on long-term flood protection, and its contribution to concerted action through the EEWS.</p> <p>However, the PCN does not mention alternative or subsequent decision pathways, or provide an evaluation in relation to different development scenarios. Climate Change, economic development, demographic development and technological innovation are all important drivers that could influence the design and the planning of this project.</p> <p>The Early Warning Erosion System included in the program could be used to develop different erosion scenarios in the future. These scenarios can be used to identify flexible interventions to be included when needed.</p>	
<b>Linkages to Climate Change Adaptation</b>	
<p>This project can be designed in a climate-robust way by investing in flood protection, flood proofing, and flood preparedness.</p>	
<b>Private Sector Financing Potential</b>	
<p>Like other similar projects in the coastal zone, the principal components of the project are structural interventions like constructing river bank protection and flood embankment, which are not suitable for PPPs.</p> <p>However, the project is expected to have significant agricultural benefits, as it will enable farmers to diversify into more high value crops and/or undertake more intensive cultivation as a result of reduced erosion/flood risk. This could mean that the government could look at developing for large scale irrigation projects (e.g. the West Delta Irrigation Project in Egypt <sup>183</sup>) in the area. The irrigation PPP could ensure that the private sector is fully vested in adequate operations and maintenance of the embankment once constructed.</p>	
<b>Policy and Institutional Reform</b>	
Main implementing agencies	Bangladesh Water Development Board (BWDB)
Required coordination mechanisms	Coordination necessary with Ministry of Environment and Forests (MoEF), Department of Environment (DOE), Non-Governmental Organizations (DORP, COAST, BRAC, ASA, PROSHIKA, etc.), and Embankment maintenance groups.
Existing policies/institutions to facilitate implementation	<ul style="list-style-type: none"> <li>• Chapter 4.6 (Part 2) of the Seventh FYP notes that (i) a systematic river dredging and riverbank protection strategy will be followed and (ii) the coastal zone will be treated as a special zone.</li> <li>• Chapter 4.1 (Part 1) of the Seventh FYP recommends spending an additional 1 percent of GDP on rural infrastructure, including for flood control</li> <li>• According to Chapter 4.6 of the Seventh FYP, World Bank, ADB, JICA (and other similar institutions), private sector</li> <li>• MoWR Task Force established to develop new institutional framework for WRM</li> </ul>

183 <http://ppp.worldbank.org/public-private-partnership/ppp-sector/water-sanitation/ppps-irrigation#examples>

	<ul style="list-style-type: none"> <li>• The Guidelines for Integrated Planning for Sustainable Water Resources Management set out the institutions and procedures for planning, O&amp;M, participatory M&amp;E, and training for FCD projects</li> <li>• The general thrust of all recommended actions under the Bangladesh Climate Fiscal Framework 2014 is to facilitate access to climate finance, and to ensure that climate change finance is deployed in the most effective way. This policy should help to ensure the project gets funded, especially considering that Appendix 2 classifies coastal protection projects as strongly relevant to CC mitigation/adaption (highest ranking)</li> <li>• Bangladesh Climate Change Resilience Fund (BCCRF) and Strategic Program for Climate Resilience may both assist with implementation</li> <li>• Bangladesh Climate Change Strategy and Action Plan 2009 includes projects like this within its action plan, and accordingly facilitates the project's implementation (refer to the Annex)</li> <li>• National Environment Committee, National Steering Committee on Climate Change, Inter-Ministerial Disaster Management Committee, National Disaster Management Advisory Committee may each assist with implementation.</li> </ul>
Desirable capacity building initiatives	BWDB is a resourceful agency regarding flood control and drainage improvement activities, but it needs up-to-date training for staff in the field of participatory water management activities.
Required policy/regulatory reforms	<ul style="list-style-type: none"> <li>• Implementation of the recommendations in the November 2014 Final Report on Institutional Improvement of BWDB</li> <li>• Bangladesh Climate Fiscal Framework 2014 recommends merging the Bangladesh Climate Change Resilience Fund and Climate Change Trust Fund to prevent duplication. It also generally recommends stronger and more integrated climate change planning</li> <li>• Bangladesh Climate Fiscal Framework 2014 recommends implementing a climate fiscal cell in the FD of MoF</li> </ul>
<b>Overall Project Assessment</b>	
Priority	<p>Project priority is high. The project is included in the list of short term projects of the Delta Plan.</p> <ul style="list-style-type: none"> <li>• Direct or indirect benefits offset implementation costs in all delta scenarios: The NPV of this project is estimated to be BDT 556 million</li> <li>• Implementing agencies have the knowledge base to implement these types of projects locally (with some limited guidance and support if needed): BWDB has extensive experience with the construction of waterworks of this type. The project requires intensive cooperation with other stakeholders. The maintenance of the embankment is crucial to ensure long term sustainability.</li> <li>• Implementing the project will reduce vulnerability to future uncertainties such as sea level rise and flooding: Flooding due to breaching of dikes is a serious threat, and implementation of this project will reduce the risk of flooding now and in the future. In the PCN, there is no mention of a certain flood risk level that needs to be achieved with the project, nor how climate change and possible sea level rise will influence the return period of flooding. This should be</li> </ul>



	<ul style="list-style-type: none"> <li>reconsidered in the project design to ensure that there is sufficient flexibility in relation to uncertainties of climate change and sea level rise.</li> <li>The project has no hard trade-offs with other policy objectives.</li> </ul>
State of readiness	The DPP is currently under process for approval. A feasibility study was published in 2015, and there is an Environmental Impact Analysis as well as a Social Impact Analysis, but these need to be updated. A full Cost-Benefit Analysis accounting for socio-economic impacts still has to be prepared.
Additional information or work required	<ul style="list-style-type: none"> <li>Integrate the project into a larger program covering the whole Bhola District</li> <li>Merge the intervention at Location 2 together with this project (Location 4)</li> <li>Add a Spatial Planning component</li> </ul>
Results framework and M&E arrangements	The PCN provides little information concerning M&E. The BDP2100 Batch 3 log frame presents the Goals and Purpose of the project, but these are very general and should be developed and refined. Criteria on input and output are straightforward, but may need adjustments for ADM-related design changes. The PCN specifies no criteria for quality and time, and lacks a monitoring plan.

### I.6.3 Urban Areas

#### UA 1.1 Protection of Rivers System around Dhaka City with Their Ecological Restoration

<p><b>Brief Project Description</b></p> <p>This project adds to the restoration of the ecosystems of four rivers in Dhaka. Over recent decades, population growth in Dhaka has led to unplanned urbanization, encroachment of floodplains, disposal of solid waste in the rivers, and discharge of untreated industrial and domestic effluents. Augmenting the discharge of these rivers during the dry season will help rehabilitate these rivers.</p> <p>Several options have been studied to connect the river system to neighboring rivers. One option is presented as the preferred alternative and described with technical details. Although relations with all sorts of programs are mentioned, this project only describes an intervention that connects this river system with the Jamuna river. Coordination with the initiative “Ecological Restoration of Four Rivers (Buriganga, Turag, Balu (plus Tongi Khala and Shitalakhya) Around Dhaka City” is crucial. An Ecological Restoration Preliminary Development Project Proforma/Proposal (PDPP) for aided projects was developed in October 2015.</p> <p>This project is part of an umbrella project under the Department of Environment (lead agency). The main objectives of this project are to:</p> <ul style="list-style-type: none"> <li>Revive the surrounding rivers of Dhaka City with their natural environment and ecosystem</li> <li>Determine the way of enhancing river flow and augmenting dry season flow in the Buriganga and Turag River systems from the Jamuna River</li> <li>Reintroduce fresh water and enable people to use the water of these rivers for domestic, industrial, and recreational purposes.</li> </ul> <p><b>Additional objectives are to:</b></p> <ul style="list-style-type: none"> <li>Determine ways to ensure adequate water depth in the Buriganga and Turag River systems so that river crafts may operate during the whole year</li> </ul>
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- Conduct a preliminary assessment for improvement of water quality due to enhancement of dry season flow in Buriganga and Turag River systems
- Explore the possibility of LLP irrigation and fisheries development
- Enhance eco-restoration, demarcation of rivers, and green belt development.

The project proposal is based on a feasibility study of 2004. Taking into consideration the urban development over the last decade, many new aspects have to be considered to ensure that the interventions proposed account for these developments. The feasibility study has to be updated and alternatives have to be assessed. It is especially important to reconsider this project in relation to other plans that are being developed, especially the “Ecological Restoration of Four Rivers (Buriganga, Turag, Balu (plus Tongi Khala and Shitalakhya) Around Dhaka City”. These two projects may even be combined into one project document.

#### **Problem/Challenges the Project Aims to Address**

The four rivers mentioned above around Dhaka City are considered the lifeline of the environment and ecosystem of the capital city. Over the decades, high population growth, unplanned urbanization, encroachment of rivers, dumping of solid wastes, and discharge of untreated industrial effluents and untreated sewage into the rivers have made the water unusable. Hence, for sustaining better life in and around Dhaka City, improvement of the water quality of the rivers and arresting the pollutants at their source will be the first priority. Then, implementation of a better Environmental Management Plan (EMP) for all sectors related to pollution of rivers will be more effective to revive the fresh water quality of these four rivers.

Major problems exist with respect to environmental degradation and navigability in the rivers surrounding Dhaka Metropolitan City area, specifically during the dry season:

- Severe pollution mainly in the Buriganga and Lakhya rivers. Sewage, solid waste, and untreated industrial wastes in the rivers have created acute pollution leading to a serious degradation of the natural environment (FS 2-1).
- Navigation problems related to drafts in the Buriganga and other surrounding rivers of the Turag, Balu, Tongi Khala and Lakhya rivers. Navigability has decreased due to reduction of flows during the dry season and deposition of sediment on the beds during monsoon (ibid).
- Encroachment of rivers further restricts river flows.

Additional problems are related to:

- Insufficient water supply for domestic, irrigation and industrial use
- Loss of aquatic biodiversity.

The projects seek to address these problems through a series of infrastructure interventions (regulators, loop cuts, fish passages, and bridge adjustments) to augment river flows and restore the ecological setting.

#### **Linkages to Existing Policies and Initiatives**

- Links to the 7th FYP: Water Resources Sector: Irrigation Sub-Sector Sectoral Objectives:
  - Constructing water management infrastructures and establishing sustainable management systems
  - Strengthening operation and maintenance by institutionalizing beneficiary participation
  - Strengthening Government institutions and facilities by establishing sustainable water management systems
  - Enhancing the access of the landless poor in the subproject areas to employment opportunities and to public natural resources.
- Links to BDP2100 Goals

<ul style="list-style-type: none"> <li>– Goal 4: Conserve and preserve wetlands and ecosystems</li> <li>– Goal 6: Achieve functional and optimal use of land and water</li> <li>• Links to the BDP2100 strategy for the urban areas: <ul style="list-style-type: none"> <li>– Goal 2 (enhance water security and efficiency of water)</li> <li>– Goal 3 (ensure sustainable and integrated river systems and estuaries management)</li> <li>– Goal 4 (conserve and preserve wetlands and ecosystems and promote their wise use).</li> </ul> </li> <li>• Links to Bangladesh Climate Change Strategy and Action Plan (2009) Pillars 2 (Comprehensive Disaster Management) and 3 (Infrastructure). Project objectives specifically noted in Plan Preface are “developing and harnessing the water resources through better river course management and river training, which also helps in minimizing the destructive potentials of future floods that are expected to be more severe due to climate change, and managing locational and involuntary displacement of people and their livelihood”</li> <li>• Links to 2030 WRG Bangladesh WRM Report. Specifically, recommendation 5.5 (Cleaning Dhaka’s Water’s-Enhancing wastewater and effluent treatment)</li> <li>• Links to National Sustainable Development Strategy (2013) areas Agriculture (fisheries), Transport, Pollution Management, and Environment Natural Resource and Disaster Management</li> <li>• In line with National Water Policy (1999) in areas such as Environment, Navigation, and Planning/ Management</li> <li>• In line with Pollution Abatement Strategies for Rivers and Wetlands in and around Dhaka City (February 2010 Parliamentary Standing Committee on Ministry of Environment &amp; Forests)</li> <li>• Follows adaptations measures found in “Urban Flooding of Greater Dhaka in a Changing Climate: Building Local Risk to Disaster Risk” (World Bank Report)</li> </ul>	
<b>Technical Assessment</b>	
Technical description of project	A new feasibility study (update of the 2004 FS) is needed taking into consideration all developments that have taken place in the past decade and the new insights that have been gained in the development needs of the city.
Evaluation of project feasibility	<p>From a technical point of view, it is possible to establish a new connection or restore former connections of these rivers to increase the discharge for improving water quality and achieving ecological restoration. It is crucial that the technical interventions are developed in an optimum manner to address the different objectives. These objectives need to be identified in relation to the use of the river (ecology, recreation, navigation, water safety, water supply, etc.).</p> <p>New insights in relation to climate change have to be considered to design water works needed to establish connections and ensure the required level of flood security.</p>
<b>Costs</b>	
Capital costs	<p>The feasibility study is old (2004). Costs have not been updated because this cannot be done by simply using a scaling factor. The FS should be updated to make a proper assessment of capital costs. The reported costs are as follows:</p> <p>Investment costs (2004):  Financial: 6,168 million BDT  Economic: 4,578 million BDT</p>
O&M costs	<p>The same caveat applies to O&amp;M costs due to the feasibility study being outdated.</p> <p>Annual O&amp;M costs (2004):  Financial: 59 million BDT  Economic 40 million BDT</p>

Evaluation of financial estimates	The economic benefit-cost ratio as reported in the FS is 2.15. However, this figure should not be taken at face value because: <ul style="list-style-type: none"> <li>• The FS is very old (2004). Because problems and context have changed, a new FS is needed.</li> <li>• The methods used in the FS of 2004 for this project have a number of limitations, which need to be taken into account: <ul style="list-style-type: none"> <li>– The FS does not make the proper distinction between direct and indirect benefits</li> <li>– The number of benefits (refer to section below) considered is optimistic and goes beyond project influence.</li> </ul> </li> </ul>
Potential environmental costs	Some of the proposed interventions in the project may have adverse environmental impacts, specifically the loop cuts. This will depend on the exact location of the loop cuts. Mitigating measures may have to be considered. This should be considered in an updated FS.
Potential socio-economic costs	The location of the proposed loop cuts may also lead to (potential) socio-economic costs (e.g. if people have to be relocated). Mitigating measures may be considered. This should be considered in an updated FS.
<b>Benefits</b>	
Potential environmental benefits	Many environmental benefits are reported in the FS, including: <ul style="list-style-type: none"> <li>• Year-round water flow will replenish aquatic biodiversity to its natural state, particularly fish biodiversity</li> <li>• Pollution will be reduced due to year-round water flow that will dilute and flush the polluted water</li> <li>• Potable water supply will be increased</li> <li>• The ground water table will be improved</li> <li>• Recreational facility will be enhanced</li> <li>• Prevalence of diseases resulting from deficiency of micronutrients will be reduced to some extent.</li> </ul> <p>These types of benefits are credible. However, the quantitative impacts cannot be judged properly because the feasibility study is too old (2004) and has methodological shortcomings.</p>
Potential socio-economic benefits	The potential environmental benefits are also reflected in socio-economic benefits, resulting in improved living standards. Additional benefits are related to: <ul style="list-style-type: none"> <li>• Improved navigation</li> <li>• Increased food and fisheries production.</li> </ul> <p>However, methodological problems exist due to the unclear relation with the direct physical effects in terms of water quality improvements or amounts of freshwater available for agriculture. The feasibility study needs to be updated to provide a more solid approach towards evaluating the socio-economic benefits.</p>
Linkages to Other Projects	
On-going projects: <ul style="list-style-type: none"> <li>• Buriganga River Restoration Project</li> </ul>	

**Proposed projects:**

- Dhaka Integrated Flood Control Embankment cum Eastern Bypass Road Multipurpose Project: 26 km long embankment along the Balu right bank is included in this project
- The project also has a possible link with FRERMIP/RBIP project (upstream flows)
- Implementation of this project would facilitate an integrated flood risk management approach for Dhaka
- DWASA Sewerage Master Plan will help decrease pollution of rivers around Dhaka.

**World Bank Group projects:**

- Water supply and sanitation in Dhaka and Chattogram (US\$0.35 billion)
- Urban resilience to disasters (US\$0.20)
- Investment promotion facility (US\$0.11 billion)
- The IFC supports the PaCT (partnership for cleaner textile) program in Dhaka. PaCT is working towards the implementation of best practices in the textile sector, with a focus on reducing resource consumption and wastewater pollution.

**Other projects:**

- The ADB focuses on holistic and integrated urban planning, resulting in climate-resilient infrastructure and services
- The GoB is planning several port and navigation related initiatives and is planning the establishment of industrial and economic zones and port terminals
- The GoB is initiating the shifting of tanneries from Hazaribagh and is constructing a combined effluent treatment plant.

A study has been carried out to provide local decision-makers with an effective planning approach for minimizing the damage risk of river and urban flooding in Dhaka in a changing climate: “Urban Flooding of Greater Dhaka in a Changing Climate: Building Local Resilience to Disaster Risk” (2015). Specific objectives of the study were to assess river flooding in the Greater Dhaka area, assess the detailed study area’s vulnerability to urban flooding and waterlogging, estimate probable economic damage due to climate change, develop structural adaptation measures, evaluate the reduction in economic damage resulting from implementing these measures, and estimate their costs. It is important to use the results of this study in the detailed elaboration of the ‘Protection of River Systems around Dhaka’, because the system has to be able to discharge the surface runoff and reduce the risk of flooding from storm water.

**ADM Principles**

This project has been defined as a short term project. This means that this project is justified under all plausible futures. However, it should be questioned whether the feasibility study has sufficiently taken into account the potential development of the city and how this influences the pressure on the waterways in and around the city.

An updated feasibility study should take into account these developments. In choosing a preferred alternative, these criteria should be considered as well.

Flexibility could be introduced by considering not just one connection, but also different combinations of connections that do not have to be carried out at the same time. This way, the different scenarios for the development of the city of Dhaka can be taken into consideration. With a modular project proposal, it will be possible to adapt to changing circumstances.

Tipping points in urban areas (not prioritized) include:

- Abstraction of groundwater for industries is larger than natural recharge

- (Ground)water availability (quantity and quality) can no longer meet the demands of water-dependent industries or domestic use
- Pollution exceeds water quality standards, posing unacceptable health and environmental risks
- Heat stress leads to unacceptable disruption of urban activities and/or loss of life
- Flood risks.

This project relates mostly to the tipping point on river pollution, but should also consider the availability of water for industrial and domestic use, the mitigation of heat stress, and the reduction of flood risks.

**Linkages to Climate Change Adaptation**

In the design of the new or restored connection, climate change has to be considered to ensure that the rivers will comply with the required flood safety levels and that the rivers have the discharge capacity to drain storm water from the urban areas. Furthermore, open water bodies decrease the effect of heat islands. Open water bodies reduce temperatures more than building materials that tend to absorb heat.

### Private Financing Potential

This project has PPP potential in the following areas:

- **Dredging:** The project involves significant dredging and disposal of the dredged materials. BIWTA could enter into a PPP for capital and maintenance dredging for the river channels. If environmentally feasible, the dredging project could be combined with a land development project where the dredged material is deployed to create new residential, commercial, or industrial facilities. It is important to consider the environmental impact of this arrangement though since some of the dredged material is expected to be toxic and hazardous. Unless combined with another PPP that generates revenue, the dredging PPP will still require BIWTA to compensate the private concessionaire for the work done. In other words, the dredging PPP may not be able to contribute any financing to the project. The PPP will, however, ensure that the rivers, once dredged, will continue to maintain their depth this is essential to ensure that the project's benefits continue to accrue in the years to come.
- **Water Navigation:** The BIWTC could enter into a PPP for managing scheduled passenger ferry facilities. Depending on the how profitable these services are, BIWTC can also require a profit share in the business. This revenue can then be utilized to finance the ongoing operations and maintenance activities on other aspects of the project. These future cash flows can also be used to raise some of the initial project financing.
- **Solid Waste Management:** Like maintenance dredging, it is critical for the success of the project that, once all solid waste has been removed from the rivers, no new waste is disposed in the rivers. This means the municipalities will need to have arrangements for solid waste management that prevent discharge of solid waste in the rivers. The municipalities can enter into PPPs for collection and disposal of solid waste. Solid Waste Management PPPs have a long and successful history globally, including in emerging markets, so there are enough precedents and guidelines for developing PPPs in this space.
- **Sewage Treatment:** Like solid waste, sewage also needs to be treated before it is discharged into the rivers. DWASA is currently considering PPPs for Sewage Treatment Plants covering most areas under their jurisdiction. We will review these projects in detail in the Investment Plan. For areas outside DWASA's control but within the catchment area of this project, other similar agencies should also consider PPPs for sewage treatment plants in their jurisdictions.
- **Riverfront developments:** The river restoration project is likely to involve some river side beautification projects (like walkways, parks, etc.). BIWTC should engage the private sector to develop and maintain these areas. If possible, some of the areas can also be used to develop large scale recreational facilities (like amusement parks). Revenues from such facilities can be used to finance operations and maintenance of the river channels or to service debt raised for the projects.

### Policy and Institutional Reform

Main implementing agencies	Bangladesh Inland Water Transport Authority (BIWTA) is the main implementing agency. The principal scope of BIWTA is: <ul style="list-style-type: none"> <li>• Inland river transport regulation</li> <li>• Maintenance of navigation routes</li> <li>• Development and maintenance of river ports.</li> </ul>
Required coordination mechanisms	There should be coordination between BIWTA and the following public sector entities: <ul style="list-style-type: none"> <li>• BWDB:</li> <li>• Demarcation of river conveyance area</li> <li>• Monitoring of water flow of the rivers</li> </ul>

	<ul style="list-style-type: none"> <li>• Providing technological assistance to BIWTA in maintaining water depth for functional navigation.</li> </ul> <p><b>DoE:</b></p> <ul style="list-style-type: none"> <li>• Monitoring of water quality on regular basis</li> <li>• Enforcing rules and regulations for ensuring proper treatment of industrial effluent and sewage</li> <li>• Monitoring of solid waste dumping in and around the river</li> <li>• Launching a polluter-pays system for protecting environmental damage and conserving nature.</li> </ul> <p><b>DPHE:</b></p> <ul style="list-style-type: none"> <li>• Monitoring of surface water induced health (water borne disease) and sanitation condition.</li> </ul> <p><b>DAE:</b></p> <ul style="list-style-type: none"> <li>• Extension of suitable crop variety</li> <li>• Technology dissemination</li> <li>• Provision of need-based consultation in pest and crop management</li> <li>• Assistance in formation and operations of water management association.</li> </ul> <p><b>BADC:</b></p> <ul style="list-style-type: none"> <li>• Creation and development of surface water irrigation facilities</li> <li>• Supply of agriculture inputs (seed, fertilizer, etc.).</li> </ul> <p><b>DoF:</b></p> <ul style="list-style-type: none"> <li>• Monitoring of fish species diversity</li> <li>• Monitoring fish catch</li> <li>• Imposing fish banning period to stop illegal fishing with the help of local administration, the coast guard, and other relevant law enforcement agencies.</li> </ul>
Existing policies/institutions to facilitate implementation	<ul style="list-style-type: none"> <li>• 7th FYP: Water Resources Sector: Irrigation Sub-Sector Policy</li> <li>• Bangladesh Climate Change Strategy and Action Plan (2009)</li> <li>• 2030 WRG Bangladesh WRM Report</li> <li>• National Sustainable Development Strategy (2013)</li> <li>• National Water Policy (1999)</li> <li>• “Urban Flooding of Greater Dhaka in a Changing Climate: Building Local Risk to Disaster Risk” (World Bank Report)</li> <li>• Pollution Abatement Strategies for Rivers and Wetlands in and Around Dhaka City</li> </ul>
Desirable capacity building initiatives	<ul style="list-style-type: none"> <li>• Capacity building for Dhaka North City Corporation and Dhaka South City Corporation</li> </ul>
Required policy/regulatory reforms	<ul style="list-style-type: none"> <li>• Creation of a single authority to manage Dhaka’s drainage system</li> </ul> <p>Allow for more flexibility in the process from DPP to implementation. Project cycles normally cover multi-year programs, during which important changes occur. The actual DPP process only allows for restricted adaptation, and this can only be done through a very bureaucratic procedure.</p>



Overall Project Assessment	
Priority	<p>This project has high priority because this is the only way to improve the water quality of the rivers in and around the city. However, if this remains a standalone project, the effects of reconnecting the river will not be optimal. This can only be done effectively in combination with other projects related to the use of the river. These are projects that relate to:</p> <ul style="list-style-type: none"> <li>• Improving the sewerage system (Urban Flooding of Greater Dhaka in a Changing Climate: Building Local Resilience to Disaster Risk)</li> <li>• Improving solid waste collection (Ecological Restoration of Four Rivers (Buriganga, Turag, Balu (plus Tongi Khala) and Shitalakhya) Around Dhaka City)</li> <li>• Decreasing the contamination of the river by industry (relocation of tanneries)</li> <li>• Navigation, spatial planning of the river banks, etc.</li> </ul> <p><b>The project meets the criteria to be considered short term:</b></p> <ul style="list-style-type: none"> <li>• Direct or indirect benefits offset implementation costs in all delta scenarios: The NPV of this project is estimated to be BDT 8,262 million</li> <li>• Implementing agencies have the knowledge base to implement these types of projects locally (with some limited guidance and support if needed): BIWTA has the required expertise to implement this project as a stand-alone activity. Considering that the restoration of the rivers in and around Dhaka needs to be addressed in an integrated manner, this project needs to be integrated with other ongoing and planned initiatives. This should be done by an overarching technical committee. BIWTA, as responsible authority for this initiative, should participate in this committee to ensure effective and efficient integration.</li> <li>• Implementing the project will reduce vulnerability to future uncertainties such as sea level rise and flooding: Water quality in the river system in and around Dhaka is very poor, and these initiatives should be carried out to start improving the water quality by allowing water to enter the system on a more regular basis. Many other initiatives have to be implemented to reach a situation that is required at this moment. In the detailing of the design and implementation, future uncertainties should be considered as much as possible.</li> <li>• The project has no hard trade-offs with other policy objectives.</li> </ul>
State of readiness	<p>The project proposal is based on a feasibility study from 2004. Considering the urban development that has taken place during the last decade, many new aspects must be considered to ensure that the interventions proposed account for these developments. The feasibility study has to be updated, and alternatives have to be assessed. It is especially important to reconsider this project in relation to other plans that are being developed, especially the “Ecological Restoration of Four Rivers (Buriganga, Turag, Balu (plus Tongi Khala) and Shitalakhya) around Dhaka City”. The two projects may even be combined into one project document.</p>
Additional information or work required	<p>BWDB has submitted a PDPP to the Department of Environment. The Department of Environment now needs to prepare a DPP.</p>

	A new FS has to be initiated to ensure that new developments are sufficiently considered. This FS has to cover the technical interventions needed and the impact this has on socio-economic development and the environment. Additionally, the FS has to assess the ability to integrate this intervention with other comprehensive plans that are being developed for the city of Dhaka.
Results framework and M&E arrangements	The log frame (Bangladesh Delta Plan 2100, Formulation Project, Investment Plan, 14 Log Frames March 2016, GED, draft) describes the goals, the purpose, the required outputs, and the inputs. These could be made more specific and time dependent. Even more importantly, the responsibility for M&E needs to be embedded in the organizational structure and the results of M&E should lead to adaptation of the objectives or the interventions.

### **UA 1.2 Dhaka Integrated Flood Control Embankment cum Eastern Bypass Road Multipurpose Project**

<b>Brief Project Description</b>
<p>The proposed Dhaka Integrated Flood Control Embankment cum Eastern Bypass Road Multipurpose Project is located in Uttara, Gulshan, Badda, Khilgaon, Sabujbag Thana Upazillas in the Dhaka District and Demra Thana in the Naryanganj District. This project is based on a study carried out by Halcrow in 2006 and previous studies by GoB and JICA.</p> <p>The main objective is to provide flood protection for the eastern part of 124km<sup>2</sup> of Dhaka City. This will mitigate damage and loss of life and wealth due to flooding by the Balu River and from internal flood water.</p> <p>The project will also improve the local road infrastructure and facilitate improved road communication in eastern Dhaka by the construction of the flood protection cum road along the right bank of the Balu river. This road will act as a bypass road for Dhaka city.</p> <p>The project includes construction of embankments, hydraulic structures, drainage systems, pumping stations, roads, and retention ponds.</p> <p>The project was first conceptualized in 1990 as part of the Flood Action Plan. Implementation was delayed, however, because of a lack of funds, a change of project scope requiring an updated feasibility study and design, and the multi-sectoral and multi-agency nature of the project.</p>
<b>Problem/Challenges the Project Aims to Address</b>
<p>The eastern part of the Dhaka city is highly vulnerable to flooding and drainage congestion. The drainage congestion and vulnerability to frequent flooding (1987, 1988, 1998, and 2004) is a major problem that affects the population of Dhaka city and the existing infrastructure. Despite the natural calamities, unplanned filling of lowlands for housing by the private developers for accommodation of migrated people has aggravated the problem.</p> <p>Inundation in the eastern part of the main city is under severe pressure from traffic congestion due to the increase in traffic demand and lack of a bypass road to provide an efficient transport route for the inter-district traffic. It has become increasingly difficult and highly time-consuming to travel from the Northeast part of Dhaka city to the Southeast part of the city. If the project would not be implemented, this would have severe negative impacts on the livelihood of the inhabitants and economy of the country as a whole.</p>

The project fits partly into the flood control aspect of the BDP strategy for urban areas. This relates specifically to goal 1 (ensure safety from floods and climate change related disasters) and goal 6 (achieve optimal and integrated use of land and water resources). If the project will be executed in a sustainable way, it will also contribute to goal 4 (conserve and preserve wetlands and ecosystems and promote their wise use).

**Linkages to Existing Policies and Initiatives**

- Links to numerous objectives in the 7th Five Year Plan, including those set out in the following Chapters of Part 2:
  - Agriculture: 4.2, 4.3, 4.6
  - Transport and Communication: 6.3
  - Environment and Climate Change: 8.5, 8.6
  - Housing and Community Amenities: 9.6
- Project fits overall strategy of the National Water Management Plan (NWMP) and links to all three NWMP immediate objectives
- Links directly to Large and Small Town Flood Protection under NWMP Programs for Major Cities. Other similar programs aimed at Dhaka flood mitigation include Dhaka Flood Protection (MCo10) and Dhaka Stormwater Drainage (MCo11).
- Links to numerous goals in the National Water Management Plan Development Strategy, including:
  - Major Cities (water supply/sanitation, flood protection and stormwater drainage)
  - Disaster Management (cyclone protection, flood proofing, riverbank maintenance and erosion control)
  - Natural Environment and Aquatic Resources (water management for ecologically sensitive areas and supporting environment measures)
- Links to the Dhaka Water and Sewerage Authority’s Drainage Master Plan
- Applies to overall objectives of Coastal Development Policy and follow-on Strategy Targets/Strategic Priorities (ensuring fresh and safe water availability, safety from man-made and natural hazards, promoting economic growth, sustainable and equitable management of natural resources, improving livelihood conditions and, environment conservation), and associated Investment Program.
- Flood protection and proofing are part of the UNDP Coordination of Cyclone Rehabilitation (1991)
- Continues the disaster management goals of the Comprehensive Disaster Management Program
- Links to National Adaption Programme of Action (2005) adaption needs and intervention measures
- Links to objectives of the National Sustainable Development Strategy in areas such as water resource management, transport, and urban environment.
- Links to objectives of the National Water Policy (1999) such as harnessing/development of all forms of surface/groundwater as well as being in line with proposed Government actions under Planning and Management of Water Resources, Water for the Environment, Water Supply and Sanitation.
- Helps to achieve the objectives of a number of the programmes outlined in the Bangladesh Climate Change Strategy and Action Plan 2009 Annex, principally under the Food Security, Social Protection and Health and Infrastructure pillars/themes.

**Technical Assessment**

<p>Technical description of project</p>	<p>The total area that will be protected by the proposed Dhaka Integrated Flood Control Embankment cum Eastern Bypass Road Multipurpose Project is 124km<sup>2</sup>.</p> <p>The integrated multipurpose scheme is consistent with the long term strategy for Greater Dhaka East. It offers the advantage of staging the</p>
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	<p>implementation of flood protection and drainage improvement over the next decades in response to development pressure, climate change and various natural calamities. It will also improve the local road infrastructure and facilitate improved road communication in eastern Dhaka by the construction of the flood protection cum road along the right bank of the Balu river. This road will act as a bypass road for Dhaka city.</p> <p>In order to rationalize the drainage flows and assist in delivering phased construction, the project is divided into three components. Each compartment is treated as discrete flood-protected area with its boundary sub-embankments being above the 100-year flood level and acting as internal link roads.</p> <p>The project will include earthworks-like embankments (24km), floodwalls (3.4km), connector embankments (0.6km), bypasses (5.2km), khal improvement (80.4km), and the construction of a dyke along the planned retention pond (21.2km).</p> <p>Furthermore, the project will include the construction of roads, a large number of water works, bank protection works and pumping stations. To be able to carry out all these construction works, a total area of around 1555ha will be acquired.</p>
Evaluation of project feasibility	<p>From a technical point of view, this project is feasible. However, the impact of this project on the development of Dhaka will be enormous, and it will be crucial to have everything in place to control these developments. Spatial planning is necessary to ensure that urban development will answer to the objectives of the different authorities that are involved. If urban development is not sufficiently controlled, many different projects will be carried out, and there will be no assurance that these developments will coincide with sound urban planning. This will lead to new challenges related to infrastructure, mobility, drinking water supply and water treatment, and storm water drainage. Therefore, it is crucial that these aspects play an important role in the decisions related to the design and the timing of the interventions.</p>
<b>Costs</b>	
Capital costs	<p>Feasibility study is old (2005), costs have partly been updated. The reported costs are as follows:</p> <p>Investment costs:  Financial: 27,504 million BDT (2005) / 57,208 million BDT (2015)  Economic: 11,855 million BDT (2005) / 44,050 million BDT (2015)</p>
O&M costs	<p>O&amp;M costs (2005) are outdated, but reported as follows:</p> <p>Long run annual O&amp;M costs (2005):  Financial: 176 million BDT  Economic 91.5 million BDT</p>
Evaluation of financial estimates	<p>The reported benefit/cost ratio is 1.76. The feasibility study should be updated to take account of the population, urban planning and transport developments that have taken place in greater Dhaka since 2005. In doing such update, the feasibility study should also better address the distinction between direct and indirect benefits, and improve the land-value estimates.</p>

Potential environmental costs	<p>Creating space for the construction and use of infrastructure components can create negative environmental impacts. The magnitude of such impacts depends on the specific location of the infrastructure as well as on its use. In this respect the impact on wetlands for instance, is missing so far in the project CBA.</p> <p>Furthermore, additional car use can lead to negative environmental impacts (emissions). It should be analyzed to what extent these impacts can be offset by the projected reduction of transport congestion.</p>
Potential socio-economic costs	<p>The relocation of people and economic activities in the area of the projected infrastructure (1155 hectares) may lead to temporary and/or structural socio-economic costs. This is underpinned by the fact that a Resettlement Action Plan (RAP) is required. These types of costs have not been considered so far and should be analyzed in order to balance them against the projected socio-economic benefits, as stated below.</p>
<b>Benefits</b>	
Potential environmental benefits	<p>The urbanization in the proposed project area is increasing gradually and unplanned filling of lands by private developers is accelerating. Adverse social and environmental impacts in the project area due to the drainage and flooding problem and unplanned urbanization can be expected. The prevention and/or mitigation of these impacts can be seen as the potential environmental benefits of the project.</p> <p>In the available project CBA, a 'land fill benefit' of BDT 2643 million is stated. It is not clear however how this impact has been quantified. The number is outdated as a result of the urban development that has taken place since 2005. Relating to environmental impacts, improved health has been mentioned as an indirect effect, but has not been quantified.</p>
Potential socio-economic benefits	<p>The following socio-economic benefits have been derived (BDT in millions) for 30 years (Halcrow Ltd., 2006, P-129):</p> <ul style="list-style-type: none"> <li>• Saving of Property loss &amp; income (all compartments): BDT 57,254</li> <li>• Transport benefits (Vehicle Operating Cost): BDT 4,849</li> <li>• Transport benefits (Time Savings): BDT 35,048</li> </ul> <p>The prevented loss of property and income is the most significant quantified socio-economic benefit. However, the transport time savings are also extensive, indicating the high level of congestion in Dhaka. It can be expected that, due to the increased population and traffic since 2005, these projected benefits are likely to have increased substantially. These numbers are not available as yet and should be updated.</p> <p>Furthermore, indirect socio-economic benefits could arise. In this respect, partly overlapping impacts are mentioned: socio-economic conditions, employment, industrial production, land value etc.</p>
<b>Linkages to Other Projects</b>	
<p>The project is related to the following ongoing projects: Metro Rail, Dhaka Water Supply and Sanitation Project, Purbachal Housing Project by RAJUK and completed Connected Road from Purbachal to Kuril Flyover. This project is also related to the following proposed projects: Protection of river systems around Dhaka City with their Ecological Restoration.</p>	

<b>ADM Principles</b>	
<p>In the PCN, only the urban development portion of the total project area of 124 square kilometers is taken into account. The project does not consider other alternatives that provide more gradual opportunities for the city to grow. No clear indications are given in relation to the assessment of the urban development plan for Dhaka. With different measures, zoning is possible. Zoning of smaller compartments will provide a more gradual growth scenario and will decrease uncertainties related to water security. Management of smaller compartments will also be less complex and lead to more controllable risks.</p> <p>This will also provide more flexibility in timing of the different interventions to answer properly to demographic and economic development in the city and, therefore, will reduce the risk of over and under investments. Phasing the interventions will also allow for optimization of the use of technological development.</p>	
<b>Linkages to Climate Change Adaptation</b>	
<p>The integrated multipurpose scheme is supposed to be consistent with the long term strategy for Greater Dhaka East, staging the implementation of flood protection and drainage improvement over the next decades in response to development pressure, climate change, and various natural calamities. Each compartment is treated as discrete flood protected area with its boundary sub-embankments being above the 100-year flood level and acting as internal link roads.</p> <p>It should be made more explicit by which specific criteria (refer to ADM-principles) this staged implementation will take place, in view of the specified 100-year flood level of the sub-embankments.</p>	
<b>Private Sector Financing Potential</b>	
<p>Road Bypass projects are very routinely developed as PPPs. In Dhaka itself, the PPP Office is currently developing a PPP for the BDT 2.37 billion Dhaka Bypass (Joydevpur-Debgram-Bhulta-Modonpur Road) currently. The Project was approved by ECNEC in March 2016<sup>184</sup>.</p> <p>The bypass component of this project should be evaluated for its PPP potential. It is quite possible that the road cannot be tolled or that the toll revenues are not sufficient to meet the costs. However, even in such cases, the private sector can be approached to finance part of the costs (the balance can be met through public funds).</p>	
<b>Policy and Institutional Reform</b>	
Main implementing agencies	<p>Bangladesh Water Development Board (BWDB) is the proposed lead implementing agency. Other stakeholders are:</p> <ul style="list-style-type: none"> <li>• Roads &amp; Highways Department (RHD): (a) Construction of Bypass road and link roads, including bridge structure (b) Traffic and transport planning for greater Dhaka</li> <li>• Local Govt. Engineering Department (LGED): Rural roads and related infrastructures</li> <li>• Department of Environment (DoE): Environmental quality. Approval for EIA and EMP</li> <li>• RAJUK: Urban and land use planning, Preparation of Master Plan and Detailed Area Plans and executing planning regulations</li> <li>• Dhaka WASA: Water supply, sanitation and drainage</li> <li>• Dhaka City Corporation (South &amp; North): Operation and maintenance of urban infrastructure. Enforcement of urban development policies and rules.</li> </ul>

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	<p><b>Associate Stakeholders:</b></p> <ul style="list-style-type: none"> <li>• Ministry of Land (MoL): Land Development activities, Land acquisition.</li> <li>• Bangladesh Inland Water Transport Authority (BIWTA): Inland navigation</li> <li>• Department of Fisheries (DoF): Training and dissemination of appropriate aquaculture technology</li> <li>• <b>Department of Agriculture Extension (DAE):</b> Extension and training on suitable crop and vegetable variety. Dissemination of technology</li> <li>• <b>Private sector developer:</b> Housing and other urban development.</li> <li>• <b>Non-Government Organizations:</b> Variety of functions including mobilization of community participation in development.</li> </ul>
Required coordination mechanisms	A complex, multi-agency approach is required to implement this project.
Existing policies/institutions to facilitate implementation	<ul style="list-style-type: none"> <li>• MoWR Task Force established to develop new institutional framework for WRM</li> <li>• Guidelines for Integrated Planning for Sustainable Water Resources Management set out the institutions and procedures for planning, O&amp;M, participatory M&amp;E, and training for FCD projects</li> <li>• The general thrust of all recommended actions under the Bangladesh Climate Fiscal Framework 2014 is to facilitate access to climate finance, and to ensure that climate change finance is deployed in the most effective way. So, to the extent that this project seeks to address the impact of climate change, and is of sufficiently high priority, this policy should help to ensure it gets funded. Appendix 2 classifies flood control projects as significantly relevant to CC mitigation/adaption (second highest ranking)</li> <li>• Bangladesh Climate Change Resilience Fund (BCCRF), Strategic Program for Climate Resilience may assist with implementation</li> <li>• Bangladesh Climate Change Strategy and Action Plan 2009 includes projects like this within its action plan, and accordingly facilitates the project's implementation (refer to the Annex).</li> <li>• National Environment Committee, National Steering Committee on Climate Change, Inter-Ministerial Disaster Management Committee, National Disaster Management Advisory Committee each may assist with implementation</li> </ul>
Desirable capacity building initiatives	<ul style="list-style-type: none"> <li>• In view of the reported complex multi-agency approach, it is advised to check with BWDB if this approach is feasible without further capacity building initiatives.</li> </ul>
Required policy/regulatory reforms	<ul style="list-style-type: none"> <li>• Implementation of the recommendations in the November 2014 Final Report on Institutional Improvement of BWDB</li> <li>• Bangladesh Climate Fiscal Framework 2014 recommends merging the Bangladesh Climate Change Resilience Fund and Climate Change Trust Fund to prevent duplication. It also generally recommends stronger and more integrated climate change planning</li> <li>• Bangladesh Climate Fiscal Framework 2014 recommends implementing a climate fiscal cell in the Finance Department of MoF</li> </ul>



Overall Project Assessment	
Priority	<p>For many of the developments in the eastern part Dhaka City, this project has high priority because flood-risk safety does not meet required standards currently.</p> <ul style="list-style-type: none"> <li>• Direct or indirect benefits offset implementation costs in all delta scenarios: The NPV of this project is estimated to be BDT 12,659 million.</li> <li>• Implementing agencies have the knowledge base to implement these types of projects locally (with some limited guidance and support if needed): BWDB has extensive experience with the construction of waterworks of this type. However, the project requires a complex, multi-agency approach to implement the interventions. For this, an overarching committee should be assembled to oversee the coordination of all the related initiatives.</li> <li>• Implementing the project will reduce vulnerability to future uncertainties such as sea level rise and flooding: As indicated above, large parts of the eastern part of the Dhaka city is highly vulnerable to flooding and drainage congestion. Unplanned filling of lowlands for housing by the private developers for accommodation of migrated people has aggravated the problem. This part is also under pressure from traffic congestion due to the increase in traffic demand. The construction of an embankment with a road would improve the livelihood of the inhabitants and economy of the country. Up to what level the project planning up till now has considered climate change and exposure to changing precipitation patterns is uncertain. In the PCN, there is no mention of a certain flood risk level that needs to be achieved with the project, nor how climate change and possible sea level rise will influence the return period of flooding. This should be reconsidered in the project design to ensure there is sufficient flexibility in relation to uncertainties of climate change and sea level rise.</li> <li>• There are no hard trade-offs with other policy objectives: The project has no hard trade-offs with other policy objectives. However, the impact of this project on the development of Dhaka will be enormous, and it will be crucial to have everything in place to control these developments. Spatial planning is necessary to ensure that urban development will answer to the objectives of the different authorities that are involved. If urban development is not sufficiently controlled, many different projects will be carried out, and there will be no guarantee that these developments will coincide with sound urban planning and equitable development. Uncontrolled development will lead to new challenges related to infrastructure, mobility, drinking water supply and water treatment, and storm water drainage. Therefore, it is crucial that these aspects play an important role in the decisions related to the design and the timing of the interventions.</li> <li>• The project has been classified as a short term project in the Delta Plan. However, in view of the above, the project needs to be reviewed to ensure that all requirements are met to facilitate an equitable and coordinate development of the eastern part of the city.</li> </ul>

<p>State of readiness</p>	<p>From a technical point of view, this project is ready. However, other aspects such as social and economic developments have to be assessed to ensure that timing is optimal. Developments within the newly protected areas must be controlled sufficiently to ensure that challenges in relation to this urban development can be overcome, such as mobility, water supply and sanitation, storm water drainage, and social cohesion. In the PCN, three compartments (A, B, and C) are mentioned, but no indications are given in relation to the timing of the implementation of these compartments or the criteria on which a go/no-go decision will be based.</p>
<p>Additional information or work required</p>	<p>This project is very complex and has to deal with numerous objectives related to land and water management. The feasibility study on which the PCN is based was published in 2006. Since 2006, many developments have taken place that must be considered thoroughly. Therefore, it is highly recommended to update the feasibility study and to ensure that with a detailed EIA, SIA, and CBA, all objectives are included and a comprehensive plan will be developed including a plan on how to control development and face the challenges this project will bring in relation to urban development.</p> <p>A revised DPP needs to be prepared for approval from the Executive Committee of the National Economic Council.</p>
<p>Results framework and M&amp;E arrangements</p>	<p>The PCN provides little information concerning M&amp;E. The BDP2100 log frame presents the goals and purpose of the project, but these are very general and should be developed and refined. Criteria on input and output are straightforward, but may need adjustments for ADM-related design changes. The PCN specifies no criteria for quality and time, and lacks a monitoring plan.</p>

### UA 1.3 Drainage Improvement of Dhaka-Narayanganj-Demra (DND) Project – Phase 2

Brief Project Description
<p><b>The overall objectives of the project are to:</b></p> <ul style="list-style-type: none"> <li>• Improve drainage management of the DND Project area</li> <li>• Flood mitigation through flood wall heightening</li> <li>• Restore the normal livelihood of the dwellers of the DND area through socio-economic enhancement and environmental endorsement.</li> <li>• Improvement of Communication facilities of the Project area.</li> </ul> <p>The DND project is one of the oldest irrigation projects in Bangladesh. The whole project area is bounded by road cum embankments and floodwalls. DND project, Phase 1 was executed from 1962 to 1968 as a flood control drainage and irrigation (FCDI) project primarily to protect Dhaka and Narayanganj towns from floods and to save croplands from overflowing river. It was then turned into an exclusive irrigation project aimed at achieving self-reliance in food grains production. But the area continued to develop as an unplanned residential area after the independence of the country, with lower middle income people buying land and building homes haphazardly. The development gained momentum after the 1988 and 1998 major flood events, which led to more people inside of the dam project area since it was free from floods. As a result, most of the agricultural land was transformed into residential, commercial, and industrial zone without any plan. The unplanned housing and establishment made an adverse impact on the existing drainage system of 10,000 hectares of land inside the DND area, which triggers water-logging even with moderate rain. The DND project primarily had a drainage system for paddy, but the paddy area has now turned into a town 10 to 15 feet below the flood level during the rainy season. The drainage system is failing.</p> <p>The project was first conceptualized in 2009. Since then, a DPP was approved in 2016, and Government funding for the project has been secured.</p>
<p><b>Problem/Challenges the Project Aims to Address</b></p> <ul style="list-style-type: none"> <li>• Water congestion creates problems of growing crops, sustenance of livelihood from various farm related occupations, and various environmental and health hazards</li> <li>• Construction of dwellings, industries, and workshops in an unplanned manner has created impediments to existing drainage networks</li> <li>• Dumping of sewage and solid wastes into the drainage canals from newly established industries and houses reduced the capacities of drainage canals</li> <li>• Construction of internal road networks in unplanned manner hampers surface drainage</li> <li>• Placing of artificial barriers in low-lying areas and cross-dams on the mouth of drainage khals created waterlogging</li> <li>• No retention ponds have been provided for storage of excess runoff in the monsoon</li> <li>• The area lacks proper sewerage and wastewater management</li> <li>• The drainage system has not been properly maintained.</li> </ul> <p><b>The project seeks to contribute towards achieving BDP 2100 goals:</b></p> <ul style="list-style-type: none"> <li>• Goal 1: safety from floods and climate change related disasters</li> <li>• Goal 2: Ensure water security and efficiency of water usages</li> <li>• Goal 6: Achieve optimal use of land and water.</li> </ul>

### Linkages to Existing Policies and Initiatives

- Links to numerous objectives in the 7th Five Year Plan, including those set out in Chapter 2 of Part 1 and the following Chapters of Part 2:
  - Agriculture: 4.2, 4.3, 4.6
  - Local Government and Rural Development: 7.2, 7.3
  - Environment and Climate Change: 8.5, 8.6
  - ICT: 12
- Project fits overall strategy of National Water Management Plan (NWMP)
- Links directly to Large and Small Town Flood Protection under NWMP Programs for Major Cities
- Links to numerous goals in the National Water Management Plan Development Strategy, including:
  - Towns and Rural Areas (water supply, flood protection)
  - Agriculture and Water Management (public irrigation development, flood control/drainage)
  - Natural Environment and Aquatic Resources (water management for ecologically sensitive areas, supporting environment measures)
- Links to the Dhaka Water and Sewerage Authority’s Drainage Master Plan
- Applies to overall objectives of Coastal Development Policy and follow-on Strategy Targets/Strategic Priorities (ensuring fresh and safe water availability, safety from man-made and natural hazards, promoting economic growth, sustainable and equitable management of natural resources, improving livelihood conditions and, environment conservation), and associated Investment Program.
- Flood protection and proofing is part of the UNDP Coordination of Cyclone Rehabilitation (1991)
- Continues the disaster management goals of the Comprehensive Disaster Management Program
- Links to National Adaption Program of Action (2005) adaption needs and intervention measures
- Links to objectives of the National Sustainable Development Strategy in areas such as water resource management, disaster management, and land/soil.
- Links to objectives of the National Water Policy (1999) such as harnessing/development of all forms of surface/groundwater as well as being in line with proposed Government actions under Planning and Management of Water Resources.
- Helps to achieve the objectives of a number of the programs outlined in the Bangladesh Climate Change Strategy and Action Plan 2009 Annex, principally under the Food Security, Social Protection and Health and Infrastructure pillars/themes.
- Links to National Food Policy 2006 Plan of Action 2.1: Agricultural disaster management (enhance disaster preparedness)

### Technical Assessment

<ul style="list-style-type: none"> <li>• Technical description of project</li> </ul>	<ul style="list-style-type: none"> <li>• Installation of new pump station/pumping plant</li> <li>• Rehabilitation of existing pump station</li> <li>• Excavation &amp; re-excavation of drainage canal network</li> <li>• Removing unauthorized encroachment from drainage routes</li> <li>• Construction of bridge/ culverts with adequate size at the road crossing with drainage canals</li> <li>• Heightening of flood wall</li> </ul>
<p>Evaluation of project feasibility</p>	<p>The project is formulated on the basis of a decade old feasibility study done in 2004. The feasibility study also covers an EIA and an SIA. Since then, significant changes have taken place in relation to the quantity and the quality of the water. Furthermore, social, environmental, and</p>

		demographic changes make it necessary to update the feasibility study with associated studies. This study should also encompass a CBA. From a technical point of view, a project like this is feasible, but there are many financial and social challenges to overcome during implementation as well as during the consecutive O&M phase.
<b>Costs (2015 Prices)</b>		
Capital costs		Financial: 5,366.02 million BDT Economic: 4,293.5 million BDT
O&M costs		Financial: 86.9 million BDT Economic: 86.9 million BDT
Evaluation of financial estimates		The economic benefit-cost ratio, based on the PCN and feasibility study, is calculated at 1.55. This value may change (probably increase) with updates to the feasibility study. The following observations relate to the updated numbers in the recent DPP compared to the feasibility study from 2009: <ul style="list-style-type: none"> <li>• O&amp;M costs in the feasibility study are 3.3 percent of total investment costs. In the DPP, O&amp;M costs are only 1.8 percent of total investment costs. It is not clear why the difference is so high (no explanation given). O&amp;M cost updating is only presented in a cash flow table without any reference.</li> <li>• Land value in the feasibility study was only considered during the first 10 years. In the DPP, this is correctly done for the entire operational period</li> <li>• The breakdown of investment costs differs significantly in the DPP compared to the feasibility study. Probably (because a detailed breakdown is used) this is OK, and updating is not just based on a price-escalation</li> <li>• The contrary is true for the benefits: no explanation is given of the relatively high increase of the benefits (factor 2.53) compared to the increase in investment costs (resulting in a factor of 1.91).</li> </ul>
Potential environmental costs		--
Potential socio-economic costs		In case of necessary resettlement of people, following land acquisition, this will induce socio-economic costs.
<b>Benefits</b>		
Potential benefits	environmental	Reduced pollution may occur, following a better drainage of the area. This will prevent the spread of water-borne diseases and insect breeding.
Potential benefits	socio-economic	<b>Quantified impacts result from avoided damage to:</b> <ul style="list-style-type: none"> <li>• Buildings, infrastructure, and losses of households</li> <li>• Commercial merchandise, profit loss, and damages to infrastructure of commercial shops, factories, and industries</li> <li>• Damage repair costs to social infrastructure</li> <li>• Enhancement of Land Values by turning lowlands into flood-free land (value increase 1 percent)</li> </ul> <p>Positive impacts may occur with respect to health, removal of transportation disruption, restricted movement, and disruption of other economic activities. These impacts have not been quantified.</p>

<b>Linkages to Other Projects</b>	
<ul style="list-style-type: none"> <li>Dhaka WASA's proposed project on Water Supply and Sanitation in Metropolitan Area falls in the boundary of DND project.</li> <li>Dhaka integrated water supply and sanitation project (proposed)</li> <li>BDP Projects: Protection of river system around Dhaka city with their ecological restoration, Dhaka integrated flood control embankment cum eastern bypass road multipurpose project, DND drainage project. Also a thematic link can be made with the proposed Improvement of Sanitation, Drainage Congestion, and Flood Control for Chattogram City Corporation Area.</li> </ul>	
<b>ADM Principles</b>	
Project planning has been insufficiently adaptive, but the drainage capacity needs to be adapted to actual circumstances considering possible future development. It is necessary to integrate these plans with other water-centric projects in and around Dhaka to assure that future developments in and around the city are considered. Attention to technology, scale, and timing could avoid over- or under-investment.	
<b>Linkages to Climate Change Adaptation</b>	
In the design of the new or restored water bodies (khals), the flood wall, and the pumping stations, climate change must be considered to assure that the water system will comply with the required flood safety levels and that the discharge / drainage capacity is available to drain storm water from the urban areas.	
<b>Private Sector Financing Potential</b>	
This project does not have any private sector financing potential since there are no revenue streams attached to it.	
<b>Policy and Institutional Reform</b>	
Main implementing agencies	DWASA (the PCN received from Team A suggests that Bangladesh Water Development Board is the main implementing agency but we believe it should be DWASA)
Required coordination mechanisms	Coordination required with BWDB, RAJUK, RHD, DCC, LGED and FD.
Existing policies/institutions to facilitate implementation	<ul style="list-style-type: none"> <li>Chapter 9.7 (Part 2) of the Seventh FYP provides that there will be a review of existing city corporation laws, regulations and introduce appropriate framework to cope with present urban needs, and that city corporations will all need urban planning sections.</li> <li>Chapter 8.6 (Part 2) of the Seventh FYP also outlines a number of efforts planned for Greater Dhaka.</li> <li>Chapter 8.6 (Part 2) of the Seventh FYP provides for the formation of an inter-ministerial Steering Committee to oversee the processing and implementation of greater Dhaka environment programmes</li> <li>MoWR Task Force established to develop new institutional framework for WRM may assist with implementation</li> <li>The Guidelines for Integrated Planning for Sustainable Water Resources Management set out the institutions and procedures for planning, O&amp;M, participatory M&amp;E, and training for FCD projects</li> <li>The general thrust of all recommended actions under the Bangladesh Climate Fiscal Framework 2014 is to facilitate access to climate finance, and to ensure that climate change finance is deployed in the most effective way. So, to the extent that this project seeks to address the impact of climate change, and is of sufficiently high priority, this policy</li> </ul>



		<p>should help to ensure it gets funded. Appendix 2 classifies flood control projects as significantly relevant to CC mitigation/adaption (second highest ranking)</p> <ul style="list-style-type: none"> <li>• Bangladesh Climate Change Resilience Fund (BCCRF), Strategic Program for Climate Resilience may assist with implementation</li> <li>• Bangladesh Climate Change Strategy and Action Plan 2009 includes projects like this within its action plan, and accordingly facilitates the project's implementation (refer to the Annex).</li> <li>• National Environment Committee, National Steering Committee on Climate Change, Inter-Ministerial Disaster Management Committee, National Disaster Management Advisory Committee each may assist with implementation</li> </ul>
Desirable initiatives	capacity building	Necessary assistance of NGOs as in other projects for community mobilization, raising awareness and sustainable livelihood.
Required reforms	policy/regulatory	<ul style="list-style-type: none"> <li>• Implementation of the recommendations in the November 2014 Final Report on Institutional Improvement of BWDB</li> <li>• Bangladesh Climate Fiscal Framework 2014 recommends merging the Bangladesh Climate Change Resilience Fund and Climate Change Trust Fund to prevent duplication. It also generally recommends stronger and more integrated climate change planning</li> <li>• Bangladesh Climate Fiscal Framework 2014 recommends implementing a climate fiscal cell in the FD of MoF</li> </ul>
Overall Project Assessment		
Priority		<p>Priority is high as the actual system does not comply with the current required level of flood risk. The project will have a strong effect on the livability of the area.</p> <ul style="list-style-type: none"> <li>• Direct or indirect benefits offset implementation costs in all delta scenarios: The NPV of this project is estimated to be BDT 2,963 million</li> <li>• Implementing agencies have the knowledge base to implement these types of projects locally (with some limited guidance and support if needed). As indicated above, we believe that DWASA should be the leading authority to implement this project. Implementation has to be coordinated with other institutions including BWDB. In addition to increasing capacity of DWASA, participation of NGOs is needed, especially to increase awareness of the people that will be affected by the implementation to increase sustainability of the project.</li> <li>• Implementing the project will reduce vulnerability to future uncertainties such as sea level rise and flooding. The project will improve drainage and will reduce flood risks. The project goals are to reduce risks, but do not indicate up to what level flood risks must be reduced. There is no indication of return periods. Therefore, it can not be concluded whether the interventions will be sufficient to reach this level. However, it is obvious that improving the drainage capacity and reducing flood risks will improve the livelihood in the affected areas and therefore are short term under each of the scenarios. In further detailing of the projects, climate change should be considered and other ADM principles should be included to come to an optimum solution in the short and medium to long term.</li> </ul>



	<ul style="list-style-type: none"> <li>The project has no hard trade-offs with other policy objectives. In view of the above, with the necessary changes in the project design, this initiative can be classified as a short term project.</li> </ul>
State of readiness	As indicated earlier, the project is formulated on the basis of a feasibility study done in 2004. The feasibility study covers an EIA and an SIA. Since then, significant changes have taken place in relation to the quantity and the quality of the water. Furthermore, social, environmental, and demographic changes make it necessary to update the feasibility study with associated studies. This study should also encompass a CBA.
<b>Additional information or work required</b>	
Results framework and M&E arrangements	The PCN provides little information concerning M&E. The BDP2100 Batch 3 log frame presents the goals and purpose of the project, but these are very general and should be developed and refined. Criteria on input and output are straightforward, but may need adjustments for ADM-related design changes. The PCN specifies no criteria for quality and time, and lacks a monitoring plan.

**UA 10.1 Improvement of Sanitation, Drainage Congestion and Flood Control for Chattogram City Corporation Area**

<b>Brief Project Description</b>	
<p><b>The purpose of the project is to:</b></p> <ul style="list-style-type: none"> <li>Improve the current grave sanitary conditions and reduce public health risks and pollution as much as possible</li> <li>Reduce urban flooding and waterlogging in Chattogram city area.</li> </ul> <p>Specific objectives are to improve the functioning of the sewerage, faecal sludge management, drainage improvement, and solid waste management.</p> <p>The City of Chattogram has an area of about 155km<sup>2</sup> with a population of about 2.8 million. About 34 khals totaling about 110km in length run through the city. These khals have been silted up by the runoff from the hills and the solid waste dumped by the city dwellers. Moreover, the khals have been narrowed down due to absence of regular maintenance, unplanned urbanization, and encroachment. These have caused severe drainage congestion in the city of Chattogram.</p> <p>The project has (i) sewerage, (ii) faecal sludge management, (iii) drainage, and (iv) solid waste management components and will be implemented in three phases: (Phase I (2016-18), Phase II (2016-23), Phase III (2023-30).</p> <p>The project was first conceptualized in the early 1990s. Implementation has been delayed, however, because of a lack of funding, a change of scope, and the involvement of multiple sectors and agencies. The project was included as part of a master plan prepared by the Chattogram Development Authority in 1995 for a 20-year period (up to 2015). This plan was not fully implemented, however, because of a lack of funding. This project is now part of a Drainage Master Plan currently under preparation. The Drainage Master Plan is expected to be completed by June 2017.</p>	
<b>Problem/Challenges the Project Aims to Address</b>	
Chattogram city does not have a formal sewage collection system. Sanitation services are informally carried out by discharging sewage directly into the inadequate surface drains of the city, while retaining (often only partially or temporarily) the faecal sludge within septic tanks. While cleaning the septic tanks, most of the faecal sludge is also discharged into the drains or directly to the open space.	

Chattogram city does not have a formal sewage collection system. Sanitation services are informally carried out by discharging sewage directly into the inadequate surface drains of the city, while retaining (often only partially or temporarily) the faecal sludge within septic tanks. While cleaning the septic tanks, most of the faecal sludge is also discharged into the drains or directly to the open space.

The sewage is eventually discharged untreated into the khals, rivers, or the sea in Chattogram, along with storm water, solid waste, silt, and debris.

The key drainage congestion and urban flooding in Chattogram city are caused by the combination of rainwater and frequent tidal variation in Karnaphuli River. The old aged drainage infrastructure, the fact that is poorly maintained, illegal dumping of solid waste, heavy sedimentation in khals and lack of tidal control regulators at the mouth of each khal are the root causes for frequent flooding.

**Major solid waste management problems arise because:**

- Waste collection is inefficient due to a number of reasons: demountable containers are not transported to the landfill on a daily basis; waste collection points are poorly monitored; and the city lacks standards for placement of collection points.
- Approximately 30 percent of waste collection vehicles are out of order
- The City lacks a weigh bridge for waste monitoring
- Approximately 200 tons of waste per day is not collected (out of an estimated 1200 tons per day generated)
- A substantial portion Chattogram City Corporation resources are used to clean drains, especially due to waste disposal
- The City lacks organic waste recycling measures despite the majority of waste being compostable
- Landfill sites at Haliashahar and Arefin Nagar are not operated as sanitary landfills (however, ADB funding is currently being directed to the Arefin Nagar site).

**The project will contribute to the following BDP 2100 goals:**

- Goal 1: safety from floods and climate change related disasters
- Goal 2: water security and efficiency of water usages

**Links to Existing Policies and Initiatives**

- Links to numerous objectives in the 7th Five Year Plan, including those set out in Chapter 2.2 of Part 1 and the following Chapters of Part 2:
    - Agriculture: 4.2, 4.3, 4.6
    - Local Government and Rural Development: 7.2
    - Environment and Climate Change: 8.3, 8.5, 8.6
    - Housing and Community Amenities: 9.3, 9.7
    - Social Protection: 14.2, 14.4
  - Projects meet Objectives, Targets, and Strategies in National Policy for Safe Water Supply & Sanitation (1998), notably sections regarding Urban Water Supply and Sanitation. Links to a number of policy issues such as:
    - Taking necessary measures for storage and use of rain water (Objective G),
    - Ensuring sanitary latrine within easy access of every urban household through technology options ranging from pit latrines to water borne sewerage (Target iv),
    - Taking measures in urban areas for removal of solid and liquid waste and their use in various purposes. Ensuring the use of waste for the production of organic fertilizer (compost) in the rural areas (Target viii),
    - Adoption of necessary measures in urban areas to prevent contamination of ground and surface water by solid and liquid wastes (Strategy Q)
- Project fits overall strategy of National Water Management Plan (NWMP) and links to all three NWMP immediate objectives.
- Links directly to Large and Small Town Flood Protection under NWMP Programs for Major Cities and other similar programs aimed at Chattogram flood mitigation such as Chattogram Flood Protection (MC012) and Chattogram Stormwater Drainage (MC013).

- Links to numerous goals in National Water Management Plan Development Strategy including: Major Cities (Water supply/sanitation, flood protection and storm water drainage), Disaster Management (Cyclone protection, flood proofing, riverbank maintenance and erosion control), and Natural Environment and Aquatic Resources (Water management for ecologically sensitive areas, supporting environment measures)
- Links to overall objectives and strategies of National Sanitation Strategy
- Applies to overall objectives of Coastal Development Policy and follow-on Strategy Targets/Strategic Priorities (Ensuring fresh and safe water availability, safety from man-made and natural hazards, promoting economic growth, sustainable and equitable management of natural resources, improving livelihood conditions, environment conservation), and associated Investment Program.
- Flood protection and proofing are key parts of the UNDP Coordination of Cyclone Rehabilitation (1991)
- Continues the disaster management goals of the Comprehensive Disaster Management Program
- Links to National Adaption Programme of Action (2005) adaption needs and intervention measures
- Links to objectives of the National Sustainable Development Strategy in areas such as water resource management, disaster management, and urban environment.
- Links to objectives of the National Water Policy (1999) such as harnessing/development of all forms of surface/groundwater as well as being in line with proposed Government actions under Planning and Management of Water Resources, Water for the Environment, Water Supply and Sanitation.
- Helps to achieve the objectives of a number of the programmes outlined in the Bangladesh Climate Change Strategy and Action Plan 2009 Annex, principally under the Food Security, Social Protection and Health and Infrastructure pillars/themes.
- Links to National Food Policy 2006 Plan of Action 3.5: safe drinking water and improved sanitation

<b>Technical Assessment</b>	
Technical description of project	<p><b>Sewerage:</b></p> <ul style="list-style-type: none"> <li>• Expansion of collection system</li> <li>• Interceptors</li> <li>• Land acquisition</li> </ul> <p><b>Faecal sludge management:</b></p> <ul style="list-style-type: none"> <li>• Expansion of faecal sludge treatment plant</li> </ul> <p><b>Drainage improvement:</b></p> <ul style="list-style-type: none"> <li>• Cleaning of khals</li> <li>• Conversion of drains</li> <li>• Sluice gates</li> <li>• Wall/roadside/embankment</li> </ul> <p><b>Solid waste management:</b></p> <ul style="list-style-type: none"> <li>• Replacement of waste bins</li> <li>• Source separation of waste</li> <li>• Container trucks</li> </ul>
Evaluation of project feasibility	<p>From a technical point of view, this project is feasible. However, to ensure that this project will be successful, mere technical implementation will not be sufficient. To improve the sewerage treatment and waste disposal, there needs to be strong focus on institutional, social, and financial aspects as well. The interventions should be an integral part of urban development plans of the city.</p>

<b>Costs (2015 Prices)</b>	
Capital costs	According to the feasibility study, as reported in the PCN, the estimated capital costs are: Financial: 31,062.5 million BDT Economic: Not mentioned in Master Plan
O&M costs	According to the feasibility study, as reported in the PCN, the estimated annual O&M costs are: Financial: 1,148.5 million BDT Economic: Not mentioned in Master Plan
Evaluation of financial estimates	The benefit-cost ratio is not available, because the environmental and socio-economic benefits of the proposed project have not been quantified. It is advised to update the feasibility study to include these benefits.
Potential environmental costs	--
Potential socio-economic costs	Resettlement of population is necessary to implement the project, and to maintain the khals. This will lead to higher costs.
<b>Benefits</b>	
Potential environmental benefits	<ul style="list-style-type: none"> <li>Major environmental benefits can be expected, but have not been quantified.</li> <li>Recharging of ground water in the project area</li> </ul>
Potential socio-economic benefits	<ul style="list-style-type: none"> <li>Following the environmental improvements, health benefits are also expected, improving livelihood of the population. These benefits have neither been quantified.</li> </ul>
Linkages to Other Projects	The project links to several others under implementation by the Chattogram Development Authority (CDA), based on the CDA Master Plan. For example, the development of a new township in Fotyabad (July 2013 to June 2018) bringing about changes in road connectivity, transportation, residential and commercial activities, etc.
<b>ADM Principles</b>	
<p>For this intervention, it is important to include sufficient flexibility to answer to the challenges included in the CDA Master Plan. This means that the actual challenges have to be faced considering the possible challenges of the future.</p> <p>The setup of the project focuses on the structural interventions to face these challenges. The short term decisions are made to solve existing problems. No information is available on whether long-term scenarios are considered, such as climate change, economic development, technological development, or demography.</p> <p>This project can improve on flexibility in relation to timing of the needed interventions and working with smaller units that could form part of a modular set up, e.g. for faecal sludge treatment. Parts of the project could be financed by the private sector. Furthermore, finding the proper financial instruments to operate and maintain the system in a sustainable manner is crucial in the mid- and long-term and could also provide the needed flexibility to become more adaptive to changing circumstances.</p>	
<b>Linkages to Climate Change Adaptation</b>	
In the design of the new or restored water bodies (khals), climate change must be accounted for to assure that the water system will comply with the required flood safety levels and that the discharge/drainage capacity is available to drain storm water from the urban areas. Furthermore, the	

capacity of the drainage system depends on tidal movements in the river. This means that with sea level rise, high tide will reduce the drainage capacity. This must be included in the design of the system.

**Private sector financing potential**

Sewerage Treatment Plants and Solid Waste management projects, together, form nearly 50 percent of the total project costs. PPPs could be used to develop these water treatment or sewerage treatment plants. PPPs are a well-established way for developing treatment plants in several parts of the world. Even countries like India with similar social and tariff issues are starting to develop a reasonable track record of developing PPPs for water treatment plants.

It is possible that the WASAs may need to finance part of the capital costs to keep the tariffs low. However, on an overall lifecycle cost basis, PPPs are likely to be cheaper even with this contribution since the projects are likely to be maintained properly and will, therefore, need lower replacement costs. This is particularly true for sewerage treatment plants since, apart from Dhaka WASA, no other WASAs in the country have the experience of operating and maintaining such plants.

**Policy and Institutional Reform**

Main implementing agencies	CWASA
Required coordination mechanisms	<p><b>Coordination required with</b></p> <ul style="list-style-type: none"> <li>• Chattogram City Corporation (CCC) for Rehabilitation and Improvement of Drainage Networks, Roads, and Bridges</li> <li>• Bangladesh Water Development Board (BWDB) for Protection of River Flood</li> <li>• Chattogram Development Authority for development of planned real estate –Commercial and Residential in the City.</li> </ul>
Existing policies/institutions to facilitate implementation	<ul style="list-style-type: none"> <li>• Chapter 7.2 (Part 2) of the Seventh FYP notes that special attention is needed for urban local government development, including to facilitate community-based fecal and solid waste management. Chapter 8.6 notes that Chattogram has especial need for drainage plans / rehabilitation of existing drainage systems.</li> <li>• Chattogram WASA may assist with implementation</li> <li>• MoWR Task Force established to develop new institutional framework for WRM</li> <li>• The Guidelines for Integrated Planning for Sustainable Water Resources Management set out the institutions and procedures for planning, O&amp;M, participatory M&amp;E, and training for FCD projects</li> <li>• The general thrust of all recommended actions under the Bangladesh Climate Fiscal Framework 2014 is to facilitate access to climate finance, and to ensure that climate change finance is deployed in the most effective way. So, to the extent that this project seeks to address the impact of climate change, and is of sufficiently high priority, this policy should help to ensure it gets funded. Appendix 2 classifies flood control projects as significantly relevant to CC mitigation/adaption (second highest ranking)</li> <li>• Bangladesh Climate Change Resilience Fund (BCCRF), Strategic Program for Climate Resilience may assist with implementation</li> </ul>

		<ul style="list-style-type: none"> <li>• Bangladesh Climate Change Strategy and Action Plan 2009 includes projects like this within its action plan, and accordingly facilitates the project's implementation (refer to the Annex).</li> <li>• National Environment Committee, National Steering Committee on Climate Change, Inter-Ministerial Disaster Management Committee, National Disaster Management Advisory Committee may each assist with implementation</li> </ul>
Desirable initiatives	capacity building	<p>This large project requires capacity building programs aimed at smooth operation and maintenance of sewerage, faecal sludge management, drainage, and solid waste management. Training on best practices observed in other cities may be offered so as to make the project sustainable.</p> <p>Local government and other stakeholders can be involved to increase the awareness of the people and to educate them about the waste management and 3R (Reduce, Reuse and Recycle) practices.</p>
Required reforms	policy/regulatory	<ul style="list-style-type: none"> <li>• Implementation of the recommendations in the November 2014 Final Report on Institutional Improvement of BWDB</li> <li>• Bangladesh Climate Fiscal Framework 2014 recommends merging the Bangladesh Climate Change Resilience Fund and Climate Change Trust Fund to prevent duplication. It also generally recommends stronger and more integrated climate change planning</li> <li>• Bangladesh Climate Fiscal Framework 2014 recommends implementing a climate fiscal cell in the FD of MoF</li> </ul>
Overall Project Assessment		
Priority		<p>This project has high priority as the actual situation leads to many problems in relation to flood risks and health risks.</p> <ul style="list-style-type: none"> <li>• Direct or indirect benefits offset implementation costs in all delta scenarios. The NPV of this project is not available</li> <li>• Implementing agencies have the knowledge base to implement these types of projects locally (with some limited guidance and support if needed). CWASA will be the implementing agency. This large project requires capacity building programs aimed at smooth operation and maintenance. Local government and other stakeholders can be involved to increase the awareness of the public.</li> <li>• Implementing the project will reduce vulnerability to future uncertainties such as sea level rise and flooding. The project will improve drainage, reduce flood risk, and improve the sanitary conditions. The planned interventions will make a first start to improve the actual situation. Further actions will be required to achieve the actual objectives outlined in, for example, the Seventh Five Year Plan. In further detailing of the projects, climate change should be considered and other ADM principles should be included to come to an optimum short term intervention that faces actual challenges and anticipates medium to long term developments.</li> <li>• The project has no hard trade-offs with other policy objectives.</li> </ul> <p>In view of the above, with the necessary changes in the project design, this initiative can be labelled as a short term project.</p>



<p>State of readiness</p>	<p>There is no feasibility study available. The project is also lacking an EIA, SIA, and CBA. Most information used for the project concept is taken from the CWASA master plan of 2015. BWDB is currently preparing a DPP for the project.</p> <p>We suggest renaming the project, “Improvement of Sanitation and Drainage Congestion, Flood &amp; Disaster Management in Chattogram City Corporation Area.”</p>
<p>Additional information or work required</p>	<p>It is important to ensure that the planned interventions are optimally integrated with the activities of the Chattogram Development Authority Master Plan.</p>
<p>Results framework and M&amp;E arrangements</p>	<p>The BDP2100 Batch 2 log frame describes the goals, the purpose, the required outputs, and the inputs.</p> <p>Output and input criteria are very well defined, but no indications are given in relation to quality and timing. This is necessary to be able to develop a thorough M&amp;E plan.</p> <p>Criteria related to objectives and purpose are provided on a very high project level and do not take in to consideration the possibility of a phased approach where the implementation of the embankment project will follow the demographic development of the city.</p> <p>Objective and purpose criteria could be made more specific and time dependent, but what is even more important is to ensure that the responsibility for M&amp;E is embedded in the organizational structure and that the results of M&amp;E lead to adaptation of the objectives or the interventions.</p>



#### 1.6.4 Haor and Wetlands

### HR 2.2 Improved Water Management in Haor Basins and HR 2.1 (3.1) Village Protection against Wave Action in Haor Area (Combined)

Brief Project Description
<p>The purpose of this project is to improve socio-economic living conditions and reducing flood damages.</p> <p><b>The specific objectives are:</b></p> <ul style="list-style-type: none"><li>• To rehabilitate 25 existing Haor schemes to protect agriculture and fisheries</li><li>• To protect from flash flood</li><li>• To protect villages from wave action and erosion</li><li>• To improve pre and post monsoon drainage</li><li>• To improve conveyance capacity and navigability of the principal rivers of Haor</li><li>• To protect immovable property</li><li>• To protect social facilities</li><li>• To ensure sustainable livelihood</li><li>• To develop a green belt.</li></ul> <p>There are altogether 373 Haors distributed in the districts of Sylhet, Sunamganj, Moulvibazar, Habiganj, Netrakona, and Kishoregonj. The region is situated just below the hilly regions of states of Assam, Meghalaya, and Tripura of India. The Haor basins are spread over the north-eastern region of Bangladesh encompassing an area of around 8,000km<sup>2</sup> and home to about 20 million people.</p> <p>The annual rainfall ranges from 2,200mm along the western boundary to 5,800mm in its northeast corner. The principal rivers of the region are Surma, Kushiya, Manu, Khowai, and Someswari, which have catchments in the hills of India. Other important rivers are Baulai, Kalni, Jadukata, and Kangsa. Haors are connected with the main rivers by numerous small rivers and khals. All these rivers discharge into the Meghna at Bhairab Bazar.</p> <p>The Haor basins are flooded for 5 to 6 months per year, leaving fertile lands for when these areas dry up. However, it is very uncertain when these areas will dry up. Flash floods in the pre-monsoon period sometimes occur, which puts boro rice crops at risk. These flash floods also damage the existing higher areas where households are located. The erosion of these areas cause significant damage to the villages located in the Haors. Flash floods and wave action due to strong winds damage the existing dikes. Most villages are located in the few elevated areas. Because of large scale erosion, households are being threatened.</p> <p>Due to physical setting, the area is underdeveloped. Communication facilities are very poor. The region remains under water almost throughout the year, with the exception of homesteads built on raised platforms. The inhabitants cultivate crops during the January-February to March-April period when the area near the banks of the Haors are exposed. As a consequence of this natural setting, the people of this area during this period cultivate only one crop: boro rice. However, occasional early flash floods damage the crops. Annual inundation causes fertile silt deposits on the land that contribute to the high yield of the boro rice.</p> <p>The village protection plan aims to improve the quality of life for the people of Haor area to protect the earthen platforms from erosion caused by wave action during the wet season. As such, there is a need to rehabilitate the existing infrastructures and manage the water resources. The project is therefore aimed to protect the villages from wave action, which causes huge damage to life and livelihood in the Haor areas.</p>

### **Problem/Challenges the Project Aims to Address**

The Haor area usually suffers from early flash floods, which damage boro rice crops and other water management infrastructures, livelihood of the people and biodiversity in the area. Consequently, socioeconomic conditions of the people of the area could further deteriorate. There is a need for conserving biodiversity, sustaining fisheries, and increasing agricultural production, through environmentally benign water management measures in order to improve the socio-economic conditions of the community in the area.

#### **Main problems are:**

- Early flash flooding in some years is the main problem of the Haor area. This affects the primary production sector and thus threatens the livelihood of the inhabitants in the Haors
- Flash floods damage the only crop, so the inhabitants remain in a distressed condition until the next year's harvest. This is a major concern for the area as well as for the whole nation as the crop yield of the area is substantial.
- Infrastructure is severely damaged by flash floods and wave action, which are not favorable for the Haor water management system.

Furthermore, the majority of the people of the Haor area use raised earthen platforms for their domiciles, however these platforms are vulnerable to wave action. Bamboo and tarja fencing used for platform protection often become ineffective. The patch of hijal and koroach tree in front of the villages acts as a fence against wave action to protect the villages. At present, some isolated plants are also used for this purpose.

There is a need for conserving biodiversity, sustaining fisheries, and increasing agricultural production through environmentally benign water management measures in order to improve the socio-economic conditions of the community.

#### **The project aims to contribute to the following BDP 2100 goals:**

- Goal 1: safety from floods and climate change related disasters
- Goal 4: conserve and preserve wetlands and ecosystems and promote their wise use
- Goal 6: optimal and integral use of land and water resources.

### **Linkages to Existing Policies and Initiatives**

- Links to numerous objectives in the 7th Five Year Plan, including those set out in Chapter 1.8 of Part 1 and the following Chapters of Part 2:
  - Agriculture: 4.2, 4.3, 4.4, 4.6
  - Environment and Climate Change: 8.5, 8.6
  - Social Protection: 14.4, 14.6
- Project fits overall strategy of National Water Management Plan and links to all three NWMP immediate objectives:
  - 1. Rational management and wise use of Bangladesh's water resources
  - 2. People's quality of life improved by the equitable, safe and reliable access to water for production, health and hygiene
  - 3. Clean water in sufficient and timely quantities for multipurpose use and preservation of the aquatic and water dependent ecosystem.
- Links to numerous goals in the National Water Management Plan Development Strategy, including:
  - Main River Development (erosion control)
  - Towns and Rural Areas (water supply, flood protection)
  - Disaster Management (flood proofing, riverbank maintenance and erosion control)

- Agriculture and Water Management (public irrigation development, river maintenance, flood control/drainage)
- Natural Environment and Aquatic Resources (water management for ecologically sensitive areas, supporting environment measures)
- Applies to overall objectives of Coastal Development Policy and follow-on Strategy Targets/ Strategic Priorities (ensuring fresh and safe water availability, safety from man-made and natural hazards, promoting economic growth, sustainable and equitable management of natural resources, improving livelihood conditions, environment conservation), and associated Investment Program.
- Links to numerous intervention areas in Master Plan for Haor Areas, most notably the development strategy (improved water and disaster management, agriculture development and food security, improved physical infrastructure)
- Flood protection is part of the UNDP Coordination of Cyclone Rehabilitation (1991)
- Continues the disaster management goals of the Comprehensive Disaster Management Program
- Links to National Adaption Programme of Action (2005) adaption needs and intervention measures
- Links to objectives of the National Sustainable Development Strategy in areas such as water resource management, disaster management, and land/soil.
- Links to objectives of the National Water Policy (1999) such as harnessing/development of all forms of surface/groundwater as well as being in line with proposed Government actions under Planning and Management of Water Resources, Water for Preservation of Haors, Baors, and Beels
- Helps to achieve the objectives of a number of the programmes outlined in the Bangladesh Climate Change Strategy and Action Plan 2009 Annex, principally under the Food Security, Social Protection and Health and Infrastructure pillars/themes.
- Links to National Food Policy 2006 Objective 1: Adequate and stable supply of safe and nutritious food, and NFP Plan of Action 2.1: Agricultural disaster management (enhance disaster preparedness)

<b>Technical Assessment</b>	
Technical description of project	<p>The proposed project is a rehabilitation of 25 BWDB schemes. Within this project there are several interventions foreseen:</p> <ul style="list-style-type: none"> <li>• Construction of 6-vent Regulator = 1 nos.</li> <li>• Construction of 2-vent Regulator = 3 nos.</li> <li>• Repair/Re-sectioning of Embankment= 250km</li> <li>• Re-excavation of River= 50km</li> <li>• Re-excavation of Khal, Canal, Drainage Channel= 200km.</li> <li>• Other works include:</li> <li>• Repair of Regulator, Pipe Sluices, Gates, Culverts</li> <li>• Bank Protection Works</li> <li>• Repair of Public Cuts.</li> <li>• Construction of a 74km (202 nos.) revetment work</li> <li>• Construction of 180 nos. of stair and ramp work</li> <li>• Establishment of a 37km green belt</li> <li>• Development of 17 nurseries</li> </ul>
Evaluation of project feasibility	<p>The measures are mostly structural and are feasible in a technical sense. However, a number of aspects have to be covered more thoroughly, as a unidimensional technical approach will not be sustainable over time. Maintenance of the intervention will be needed on a continuous basis. This must become intrinsic and</p>

	<p>inclusive. If damage to the structures is not repaired as soon as possible, erosive processes will speed up.</p> <p>Maintenance is extremely important to ensure that these interventions will be effective on the long run. Regular monitoring is required to ensure that damages are repaired as soon as possible after they have occurred.</p>
<b>Costs (2015 Prices)</b>	
Capital costs	<p>The capital costs are presented for the two separate projects. We recommend redoing the CBA for the combined project to account for projected synergies.</p> <p>According to the feasibility study (2011) as reported in the PCN, the estimated capital costs for project 2.2 (improved water management) are:  Financial: 2,592 million BDT  Economic: 1,812 million BDT</p> <p>According to the feasibility study (2011) of project 2.1/3.1 (protection against wave action), the estimated capital costs are:  Financial: 5,474 million BDT  Economic: 4,212 million BDT</p>
O&M costs	<p>According to the feasibility study of project 2.2 (improved water management), as reported in the PCN, the estimated annual O&amp;M costs are:  Financial: 117 million BDT  Economic: 81 million BDT</p> <p>The annual O&amp;M costs for the program to protect the villages against wave action are:  Financial: 97 million BDT  Economic: 74 million BDT</p>
Evaluation of financial estimates	<p>The calculated benefit-cost ratio for project 2.2 is 4.37. For project 2.1/3.1 no such ratio is available, as no benefits have been quantified.</p> <p>As stated in the PCN concerning project 2.2, the flood protection benefits (damage reductions with respect to crop production) are methodologically correct, calculated using a 'with' and 'without' project scenario. However, some other benefits have not been quantified.</p> <p>The measures to protect the villages against wave action need a more detailed feasibility study including CBA. The information in the Haor Area Master Plan is insufficient for this purpose.</p>
Potential environmental costs	--
Potential socio-economic costs	--
<b>Benefits</b>	
Potential environmental benefits	The development of greenbelt may contribute to ecological benefits. Also, solving drainage congestion may lead to positive environmental impacts. Both potential impacts have not been quantified yet.

Potential socio-economic benefits	<p>The main benefits relate to preventing crop loss and damage of homestead areas:</p> <ul style="list-style-type: none"> <li>• Total saved output of boro rice is estimated at 64,085 tons, resulting in a total benefit of 1,382 million BDT.</li> <li>• Local communities will be protected from floods and wave action, assessed at a total of 202 homestead areas.</li> <li>• Navigability will benefit (not quantified)</li> <li>• Communication facilities will benefit (not quantified)</li> <li>• Health, Sanitation and Education facilities will benefit (not quantified)</li> </ul>
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### Linkages to Other Projects

This project is linked to these 25 schemes of BWDB constructed earlier. The project will also be affected by and linked to the JICA Haor Flood Management and Livelihood Improvement Project

		<i>(Duration in year and Cost in lakh taka)</i>				
DA Code	Project Title	Duration	Short Term	Medium Term	Long Term	Total cost
<b>Water Resources</b>						
WR-01	Pre-Monsoon Flood Protection and Drainage Improvement in Haor Areas	5	12,550			12,550
WR-02	Flood Management of Haor Areas	7		81,643		81,643
WR-03	River Dredging and Development of Settlement	5	48,970			48,970
WR-04	Development of Early Warning System for Flash Flood prone areas in Haor and dissemination to Community Level	4	768			768
WR-05	Village Protection against Wave Action of Haor Area	3	31,046			31,046
WR-06	Monitoring of the Rivers in Haor Area	4	900			900
WR-07	Impact study of the interventions of transboundary river system	5	1,500			1,500
WR-08	Study of the Climate Change impact of Haor areas	2	800			800
<b>Total</b>			<b>96,534</b>	<b>81,643</b>		<b>178,177</b>

### ADM Principles

The Haor Area Master Plan anticipates different development scenarios. It ensures adequate, sufficient measures by connecting short term decisions to long term delta needs (like Flood Protection, Drainage and Habitat Management). Given the different initiatives it provides sufficient flexibility to address uncertainties and to invest in real needs. Finally, it addresses not only flood risks and erosion, it also pays attention to socioeconomic activities as well as ecosystem management.

It is extremely important that the different components of the project are addressed in an integrated manner, considering all the initiatives in the region, including initiatives directed at infrastructure, mobility, economic development, agriculture, aquaculture, education, health, etc.

Impact of projects on a broad range of objectives included in the Seventh 5-Year Plan will be stronger if these initiatives are planned in a more integrated manner. Relatively small scale interventions can be carried out, and in the proper planning of these interventions there will be strong flexibility in adapting to changing circumstances. These changing circumstances are not only climate change related. These interventions will directly influence potential for regional development and as such have to consider regional plans and challenges.

Considering the interconnectivity of river systems, it is crucial that the up and downstream effects of interventions are assessed. Interventions as construction of new dikes and deepening drainage canals will change the water system and will therefore change flood risks and erosion processes in other areas. These effects have to be considered when planning interventions.

**Linkages to Climate Change Adaptation**

The initiatives mentioned in the Haor Master Plan are very strongly related to climate change. Climate change will have a strong effect on precipitation patterns and therefore how the characteristics of dry spells and flash floods will change. Plans for intervention must consider the climate change effects in the watersheds to mitigate potential damage.

Climate change will affect all economic (agriculture, aquaculture, access to markets, etc), social (flood risks, disruption, loss of lives, etc.), and ecologic development in the region. Hydrological and hydraulic changes are expected to increase the challenges in relation to water quantity.

**Private Sector Financing Potential**

**This project does not have any significant private sector financing potential.**

**Policy and Institutional Reform**

Main implementing agencies	DBHWD BWDB
Required coordination mechanisms	<p>The projects have not proposed any institutional change or reform, but mention the requirement of additional manpower for DBHWD (the proposing organization).</p> <p>Since the project will follow a Multi Sectoral &amp; Multidisciplinary approach in the project cycle, the lead partner Agencies/ Stakeholders DBHWD, BWDB, DOF, DAE, LGED, DoEF and LGIs will implement the project. This means that strong coordination is needed and that these organizations have the proper personnel with the needed capabilities to implement and to coordinate.</p> <p>It is also needed to ensure that there is sufficient coordination for operation and maintenance of the interventions. This requires specialized departments that are responsible for these activities. These are insufficiently developed at the moment. The DPP has to include a thorough description of how O&amp;M will be organized during the years after project implementation, and how this will be financed and organized in sustainable manner.</p>
Existing policies/institutions to facilitate implementation	<ul style="list-style-type: none"> <li>• Chapter 4.3 (Part 2) of the Seventh FYP provides that agricultural research to address such issues will be prioritized for Haor areas.</li> <li>• Chapter 8.6 (Part 2) of the Seventh FYP states that watershed management and wetland conservation will be initiated in the Haor regions.</li> <li>• National Agricultural Research System (NARS) organizations (Seventh FYP Chapter 4,3 (Part 2)), Bangladesh Agricultural Research Institute, and the Bangladesh Agricultural Research Council may assist with implementation</li> <li>• National Water Resources Council may assist with implementation</li> </ul>



	<ul style="list-style-type: none"> <li>• MoWR Task Force established to develop new institutional framework for WRM</li> <li>• Guidelines for Integrated Planning for Sustainable Water Resources Management set out the institutions and procedures for planning, O&amp;M, participatory M&amp;E, and training for FCD projects</li> <li>• The general thrust of all recommended actions under the Bangladesh Climate Fiscal Framework 2014 is to facilitate access to climate finance, and to ensure that climate change finance is deployed in the most effective way. So, to the extent that this project seeks to address the impact of climate change, and is of sufficiently high priority, this policy should help to ensure it gets funded. Appendix 2 classifies Haor management projects as somewhat relevant to CC mitigation/adaption (third highest ranking)</li> <li>• Bangladesh Climate Change Strategy and Action Plan 2009 includes projects like this within its action plan, and accordingly facilitates the project's implementation (refer to the Annex).</li> <li>• National Environment Committee, National Steering Committee on Climate Change, Inter-Ministerial Disaster Management Committee, and the National Disaster Management Advisory Committee may assist with implementation</li> </ul>
Desirable capacity building initiatives	As stated above, a strong coordination is needed and the organizations involved should have the proper personnel with the needed capabilities to implement and to coordinate. Also, sufficient coordination for operation and maintenance of the interventions is required. Both issues may call for capacity building.
Required policy/regulatory reforms	<ul style="list-style-type: none"> <li>• Implementation of the recommendations in the November 2014 Final Report on Institutional Improvement of BWDB</li> <li>• Bangladesh Climate Fiscal Framework 2014 recommends merging the Bangladesh Climate Change Resilience Fund and Climate Change Trust Fund to prevent duplication. It also generally recommends stronger and more integrated climate change planning</li> <li>• Bangladesh Climate Fiscal Framework 2014 recommends implementing a climate fiscal cell in the FD of MoF.</li> </ul>
<b>Overall Project Assessment</b>	
Priority	<p>The priority of these project is high as flooding and erosion are seriously threatening the lives and economic development in the region. These interventions will provide a more stable basis for local municipalities and populations to develop.</p> <ul style="list-style-type: none"> <li>• Direct or indirect benefits offset implementation costs in all delta scenarios. The NPV of this project is estimated to be BDT 5,212 million</li> <li>• Implementing agencies have the knowledge base to implement these types of projects locally (with some limited guidance and support if needed). The responsibility for the implementing this project lies with BWDB and DBHWD. They have extensive experience with these types of projects. However, if many</li> </ul>



	<p>projects are being implemented at the same time, it becomes questionable if BWDB has sufficient personnel to manage all projects. Also, DBHWD needs additional manpower. For this project, it is important that there is efficient coordination between the different organizations involved. All these organizations need the capacity building to carry out their share of the responsibilities. These responsibilities include operation and maintenance of the waterworks.</p> <ul style="list-style-type: none"> <li>Implementing the project will reduce vulnerability to future uncertainties such as sea level rise and flooding. As indicated above, the region suffers increasingly from flash floods. The objectives include the rehabilitation of 25 existing Haor schemes, protection of agriculture and fisheries, and protection of villages from wave action and erosion to ensure sustainable livelihood. People and property are not protected sufficiently, and these projects improve that protection. With that, it facilitates economic, social, and natural development in the region. Many additional activities will be required to establish a certain base level that is required according to the different national and regional strategies.</li> </ul> <p>It is not indicated in the PCN whether these design specifics also consider climate change effects in relation to precipitation and discharge patterns. These should be considered in the further planning and design of this proposed project, but should also be related to the identification of a certain minimum flood safety level that is required. ADM principles should be included in further detailing of the plans as well.</p> <ul style="list-style-type: none"> <li>The project has no hard trade-offs with other policy objectives.</li> </ul> <p>In view of the above, with the necessary changes in the project design, this initiative can be labelled as a short term project.</p>
State of readiness	<p>The Hoar Area Master Plan and several other studies provide most of the necessary information, but it is not very accessible. We recommend consolidation and coordination of the studies into a single detailed plan.</p> <p>In addition, the financing of these projects is still a bigger challenge.</p>
Additional information or work required	<p>Actualization of the feasibility study with required EIA and SIA is needed. The design must be upgraded to assure that present and possible future developments are included in the design and planning of the implementation.</p>
Results framework and M&E arrangements	<p>The PCN provides little information on M&amp;E. In the logframe of the first batch of the BDP2100 PCNs, there is information on the objectives of the projects, but most objectives have not been made specific or measurable in relation to quality, quantity, and time.</p> <p>A monitoring plan needs to be developed to help generate an asset management and maintenance plan, and to generate sufficient information to adapt to changing circumstances. If information leads to the conclusion that objectives are not being achieved, either the project or the objectives must adapt to a more realistic level.</p>

## 1.6.5 Drought Prone Areas (Barind Tracts)

### DP 1.1 North Rajshahi Irrigation Project

<b>Brief Project Description</b>
<p><b>The primary purpose of the project is to:</b></p> <ul style="list-style-type: none"><li>• Provide irrigation to a net area of about 74,800ha in North Rajshahi</li><li>• Increase crop yield by reducing crop damage</li><li>• Switch from local to High Yield Variety rice.</li></ul> <p><b>Specific objectives are to:</b></p> <ul style="list-style-type: none"><li>• Construct a pump house, pumping stations, and a network of irrigation canals and water control structures, drawing source water from the Ganges</li><li>• Review the existing drainage system of the project area to find a suitable area for fish culture, expansion of Boro crops, and T-Aman cultivation.</li></ul> <p>The project aims to supply water to 78,400ha in the project area, situated on the west bank of Sib river and bounded by the high ride of Barind tract. Part of this area is irrigated with groundwater, but much of the area has no or limited access to groundwater or tube wells during the pre-monsoon season.</p> <p>To address this, a comprehensive irrigation network will be constructed enabling joint use of groundwater and surface water through the proposed irrigation and drainage interventions. The irrigation system would increase the total harvest, leading to improved livelihoods for residents.</p> <p>The area is divided into two parts: Barind tract (covering 82 percent), and the Paba floodplain (Ganges floodplain, covering 18 percent). The land elevation of Barind tract varies from 45.2m to 15.2m and is a flood-free area. The land elevation of Paba floodplain varies from 18.3m to 12.2m, and is subjected to floods and drainage congestion. The Chalan Beel low-lying area is situated on the eastern side of the proposed project area. The project area comprises 9 Upazilas in the Greater Rajshahi District.</p> <p>The project was first conceptualized in 2006. Implementation has been delayed, however, because of a lack of funds, a change of project scope, and the multi-sectoral and multi-agency nature of the project.</p>
<b>Problem/Challenges the Project Aims to Address</b>
<p>Farmers in the area depend on rainfall and groundwater irrigation to cultivate rice, boro, and aman crops. During boro season, the farmers irrigate the boro crops using groundwater from Deep Tube Wells (DTW). However, insufficient rainfall over the year hampers groundwater recharge, leading to a gradual depletion of the groundwater table. Thus, irrigation coverage is declining. Tube-well irrigation is used as a supplemental source, but this is insufficient. Boro yields have already decreased by about 50 percent.</p> <p><b>The project seeks to contribute towards the achievement of the following BDP 2100 goals:</b></p> <ul style="list-style-type: none"><li>• Goal 2: enhance water security and efficiency of water usage</li><li>• Goal 3: ensure sustainable and integrated river systems and estuaries management</li><li>• Goal 4: conserve and preserve wetlands and ecosystems and promote their wise use.</li></ul>
<b>Linkages to Existing Policies and Initiatives</b>
<ul style="list-style-type: none"><li>• Links to numerous objectives in the 7th Five Year Plan, including those set out in the following Chapters of Part 2:<ul style="list-style-type: none"><li>– Agriculture: 4.2, 4.3, 4.4, 4.6</li><li>– Environment and Climate Change: 8.3</li></ul></li></ul>

- Project fits overall strategy of National Water Management Plan (NWMP) and links to all three NWMP immediate objectives:
  - 1. Rational management and wise use of Bangladesh’s water resources
  - 2. People’s quality of life improved by the equitable, safe and reliable access to water for production, health and hygiene
  - 3. Clean water in sufficient and timely quantities for multipurpose use and preservation of the aquatic and water dependent ecosystem.

The project would complement other proposed NWMP projects planned for Rajshahi district: Rajshahi Bulk Water Supply and Distribution Systems (MCo05), Rajshahi Sanitation and Sewerage System (MCo09), Rajshahi Flood Protection (MCo16), and Rajshahi Stormwater Drainage (MCo17)

- Links to numerous goals in the National Water Management Plan Development Strategy, including:
  - Towns and Rural Areas (water supply, flood protection)
  - Agriculture and Water Management (public irrigation development, flood control/drainage)
  - Natural Environment and Aquatic Resources (water management for ecologically sensitive areas, supporting environment measures)
- Applies to overall objectives of Coastal Development Policy and follow-on Strategy Targets/Strategic Priorities (ensuring fresh and safe water availability, safety from man-made and natural hazards, promoting economic growth, sustainable and equitable management of natural resources, improving livelihood conditions, and environment conservation), and associated Investment Program.
- Continues the disaster management goals of the Comprehensive Disaster Management Program
- Links to National Adaption Programme of Action (2005) adaption needs and intervention measures.
- Links to objectives of the National Sustainable Development Strategy in areas such as water resource management and agriculture development.
- Links to objectives of the National Water Policy (1999) such as harnessing/development of all forms of surface/groundwater and ensuring water availability as well as being in line with proposed Government actions under Planning and Management of Water Resources, Water and Agriculture.
- Helps to achieve the objectives of a number of the programmes outlined in the Bangladesh Climate Change Strategy and Action Plan 2009 Annex, principally under the Food Security, Social Protection and Health and Infrastructure pillars/themes.
- Links to National Food Policy 2006 Objective 1: Adequate and stable supply of safe and nutritious food and NFP Plan of Action 1.2: Use and management of water resources (increase irrigation coverage, efficient use of irrigation water, reduce dependency on groundwater, and reduce cost of irrigation water).

**Technical Assessment**

<p>Technical description of project</p>	<p>The intervention comprises construction of a system of 4361 irrigation structures and facilities including:</p> <ul style="list-style-type: none"> <li>• The construction of a main pump at Matikata and a booster pump at Amnura</li> <li>• Main Canal 52.50km</li> <li>• Secondary Canal 239.00km</li> <li>• Tertiary Canal 427.33km.</li> <li>• 47 bridges and culverts:           <ul style="list-style-type: none"> <li>– Road Bridge (27)</li> </ul> </li> </ul>
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	<ul style="list-style-type: none"> <li>– Railway Bridge-(5)</li> <li>– Culvert (15)</li> <li>• An inspection Road with a total length of 52.50km</li> <li>• A telephone line</li> <li>• A transmission line for Matikata Pump Station including sub-station</li> <li>• A transmission line for Amnura Pump Station including sub-station</li> </ul> <p>Note: Operation and maintenance plans are included in the design.</p>
Evaluation of project feasibility	<p>This project is designed to follow completion of the “Ganges Barrage Project,” as the reservoir created by the barrage is to provide source water for the present project. As such, changes in the design or implementation of the Ganges Barrage may necessitate adjustments to the designs for the present project. Implementation of the present project is projected to start at 2-3 years after commencement of the Ganges Barrage Project.</p> <p>Technically, this project is feasible and straightforward. In 2012, BDWB completed a comprehensive feasibility study on the technical requirements and locations of the different water works. It is not clear to what extent this feasibility study included social or environmental impact assessments.</p> <p>The study also lacks an assessment of the economic implications of crop rotations, or their effect on water demand for the irrigation system.</p>
<b>Costs (2015 Prices)</b>	
Capital costs	<p>According to the feasibility study (2012) as reported in the PCN, the estimated capital costs are:</p> <p>Financial: 19,290.3 million BDT Economic: 12,992.0 million BDT</p>
O&M costs	<p>According to the feasibility study as reported in the PCN, the estimated annual O&amp;M costs are:</p> <p>Financial: 100.9 million BDT Economic: 90.98 million BDT</p>
Evaluation of financial estimates	<p>Both the original (1988, Jica) and updated feasibility study (2006) are outdated. More fundamentally, the CBA does not explicitly compare the ‘With Project’ and ‘Without Project’ scenarios for agricultural benefits. This may result in overstatement of agricultural productivity increases attributable to the project.</p> <p>The study also fails to quantify the relation of agricultural benefits to the projected increase in available water due to the project. Externalities such as negative environmental and socio-economic impacts are not considered.</p> <p>Externalities such as negative environmental and socio-economic impacts are not considered.</p> <p>An updated feasibility should reflect the current situation, considering the existence of the Ganges barrage, and provide for an improved methodological framework.</p>
Potential environmental costs	<p>Planned water extraction may lead to water shortages elsewhere.</p>

Potential socio-economic costs	Resettlement of population is expected. This should also be reflected in the feasibility study, being socio-economic costs.
<b>Benefits</b>	
Potential environmental benefits	Additional water supply may benefit flora and fauna in the project area. This potential benefit has not been quantified yet.
Potential socio-economic benefits	<p>The primary projected benefit is the increase of crop output in the area, improving food security and livelihoods:</p> <ul style="list-style-type: none"> <li>• Total cultivated area will increase from 143,600ha to 170,600ha</li> <li>• Crop intensity will increase from 192 percent to 228 percent</li> <li>• Total paddy production will be increased by 211,050 tons</li> <li>• Value of production will increase by BDT1,291.27 million per year</li> </ul> <p>Depending on the design, increased water availability may also broaden access to participation in agriculture as a livelihood for the poor. Decreasing the uncertainty of water ability will also increase opportunities for women, as they have an important role in agricultural production. This will depend on water availability at the field level.</p>
<b>Linkages to Other Projects</b>	
<p>This project depends on water sourced from the planned reservoir to be created by the Ganges Barrage Project.</p> <p>About 58,900ha of the project area has already been brought under irrigation coverage by a BMDA-operated by Deep Tube Wells (DTW) project.</p> <p>The project is linked thematically to other projects in the Draught Prone (DP) area, as they also focus on irrigation as a way to increase crop production and establish a more sustainable livelihood for the residents.</p>	
<b>ADM Principles</b>	
<p>For irrigation projects of this size, it is important to consider both short- and long-term developments, including:</p> <ul style="list-style-type: none"> <li>• Climate change effects on precipitation, evapotranspiration, seasonal variation, river discharge, etc.</li> <li>• Developments affecting source water availability, such as agreements with India on upstream water extraction</li> <li>• Development of regional and national water policy</li> <li>• Development of regional and national priorities and policies within the agricultural sector</li> <li>• Technological development decreasing demand or increasing efficiency of agriculture</li> <li>• Demographic developments and migration patterns</li> <li>• Economic developments and consequential growth of the agricultural sector.</li> </ul> <p>Alignment with ADM principles must optimize the irrigation scheme to be adjustable to different scenarios based on these uncertainties.</p>	
<b>Linkages to Climate Change Adaptation</b>	
<p>Climate change will affect the demand as well as the availability of water. Changes in rainfall patterns and intensity strongly influence agriculture. Climate change adaptation is crucial within the agricultural sector and has to be considered in the design and implementation of irrigation schemes.</p>	

<b>Private Sector Financing Potential</b>	
<p>The principal objectives of this project are to provide irrigation to an area of about 74,800 ha by using water from river Ganges which will be transported to the area by construction of pumping stations and one booster pumping station and a network of irrigation canals. The project also envisages review the existing drainage system of the project area and to find suitable area for fish culture, expansion of Boro crops and T-Aman cultivation. Due to the project, the value of production will be increased by Tk.1,291.27 million BDT per year.</p> <p>Large scale irrigation projects like this one have potential for PPPs. Unlike water treatment and water supply sector, irrigation does not have a long track record of PPPs. However, the sector has seen a few precedents in emerging markets. For example, in Morocco, the Guerdane Irrigation Project is a 30-year Design-Build-Finance-Transfer-Operate scheme where the private operators are responsible for construction and for substantially financing a capital investment program that makes surface water accessible and affordable to a large number of farmers. The private developer is compensated through user payments, which comprise an upfront subscription plus a variable component.</p> <p>Further, there have been successful precedents for applying user-pay principles in irrigation in Bangladesh. The Barind Multipurpose Development Authority (BMDA) collects upfront user fees for tube well irrigation using a prepaid card system to operate tube wells. The Authority was established by the Government of Bangladesh but became financially self-sustaining after about 10 years and has also diversified to include other activities such as agricultural extension support. This means that even poor farmers are able and willing to pay for receiving high quality and consistent water supply.</p> <p>In view of the above, the BWDB and the BMDA (which will be involved in on farm water management and collection of irrigation charge) should definitely look at PPPs for financing, operating, and maintaining at least part of this project.</p>	
<b>Policy and Institutional Reform</b>	
Main implementing agencies	Bangladesh Water Development Board (BWDB)
Required coordination mechanisms	Coordination required with Barind Multipurpose Development Authority (BMDA), involved in farm water management and collection of irrigation fees.
Existing policies/institutions to facilitate implementation	<ul style="list-style-type: none"> <li>Chapter 4.1 (Part 1) of the Seventh FYP recommends spending an additional 1 percent of GDP on rural infrastructure, including for irrigation</li> <li>Rajshahi is a district singled out in Chapter 4.6 (Part 1) of the Seventh FYP for prioritized irrigation measures</li> <li>Chapter 4.3 (Part 2) of the Seventh FYP recommends encouraging more use of surface water for irrigation and expanding/improving irrigation infrastructures. In particular, installations of solar panels for small scale irrigation in rural areas will be given priority.</li> <li>Chapter 4.3 of the Seventh FYP also says there will be a focus on precision agriculture, including in the area of irrigation.</li> <li>Infrastructure Development Company Limited (IDCOL) is facilitating solar-based irrigation systems and the World Bank, KfW, GPOBA, JICA, USAID, ADB and Bangladesh Climate Change Resilience Fund (BCCRF), Strategic Program for Climate Resilience are supporting this initiative (Chapter 8.4 (Part 2)).</li> </ul>



	<ul style="list-style-type: none"> <li>• MoWR Task Force established to develop new institutional framework for WRM may assist with implementation</li> <li>• The Guidelines for Integrated Planning for Sustainable Water Resources Management set out the institutions and procedures for planning, O&amp;M, participatory M&amp;E, and training for FCD projects</li> <li>• The general thrust of all recommended actions under the Bangladesh Climate Fiscal Framework 2014 is to facilitate access to climate finance, and to ensure that climate change finance is deployed in the most effective way. So, to the extent that this project seeks to address the impact of climate change, and is of sufficiently high priority, this policy should help to ensure it gets funded. Appendix 2 classifies irrigation projects as significantly relevant to CC mitigation/adaption (second highest ranking)</li> <li>• Bangladesh Climate Change Resilience Fund (BCCRF), Strategic Program for Climate Resilience may assist with implementation</li> <li>• Bangladesh Climate Change Strategy and Action Plan 2009 includes projects like this within its action plan, and accordingly facilitates the project's implementation (refer to the Annex).</li> <li>• National Environment Committee, National Steering Committee on Climate Change, Inter-Ministerial Disaster Management Committee, National Disaster Management Advisory Committee, Inter-Ministerial Disaster Management Committee, and the National Disaster Management Advisory Committee may assist with implementation</li> </ul>
Desirable capacity building initiatives	<p>Training &amp; coaching may be needed for the following:</p> <ul style="list-style-type: none"> <li>• Irrigation water management</li> <li>• Monitoring and evaluation</li> </ul>
Required policy/regulatory reforms	<ul style="list-style-type: none"> <li>• Review and align food security with agricultural and water resource management policies</li> <li>• Implementation of the recommendations in the November 2014 Final Report on Institutional Improvement of BWDB</li> </ul>
<b>Overall Project Assessment</b>	
Priority	<p>Project priority is high. However, project implementation is contingent on completion of the Ganges Barrage.</p> <ul style="list-style-type: none"> <li>• Direct or indirect benefits offset implementation costs in all delta scenarios. The NPV of this project is estimated to be BDT 15,944 million</li> <li>• Implementing agencies have the knowledge base to implement these types of projects locally (with some limited guidance and support if needed). The responsibility for the implementation of this project lies with BWDB in cooperation with the Barind Multipurpose Development Authority (BMDA). The BMDA is involved in farm water management and collection of irrigation fees. Local organization structures will be required to facilitate optimum management of the land and water resources. Both have extensive experience with these types of projects. Additional training could be required to ensure that the irrigation water is managed in a proper way and that there is sufficient monitoring and evaluation to optimize project management continuously.</li> <li>• Implementing the project will reduce vulnerability to future uncertainties such as sea level rise and flooding. As indicated above,</li> </ul>



	<p>the region suffers increasingly from flash floods. The objectives are to increase water availability and to irrigate almost 75,000ha and to increase harvests. This addresses the objectives outlined in the Seventh Five-Year Plan as well as in the sectoral strategies. This will increase food security, improve livelihoods, and reduce poverty. Many other objectives as included in the national strategies will be served by this intervention. It is not indicated in the PCN whether these design specifics also consider climate change effects in relation to precipitation and discharge patterns. These should be considered in the further planning and design of this proposed project. ADM principles have to be included in further detailing of the plans as well. These could lead to a more module oriented implementation of the project that will make it possible to spread the required investments and will leave sufficient flexibility to adapt to technological development, for example in relation to crop rotations and water demand.</p> <ul style="list-style-type: none"> <li>• There are no hard trade-offs with other policy objectives. In the development of the irrigation projects, the economic and social development normally tend to outweigh the ecological development. When detailing the project, sufficient attention should be paid to nature development and good management of land and water resources as well as the use of chemicals.</li> </ul> <p>In view of the above, with the necessary changes in the project design, this initiative can be classified as a short term project.</p>
State of readiness	<p>The project design was based on the feasibility study prepared by JICA in 1988 and an updated study in 2006. These are obsolete, and there is a clear need to update information. Environmental and Social Impact Analyses were also published in 2006, and a DPP was elaborated in 2012-2013.</p> <p>Training and capacity building can start at the current level of preparation, in parallel with the Ganges Barrage Project. However, significant further assessment is required before proceeding with construction. From the available documentation, it is unclear whether there is sufficient support from the environmental stakeholders. This is important to know as irrigation projects can have a large impact on existing habitats.</p>
Additional information or work required	<ul style="list-style-type: none"> <li>• Update project designs to align with ADM</li> <li>• Conduct a hydro-morphological Study</li> <li>• Develop a Resettlement Action Plan (RAP)</li> <li>• Conduct an environmental cost-benefit analysis</li> <li>• Develop a Monitoring and Evaluation Plan</li> <li>• Assess BWDB capacity and include Capacity Building in the DPP</li> <li>• Conduct capacity building and training for BWDB and BMDA on irrigation and water management and monitoring and evaluation</li> <li>• Incorporate a detailed risk assessment into the feasibility study.</li> </ul>
Results framework and M&E arrangements	<p>The PCN provides little information concerning M&amp;E. The BDP2100 Batch 1 log frame presents the goals and purpose of the project, but these are very general and should be developed and refined. Criteria on input and output are straightforward, but may need adjustments for ADM-related design changes. The PCN specifies no criteria for quality and time, and lacks a monitoring plan.</p>

## DP 1.2 Revitalization and Restoration of Beel Halti (Chalan Beel)

Brief Project Description
<p>The overall project objective is to enhance livelihood and food security for local communities by protecting land from flooding and extending irrigation coverage in the dry season. The project aims to improve flood management, drainage, and irrigation inside the polders while mitigating negative effects outside the polders.</p> <p><b>The specific objectives of the project are to:</b></p> <ul style="list-style-type: none"> <li>• Allow controlled water flow in the polders during the wet season to support agriculture, fisheries, etc.</li> <li>• Use surface and groundwater jointly during the dry season for agricultural activities</li> <li>• Mitigate adverse environmental impacts of past projects</li> <li>• Preserve biodiversity</li> <li>• Promote fishery cultures and allowing flood plain capture fisheries.</li> </ul> <p>The project was first conceptualized in 2010. Implementation was delayed, however, because of a lack of funds, a change of project scope, and the multi-sectoral and multi-agency nature of the project.</p> <p>This project is an integral part of the strategy for the drought prone area because it allows for better control over water management in the polders of this region. The project aids long-term adaptation to climate change and other uncertainties related to water availability and excess of water.</p> <p>The project is located in the districts of Rajshahi, Naogaon, Natore, Bogra, Pabna and Sirajganj. The project area is bounded by Naogaon-Mohadevpur road and the Santahar-Bogra railway line in the North; Rajshahi-Charghat road, Baral-Nandakuza river, and Pabna project in the South; Barind tract along the Sib Barnai river in the West; and Bogra-Nagarbari Highway in the East. The polders A, B, C &amp; D of Chalan Beel area are located along the right bank of the Atrai river. The Naogaon Polder, Bogra polders 2, 3 &amp; 4, and SIRDP are located along the left bank of the Atrai. Therefore, the Atrai river plays the main role in water management of the Chalan Beel area.</p> <p>Impacts of the Chalan Beel also extend to its southern side on the Baral and Barnai projects which do not form part of the Chalan Beel. Bogra polder 4 is open to natural condition. The Beel Halti is within Chalan Beel Polder C and is a large beel area. The gross area of the project is about 566,000ha, of which about 75 percent is cultivated area.</p>
Problem/Challenges the Project Aims to Address
<p>Past flood control and drainage (FCD) projects in the area have had adverse economic, social, and environmental impacts. Construction of embankments and improvement of drainage facilities have resulted in loss of flood plains and bio-diversity. Monsoon rain has damaged T. Aman and B. Aman rice cultivation and fisheries. Wetland has been lost. Cuts and breaches in the embankments have hindered communication. Inexpensive navigation routes have been closed.</p> <p>The FCD projects on both banks of the Atrai river did not fulfill all their objectives. An area once characterized by huge water bodies and extensive flood plains that served as the main habitat and breeding ground for traditional fish species has been severely affected.</p> <p>Thus, there is a need to solve the problems of uncertainty in T. and B. Aman rice cultivation, increase capture fisheries, and restore navigation routes.</p>
Linkages to Existing Policies and Initiatives
<ul style="list-style-type: none"> <li>• Links to the 7th FYP, Water Resources Sector, Irrigation Sub-Sector overall goal to “support the Government’s poverty reduction effort through the increase of sustainable agricultural production”. Links to the following sectoral objectives:</li> </ul>

Links to the 7th FYP, Water Resources Sector, Irrigation Sub-Sector overall goal to “support the Government’s poverty reduction effort through the increase of sustainable agricultural production”. Links to the following sectoral objectives:

- Constructing water management infrastructure and establishing sustainable management systems
- Strengthening operation and maintenance by institutionalizing beneficiary participation
- Strengthening Government institutions and facilities by establishing sustainable water management systems
- Enhancing the access of the landless poor in the subproject areas to employment opportunities and to public natural resources.
- Promotes 7th FYP Climate Change and Disaster Management sector goals of “Towards a Climate Resilient Bangladesh” and “Making Bangladesh Less Vulnerable to Disasters”
- Meets 7th FYP Agriculture Development Sector Goals:
  - Increases agriculture production to meet needs of increasing population and maximize rural incomes
  - Promotes sustainability of natural resources use for sustainable agricultural growth
  - Promotes adaptation to climate change of agro-food systems to enhance resilience of agriculture based livelihood systems

Links to the following BDP2100 Goals:

- Goal 1: Ensure safety against water and climate change related disasters
- Goal 2: Ensure water security and efficiency of water usages
- Goal 3: Ensure integrated river systems and estuaries management
- Goal 4: Conserve and preserve wetlands and ecosystems
- Goal 6: Achieve functional and optimal use of land and water
- In line with IDA, IFC, MIGA Country Partnership Framework (CPF) Focus Areas 2 (Social Inclusion) and 3 (Climate and Environment Management). Specifically:
  - Enhanced rural income opportunities for the poor (Focus Area 2.4)
  - Increased resilience of population to natural disasters in urban and coastal areas (Focus Area 3.1)
  - Improved water resource infrastructure for climate resilience (Focus Area 3.2)
  - Increased adoption of sustainable agricultural practices (Focus Area 3.3)
- Links to Bangladesh Climate Change Strategy and Action Plan (2009) Pillars 1 (Food Security, Social Protection, and Health), 2 (Comprehensive Disaster Management), and 3 (Infrastructure)
- Links to overall strategy and the three investment projects of the Pilot Program for Climate Resilience (PPCR), under the Strategic Program for Climate Resilience (SPCR). The three investment projects are 1) Promoting Climate Resilient Agriculture and Food Security, 2) Coastal Embankments Improvement and Afforestation, and 3) Coastal Climate Resilient Water Supply, Sanitation, and Infrastructure Improvement
- Links to intervention measures and similar to priority activities under the National Adaption Programme of Action (NAPA) of 2005
- In line with key principles and pillars of National Agricultural Extension Policy (NAEP) of 2012
- Links to the National Sustainable Development Strategy (2013) areas of Agriculture and Environment Natural Resource and Disaster Management
- In line with National Water Policy (1999) in such areas as Agriculture, Environment, and Beel Preservation

**Technical Assessment**

<p>Technical description of project</p>	<p>Different options have been studied. Technically, these options are all feasible. What is more important is the effects of these options and the costs and benefits of these options. The long term O&amp;M costs depend strongly on the options that are chosen.</p>
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Evaluation of project feasibility	A feasibility study has been conducted.
<b>Costs</b>	
Capital costs	<p>Investment costs</p> <p>Financial: 4474.7 million BDT</p> <p>Economic: 3405.3 million BDT</p> <p>The cost estimate was prepared on the basis of the approved design vetted by the BWDB design office per approved current schedule of rates of Rajshahi O&amp;M Circle, BWDB, and Rajshahi from FY2014-15</p>
O&M costs	<p>Annual O&amp;M costs</p> <p>Financial:</p> <p>1st year to 4th year: 0 million BDT</p> <p>5th year to 30th year: 104 million BDT</p> <p>Economic:</p> <p>1st year to 4th year: 0 million BDT</p> <p>5th year to 30th year: 93.8 million BDT</p> <p>After completion of the project, major repair/rehabilitation works will be funded from the regular O&amp;M budget of BWDB. Annual O&amp;M work will be done with BWDB's existing manpower.</p>
Evaluation of financial estimates	Agricultural benefits and employment are the only benefits considered. However, realization of agricultural benefits is also contingent on the availability of water, and thus vulnerable to upstream risks or extreme droughts. The sensitivity for this is not clear.
Potential environmental costs	Not available
Potential socio-economic costs	Not available
<b>Benefits</b>	
Potential environmental benefits	Not available
Potential socio-economic benefits	<p><b>Direct benefits</b></p> <ul style="list-style-type: none"> <li>• Cropping intensity would be increased by about 6.72 percent as a result of better flood and drainage management (CEGIS (2007) page XXIII).</li> <li>• Crop production would be increased by about 0.26 and 0.49 million metric tons of paddy and non-paddy respectively due to increased crop area, crop saved from flood damage, augmentation of surface water irrigation, etc. Among the non-paddy crops, maize, garlic, vegetables, and potato yield would increase significantly.</li> </ul> <p><b>Indirect benefits</b></p> <p>Soil fertility would be enriched by allowing monsoon flood within the project areas to some extent and increasing surface water irrigation.</p> <ul style="list-style-type: none"> <li>• Project activities would create employment opportunities of 0.60 million man days annually, and this will help alleviate poverty.</li> <li>• The employment opportunities of agricultural labor will increase by around 9,000 thousand man days per year.</li> </ul>

	<ul style="list-style-type: none"> <li>The length of the fishing period will increase from 6 to 7 months and 1,584 thousand man-days of employment opportunities will be created for the fishing communities.</li> </ul> <p>Value of annual benefits</p> <p>Financial:</p> <p>1st year to 4th year: 0 million BDT</p> <p>5th year to 30th year: 1139.7 million BDT</p> <p>Economic:</p> <p>1st year to 4th year: 0 million BDT</p> <p>5th year to 30th year: 908.7 million BDT</p>
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### Linkages to Other Projects

#### This project is linked with:

- North Rajshahi Irrigation Project (proposed)
- Ganges Barrage project (proposed)
- Revitalization and restoration of Hurasagar and Atrai rivers (proposed)
- River Management Improvement Program (proposed)
- Flood and Riverbank Erosion Risk Management Investment Program (under implementation)
- Baral Basin Development Project (implemented)
- Barnai Project (implemented)
- Chalan Beel Polders A, B, C, and D (implemented)
- Naogaon Polder (implemented)
- Bogra Polders 2, 3, and 4 (implemented)
- Sirajganj Integrated Rural Development Project (implemented).

Therefore, it is crucial to assess the effects of these projects in an integrated manner to ensure that no reverse effects are caused by up- or downstream projects. Interventions can have direct effects on water availability downstream as well as on the erosion and sedimentation processes. Furthermore, interventions to cope with the challenges at hand might have a lower cost/benefit ratio when they are identified in a broader geographical scope.

### ADM Principles

The revitalization and restoration of that Halti Beel is mainly to ensure that water is drained properly during the wet season and does not damage crops. Exogenous developments that could affect this objective are demographic developments, climate change, and economic developments. In particular, what are the land use types that have to be stimulated to reach national objectives, and what effect do these potential changes in land use have on the water demand and required safety level in this area? Technological and social development might also play an important role because choices in agricultural practices determines the need for this intervention. Shorter growth seasons could change decision making considerably.

The information available through the project concept note (PCN) only covers the structural measures (embankment, gates, sluices, excavation, etc.). They are presented as one-time interventions to decrease flood risk, but do not include flexibility of implementing these interventions over time, depending on development of exogenous drivers.

To incorporate the principles of ADM, it is important to give ample attention to O&M in the project definition phase. O&M will be crucial to ensure sustainability of the interventions. It is indicated that the project duration is 4 years, but the O&M activities will have to go on long after that.

Other tipping points that are relevant for the drought prone areas are:

- Abstraction of groundwater for irrigation is larger than natural recharge
- Groundwater levels fall below threshold levels (for example, they are too deep for cost effective irrigation or they cause subsidence)
- Water availability in rivers is too low for surface water irrigation systems
- Droughts, as a result of increased temperatures, cause unacceptable annual damage to the agricultural sector.

#### Linkages to Climate Change Adaptation

This project strongly relates to climate change because the water balance will be affected by changes in precipitation patterns. This will affect flood and drought risks and should be considered when designing the interventions. Embankments have to consider changes in discharges, and retention areas have to consider the possibility of extended periods with less rain. Also, the operation and maintenance plans of the region have to take into account these climate change effects.

#### Private Financing Potential

Embankment projects do not have any direct revenue streams (for instance, a drainage cess or similar usage based tax on the beneficiaries of the project) attached to them. Further, such projects are also quite complex from an environmental impact, political, national security, and social perspective. Hence, it is difficult to develop a PPP specifically for the embankment construction and management. Globally, there are no PPPs to our knowledge that cover construction of embankment projects. Even if there are a few cases, those are likely to be in more advanced countries with a strong track record of developing PPPs in other more traditional sectors.

That said, the project’s goals include targets of higher crop production, employment generation, and improved communication. All of these activities are typically led by the private sector formally or informally. Considering the potential benefits to the private sector from this project, there are three potential options for involving the private sector in this project:

- The program could be combined with developing PPPs for fisheries where the private sector can be tapped for financing, constructing, and then operating large-scale fisheries. The government can also earn a revenue share from these projects which can then be used to finance part of the operations and maintenance costs of the embankment. (e.g. there is a successful PPP for organic catfish production in Vietnam <sup>185</sup>).
- The embankment project can be combined with a highway project. The private sector can construct, finance, and operate the highway. The highway could improve connectivity between the wetland and urban areas. This would also enable the government to access private finance for at least part of the project (e.g. Badaun–Ballia Ganga Expressway project in Uttar Pradesh, India).
- Another possible avenue for indirectly including the private sector in this project is to develop PPPs for large scale irrigation projects (e.g. the West Delta Irrigation Project in Egypt<sup>186</sup> ) in the Beel area. The irrigation PPP could ensure that the private sector is fully vested in adequate operations and maintenance of the coastal embankments once constructed. However, the PPP can only be developed once the construction work for the embankment has been completed successfully because private sector partners are unlikely to be willing to enter into a long term partnership until they are certain that the crops will be protected.

185 [http://pubs.iclarm.net/resource\\_centre/WF\\_1068.pdf](http://pubs.iclarm.net/resource_centre/WF_1068.pdf)

186 <http://ppp.worldbank.org/public-private-partnership/ppp-sector/water-sanitation/ppps-irrigation#examples>



<b>Policy and Institutional Reform</b>	
Main implementing agencies	<p>BWDB will be the main implementing agency, and the Ministry of Water Resources is the sponsoring ministry.</p> <p>The Chief Engineer, North Western Zone, BWDB, Rajshahi has jurisdiction over the project. The divisional Executive Engineer is in direct charge of operations, maintenance, and administration.</p> <p>Specifics needs for this project will depend on choices in relation to the type of contract under which this will be carried out and how much work can be delegated to the executing agency.</p>
Required coordination mechanisms	<p>The DPP provides for a Project Steering Committee under the Chairmanship of the Secretary of the Ministry of Water Resources. Committee members will include the Project Director and representatives from the Ministry of Water Resources, Ministry of Finance, Implementation Monitoring and Evaluation Division, Planning Commission, Additional Secretary, Joint Secretary, Joint Chief, Deputy Chief, and Senior Assistant Chief/Assistant Chief. The Ministry of Land should also be included.</p>
Existing policies/institutions to facilitate implementation	<ul style="list-style-type: none"> <li>• 7th FYP: <ul style="list-style-type: none"> <li>– Water Resources Sector: Irrigation Sub-Sector Policy</li> <li>– Climate Change and Disaster Management Sectors</li> <li>– Agriculture Development Sector</li> </ul> </li> <li>• Bangladesh Climate Change Strategy and Action Plan (2009)</li> <li>• Pilot Program for Climate Resilience (PPCR), under the Strategic Program for Climate Resilience (SPCR) – 2010</li> <li>• National Agricultural Extension Policy (NAEP)-2012</li> <li>• National Adaption Programme of Action (NAPA) -2005</li> <li>• National Sustainable Development Strategy (2013)</li> <li>• National Water Policy (1999)</li> <li>• IDA, IFC, MIGA Country Partnership Framework (CPF) Focus Areas 2 (Social Inclusion) and 3 (Climate and Environment Management)</li> </ul>
Desirable capacity building initiatives	<p>This should be part of the overall strengthening of the BWDB. For this project, specific needs might exist, but needs also depend on what will be done by the BWDB and what will be tendered to private firms. This is true for the implementation phase as well as the period afterwards where O&amp;M will still be crucial.</p> <p>As is indicated in the ‘Institutional and Financial Assessment, Draft Feasibility Report and Detailed Design Priority Reach, April 2015 (Annex B Vol 1 to the River Bank Improvement Program), the capacity of the BWDB is very limited. Since 2000, their staff has been reduced from 19,000 to 6,000. Over the last 10 years, only a limited number of young employees have been contracted, and there is a strong engineering culture. Project implementation needs to be integrated, taking in to consideration a broad range of social, economic, and ecological aspects.</p>



Required policy/regulatory reforms	A regulatory reform that is mentioned regularly is the actual DPP procedure: ‘Funding for water management projects under the development budget follows standard GoB procedures. After a project is identified, planned, designed and its budget determined, a DPP is formulated and the requested budget is submitted to be included in the Annual Development Plan (ADP). DPPs have to describe the planned works in detail, also in case of DPPs for projects of a duration of 3-5 years. Changing DPPs is time consuming and adjusting the budget allocation without changing the DPP is not possible. Overall the process of planning and budget allocation is characterized by rigidity. This ill suits an often rapidly changing situation on the ground, specifically the condition of infrastructures that may deteriorate rapidly during the flood season. The consequence is that much of the time and effort of professional BWDB staff is taken by bureaucratic procedures to adjust budgets to the reality on the ground.’ (Source Annex B, RBIP)
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**Overall Project Assessment**

Priority	<p>This project has high priority because it will help significantly in poverty reduction for people living in the project area. The project receives a lot of support from different stakeholders.</p> <ul style="list-style-type: none"> <li>• Direct or indirect benefits offset implementation costs in all delta scenarios. The NPV of this project is estimated to be BDT 1,325 million.</li> <li>• Implementing agencies have the knowledge base to implement these types of projects locally (with some limited guidance and support if needed). The responsibility for the implementation of this project lies with BWDB. The total number of employees at BWDB has reduce significantly over the last two decades. Therefore, an assessment of the capacity of the BWDB indicates that the technical know-how to carry out these types of projects exists, but the total number of capable employees is not sufficient to carry out all projects that are included in the Investment Plan. Capacity building and contracting additional personnel is required to successfully implement all these projects. Training should also cover operation and maintenance.</li> <li>• Implementing the project will reduce vulnerability to future uncertainties such as sea level rise and flooding. The project aims to improve flood management, drainage, and irrigation inside the polders while mitigating negative effects outside the polders. The planned interventions facilitate economic, social, and ecological development. Water security is too low, and flood risks are too high. Interventions are needed to improve livelihoods. It is not indicated in the PCN whether these design specifics also consider climate change effects in relation to precipitation and discharge patterns. These should be considered in the further planning and design of this proposed project, but should also be related to the identification of a certain minimum flood safety level that is required. ADM principles should be included in further detailing of the plans as well.</li> </ul>
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	<ul style="list-style-type: none"> <li>The project has no hard trade-offs with other policy objectives.</li> </ul> <p>In view of the above, with the necessary changes in the project design, this initiative can be classified as a short term project. However, effects of the interventions on neighboring areas should be studied to ensure that the project will not have adverse effects. If these negative effects exist, the project runs the risk that dams may be destroyed because people think that they cause flooding in adjacent areas. This also means that the project should include a well-designed communication program to ensure that stakeholders are properly informed.</p>
State of readiness	Readiness is high. A DPP is available as well as a FS, an EIA, and an SIA (all published in 2007).
Additional information or work required	<p>According to the DPP (updated in 2011), the project was included in the Annual Development Project of FY2011-12 and was planned to be completed in FY2014-15. An updated FS/EIA/SIA may be needed.</p> <p>The project should be designed considering water flow, fisheries, crop production, and road networks through the entire Chalan Beel area. Maintenance of the area's rich ecosystem also needs to be taken into account.</p>
Results framework and M&E arrangements	<p>There is a log frame (Bangladesh Delta Plan 2100, Formulation Project, Investment Plan, 7 Log Frames of Batch 2, March 2016, GED, draft) in place indicating the goals, the purpose, the outputs, and the required inputs. This has been detailed to some extent, but criteria could be made more concrete and measurable. Also, time horizons should be established to monitor whether activities have been initiated and to evaluate if these have had the required effect.</p> <p>Furthermore, the institutional setting, including the responsibilities to monitor and evaluate, has to be established. Lastly, it has to be clarified how recommendations coming from M&amp;E will lead to redefining objectives or identification of additional or other interventions.</p>

## DP 1.4 Kurigram Irrigation Project (South Unit, 2nd Phase) and DP 1.5 Kurigram Irrigation Project (North Unit, 2nd Phase) Combined

### Brief Project Description

The project consists of the combined projects DP 1.4 and DP 1.5, covering the North and South Unit of the Kurigram Irrigation project. The project was first conceptualized in 2005. Implementation has been delayed, however, because of a lack of funds, a change in project scope, and the multi-sectoral and multi-agency nature of the project. A PDPP for the units was submitted to the Planning Commission and Economic Relations Division in 2012, but the projects have not yet been approved.

The main objective of the project is to ensure irrigation facilities in order to provide full irrigation coverage to nearly 50,000ha of arable lands (nearly even split between South and North unit<sup>187</sup>) in the Kurigram area. The project aims to alleviate poverty and enhance socioeconomic conditions of the poor in the area by stimulating agricultural production and development of tertiary sectors. More specific additional objectives are:

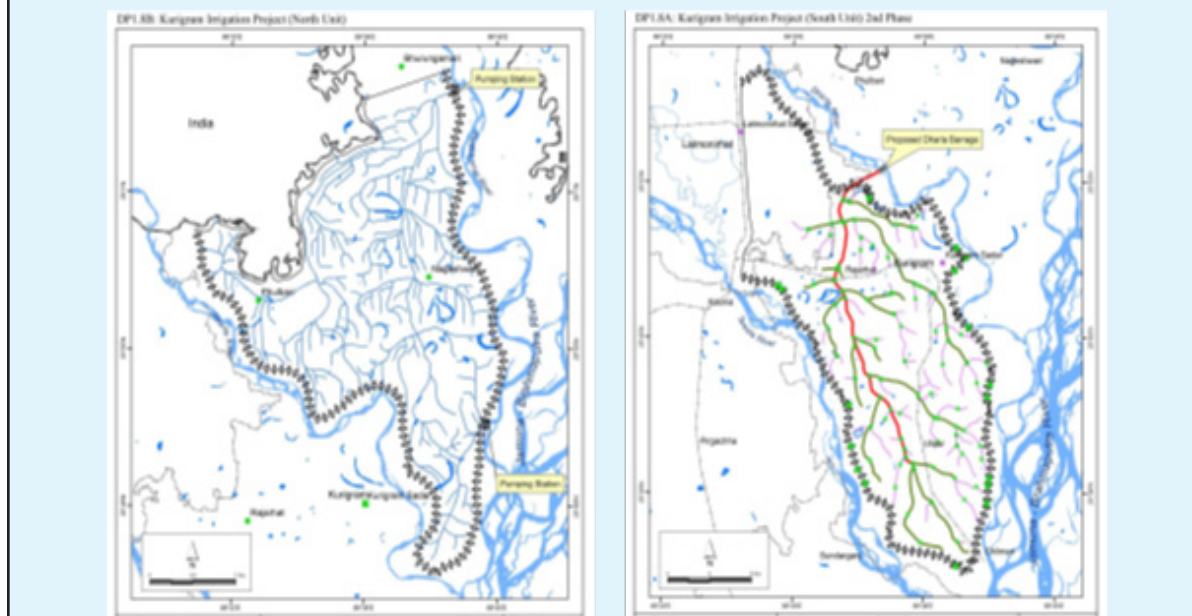
- Flood protection along the rivers
- Increased employment of women
- Construction of an irrigation scheme to supply water to the area.

The drainage function is not indicated in the PCN. Water will be diverted from the Dharla and Dhudkumar river, for which a barrage is planned.

### North Unit:

The project area is located in the northern part of Kurigram district comprising major parts of Fulbari, Nageswari and minor parts of Bhurungamari and Kurigram Sadar Upazila. The project area is bounded by the Dhudkumar river in the east, the Brahmaputra river in the south, the

Dharla river in the west and the India- Bangladesh border line & Bhurungamari-Sonahat rail line in the north.



187 In the DP 1.4 PCN, reference is made to 23,400ha net arable land as well as to 42,800ha net arable land in the South Unit.

**South Unit:**

The project area is located in the southern part of the Kurigram district comprising Kurigram Sadar, Ulipur, Razarhat and Chimari Upazilas, and part of Lalmonirhat Sadar upazila of Lalmonirhat District. The project area is bounded by Dharla river in the north-east, the railway line leading to Lalmonirhat in the west, the Teesta river in the southwest and the Dharla and Brahmaputra rivers in the north and west.

**Problem/Challenges the Project Aims to Address**

The area is affected by flooding during monsoons and insufficient water during the dry season. As a result of intensive use of groundwater for irrigation, groundwater levels decline, and crop production decreases. An irrigation scheme will improve water availability during the dry season and decrease pressure on groundwater. This will lead to improved crop production and recovery of groundwater levels.

The increased availability of water in the pre-monsoon period in particular will increase harvests and improve food security. The project will also lead to other economic developments and secondary effects. This will improve livelihoods and contribute to many different goals included in the Seventh 5-Year Plan, such as the stimulation of female employment.

**The project addresses the following BDP2100 goals:**

- Goal 2: Ensure water security and efficiency of water usages (primary goal)
- Goal 1: Ensure safety against water and climate change related disasters (secondary goal)

**Linkages to Existing Policies and Initiatives**

- Links to numerous objectives in the 7th Five Year Plan, including those set out in Chapter 2 of Part 1 and the following Chapters of Part 2:
  - Agriculture: 4.2, 4.3, 4.4, 4.6
  - Environment and Climate Change: 8.3, 8.5, 8.6
  - Social Protection: 14.5, 14.6
- Project fits overall strategy of NWMP and links to all three NWMP immediate objectives:
  - 1. Rational management and wise use of Bangladesh's water resources
  - 2. People's quality of life improved by the equitable, safe and reliable access to water for production, health and hygiene
  - 3. Clean water in sufficient and timely quantities for multipurpose use and preservation of the aquatic and water dependent ecosystem.
- Links to numerous goals in the National Water Management Plan Development Strategy, including:
  - Towns and Rural Areas (water supply, flood protection)
  - Agriculture and Water Management (public irrigation development, river maintenance, and flood control/drainage)
  - Natural Environment and Aquatic Resources (water management for ecologically sensitive areas and supporting environment measures)
- Applies to overall objectives of Coastal Development Policy and follow-on Strategy Targets/Strategic Priorities (ensuring fresh and safe water availability, safety from man-made and natural hazards, promoting economic growth, sustainable and equitable management of natural resources, improving livelihood conditions, and environment conservation), and associated Investment Program.
- Flood protection is one of the key parts of the UNDP Coordination of Cyclone Rehabilitation (1991)
- Continues the disaster management goals of the Comprehensive Disaster Management Program

- Links to National Adaption Programme of Action (2005) adaption needs and intervention measures
- Links to National Agricultural Extension Policy agenda, key principles, and pillars, especially the goal of increasing production.
- Links to objectives of the National Agriculture Policy such as increasing production and developing more efficient irrigation systems.
- Links to objectives of the National Sustainable Development Strategy in areas such as water resource management, agriculture development, and human resource development (women’s employment).
- Links to objectives of the National Water Policy (1999) such as harnessing/development of all forms of surface/groundwater and ensuring water availability as well as being in line with proposed Government actions under Planning and Management of Water Resources, Water and Agriculture.
- Helps to achieve the objectives of a number of the programmes outlined in the Bangladesh Climate Change Strategy and Action Plan 2009 Annex, principally under the Food Security, Social Protection and Health and Infrastructure pillars/themes.
- Links to the following parts of the National Food Policy 2006
  - NFP Objective 1: Adequate and stable supply of safe and nutritious food;
  - NFP Plan of Action 1.2: Use and management of water resources (increase irrigation coverage, efficient use of irrigation water, reduce dependency on ground water, reduce cost of irrigation water);

NFP Plan of Action 2.5 Income generation for women and the disabled

#### Technical Assessment

<p>Technical description of project</p>	<p><b>South Unit:</b>          The project will provide irrigation facilities which will cover around 70 percent of the project area by the Dharla Barrage. The project area is protected by about 144km of flood control embankments, which have been breached at many locations due to river bank erosion. As such, the improvement of these embankments is also included in the project.  <b>Within this project there will be several components such as:</b></p> <ul style="list-style-type: none"> <li>• Construction of Dharla Barrage (43.29 cumec)</li> <li>• Construction of main canal (32.00km)</li> <li>• Construction of Secondary canal (92.79km)</li> <li>• Construction of tertiary canal (164.05km)</li> <li>• Construction of escape (4 nos.)</li> <li>• Construction of syphon (87 nos.)</li> <li>• Construction of check structure (47 nos.)</li> <li>• Construction of cross-drainage structure (76 nos.)</li> <li>• Construction of bridges/culverts (257 nos.)</li> <li>• Retirement of embankment (4.37km)</li> <li>• Bank revetment (6.10km)</li> <li>• Construction of drainage regulator (9 nos. new)</li> <li>• Re-excavation of drainage channel (64.38km)</li> <li>• Embankment re-sectioning (65.00km)</li> </ul> <p><b>North Unit:</b></p> <ul style="list-style-type: none"> <li>• Pumping station at Pateswari: (Irrigation pump): 35.00 cumec</li> <li>• Pumping station at Tangonmari: (Reversible pump): 6.20 cumec</li> <li>• Main canal: 55.62km</li> </ul>
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	<ul style="list-style-type: none"> <li>• Secondary canal: 107.032km</li> <li>• Tertiary canal: 119.15km</li> <li>• Escapes, Siphons, Aqueducts, Turnouts, Regulators: 652 nos</li> <li>• Road Bridges / Foot bridges/ culverts: 362 nos.</li> </ul>
Evaluation of project feasibility	<p>Technically, this project is feasible. Many similar irrigation projects have been implemented. In the feasibility studies, extensive research has been carried out related to the technical requirements and the location of the different water works. It is not clear to what extent the feasibility study also included social and environmental impact assessments. Also, no information was available on economic and agricultural effects of crop rotations, or how potential rotations will influence the water demand on the irrigation system.</p> <p>Increasing the water availability will result in higher crop production, and depending on the design will also create new opportunities for people who have not had access to this economic sector. As women have an important role in agricultural production, decreasing the uncertainty of water availability will also increase their opportunities. This of course will depend on water availability at the field level.</p>
<b>Costs (2015 Prices)</b>	
Capital costs	<p>The costs are calculated as yet for each of the two parts of the project. It can be expected that some synergy effects will occur when the North and South Unit will be executed in a coordinated way. We recommend updating the feasibility study based on such a combined approach.</p> <p>South Unit: According to the feasibility study (2011), as reported in the PCN, the estimated capital costs are: Financial: 19892.8 million BDT Economic: 14939.1 million BDT</p> <p>North Unit: According to the feasibility study (2011), as reported in the PCN, the estimated capital costs are: Financial: 69,490 million BDT Economic: 59,249 million BDT</p>
O&M costs	<p>South Unit: According to the feasibility study, as reported in the PCN, the estimated annual O&amp;M costs are: Financial: 183.2 million BDT Economic: 165.2 million BDT</p> <p>North Unit: According to the feasibility study, as reported in the PCN, the estimated annual O&amp;M costs are: Financial: 173.7 million BDT Economic: 156.7 million BDT</p>
Evaluation of financial estimates	<p>The calculated benefit-cost ratios for the individual North and South units range from 1.86 to 2.31. However, the CBA method used is not very clear regarding the incremental approach (with and without project scenario)</p>



		<p>for agricultural benefits, which might result in overstatement of agricultural productivity increases attributable to the project.</p> <p>Agricultural benefits and employment are the only benefits considered. However, realization of agricultural benefits is also contingent on the availability of water, and thus vulnerable to upstream risks or extreme droughts. The sensitivity for this is not clear.</p> <p>Some benefits are presented in the CBA report as financial revenues even though the operator/investor does not derive any direct cash flows from project operations. These benefits should be regarded as economic benefits.</p> <p>Finally, the agricultural benefits in the feasibility study start years before implementation is finalized, this seems incorrect.</p>
Potential environmental costs		Environmental risks with respect to the projected barrage and impacts downstream of the project area.
Potential socio-economic costs		None
<b>Benefits</b>		
Potential environmental benefits		The surface water irrigation will decrease the pressure on the groundwater. As a result, the Ground Water Table (GWT) will be increased.
Potential socio-economic benefits		<p>The main projected benefit is the increased crop production, leading to additional income and employment opportunities:</p> <ul style="list-style-type: none"> <li>• Crop intensity in the project area will be increased from 174 percent to 206 percent. Annual incremental crop production will be up to 204,880MT of rice, 5400MT of wheat, and 47,500MT of vegetables. Total value is 2,150 million BDT (North Unit) and 4,346 million BDT (South Unit).</li> <li>• Annual labor demand will increase to 36.14 lakh man days due to acceleration of agricultural production</li> </ul>
<b>Linkages to Other Projects</b>		
The project is linked to other projects in the Draught-Prone (DP) area, as they all focus on irrigation with respect to increasing crop production and establishing a more sustainable livelihood for the residents in the area. It is also linked to the Ganges Barrage project.		
<b>ADM Principles</b>		
<p>For irrigation projects of these size it is important to consider both short- and long-term developments, particularly those related to:</p> <ul style="list-style-type: none"> <li>• Climate change (precipitation, evapotranspiration, seasonal variation, river discharge)</li> <li>• Developments influencing water availability, such as water extraction agreements with India</li> <li>• Development of regional and national policies in relation to priorities for water</li> <li>• Development if regional and national priorities and policies within the agricultural sector</li> <li>• Technological development decreasing demands or increasing efficiency of agriculture</li> <li>• Demographic developments and migration patterns</li> <li>• Economic developments and consequential growth of the agricultural sector.</li> </ul> <p>Optimization of the irrigation scheme should include these uncertainties and possible scenarios to assure that the water system will be able to adapt to changing circumstances.</p>		



<b>Linkages to Climate Change Adaptation</b>	
Climate change will affect the demand as well as the availability of water. Changing patterns of precipitation (intensity, temporal and geographical distribution) and changing evapotranspiration as a result of changing temperature and distribution of clouded or sunny days will highly influence agriculture. Therefore, climate change adaptation is crucial within the agricultural sector and has to be considered in the design and implementation of these two irrigation schemes.	
<b>Private Sector Financing Potential</b>	
The main focus of this project is construction of the Dharla Barrage and associated infrastructure facilities like a road, bridge and a culvert. The project also includes improvements to about 144km flood control embankments, which have been breached at many locations due to river bank erosion.	
The project also has an equally large irrigation component (main canal, secondary canal, regulators, sluice gates etc.). This project will provide irrigation facilities to around 70 percent of the project area by the Dharla Barrage. This component will cost between 3000-3500 million BDT and could be considered for implementation using private financing. This is because:	
<ul style="list-style-type: none"> <li>• Large scale irrigation projects have the potential to be developed as PPPs because the investment can be recovered through user charges. Bangladesh has had successful precedents for applying user-pay principles in irrigation in Bangladesh. The Barind Multipurpose Development Authority (BMDA) collects upfront user fees for tube well irrigation using a prepaid card system to operate tube wells. The Authority was established by the Government of Bangladesh but became financially self-sustaining after about 10 years and has also diversified to include other activities such as agricultural extension support.</li> <li>• Even if user charges are not sufficient, there could be hybrid approaches to develop PPPs. For example, in Peru, the Chavimochic Irrigation Project is a 25-year co-financed concession that involves improving irrigation in 78,310ha in the northeastern La Libertad region through the capture and distribution of the Santa River's water. The concession is a Build-Own-Operate-Transfer where the Government of Peru auctions the land to be irrigated, the proceeds of such sale finance the construction of the irrigation infrastructure, and the private partner develops the necessary works to operate adequate irrigation services. The private partner then manages and charges for irrigation services<sup>188</sup>.</li> </ul>	
<b>Policy and Institutional Reform</b>	
Main implementing agencies	BWDB
Required coordination mechanisms	Coordination is required with Department of Agricultural Extension, Bangladesh Agricultural Development Corporation, and Department of Fisheries.
Existing policies/institutions to facilitate implementation	<ul style="list-style-type: none"> <li>• Public sector involvement in irrigation in Bangladesh is shared between the Ministry of Agriculture (MOA) and the Ministry of Local Government, Rural Development and Co-operatives (LGRD), with jurisdiction over minor irrigation, and the Ministry of Water Resources (MOWR), with jurisdiction over all other forms of water management.</li> <li>• The MOA is mainly concerned with agricultural policy development, planning and monitoring. Project delivery is the responsibility of its various agencies, the most important being the Bangladesh Agricultural Development Corporation (BADC). In the past, the BADC</li> </ul>

	<p>had been directly involved in input supply. It is now withdrawing from all commercial operations relating to minor irrigation, leaving them to the private sector.</p> <ul style="list-style-type: none"> <li>• The Department of Agriculture Extension demonstrates and extends information to farmers on crops, varieties, and agronomic practices for irrigated agriculture.</li> <li>• The Water Resources Planning Organisation (WARPO), under the Ministry of Water Resources, has a mandate to ensure coordination of all relevant ministries through the National Water Council and to plan all aspects of water development including major and minor irrigation, navigation, fisheries and domestic water supply.</li> <li>• The Bangladesh Water Development Board (BWDB) is responsible for the planning, implementation and operation of small, medium and large-scale flood control, drainage and irrigation schemes.</li> <li>• Two other types of institutions are involved in irrigation: the nationalized banks, and several private cooperatives managed by government. The banks are supposed to make loans to farmers for the purchase of minor irrigation equipment. The Bangladesh Rural Development Board (BRDB) guides the development of two-thirds of the national cooperative system (source: <a href="http://www.fao.org/nr/water/espim/country/bangladesh/index.stm">http://www.fao.org/nr/water/espim/country/bangladesh/index.stm</a>)</li> </ul>
Desirable capacity building initiatives	<p>The PCN has not proposed any institutional reform, capacity building, or development of additional skilled manpower for the project.</p> <p>However, BWDB has faced a lack of skilled manpower for quite some time to develop a series of such large scale projects. The other stakeholder organizations DOF, DAE, and BADC also face a shortage of skilled manpower.</p> <p>For proper implementation and efficient O&amp;M of the project, deployment of the required number of skilled personnel must be ensured. Capacity building through training and updating personnel on new technologies is crucial.</p>
Required policy/regulatory reforms	<p>If the project has to be flexible, then the implementation of the project itself also has to be flexible to assure that new developments are sufficiently taken into account to adapt the original design to these developments.</p>
Overall Project Assessment	
Priority	<p>Project priority is high. There is significant support for these projects from governmental, social, economic, and NGO stakeholders. From the available documentation, it does not become clear whether there is sufficient support from the environmental stakeholders. This is important to know as these types of projects can have a large impact on existing habitats.</p> <p>Direct or indirect benefits offset implementation costs in all delta scenarios. The NPV of this project is estimated to be BDT 4,627 million</p> <p>Implementing agencies have the knowledge base to implement these types of projects locally (with some limited guidance and support if needed). The responsibility for the implementation of this project lies</p>

	<p>with BWDB in cooperation with the Department of Agricultural Extension, Bangladesh Agricultural Development Corporation, and Department of Fisheries. The lack of scaled manpower to implement such large projects is a risk. The lack of manpower does not only hamper implementation. It also is a serious risk to operations and maintenance. In the further detailing this project, training programs should be included with the contracting of new personnel to implement, operate, and maintain this project. Local organization structures will be required to facilitate optimum management of the land and water resources.</p> <ul style="list-style-type: none"> <li>• Implementing the project will reduce vulnerability to future uncertainties such as sea level rise and flooding: As indicated above, the region increasingly suffers from flash floods. The objectives are to increase water availability and reduce flood risks. With the increased availability of water, an additional 50,000ha can be irrigated to increase food security. New jobs will be created, livelihood will be improved, and poverty will be alleviated. This addresses the objectives outlined in the Seventh Five-Year Plan as well as in the sectoral strategies. It is not indicated in the PCN whether these design specifics also consider climate change effects in relation to precipitation and discharge patterns. These should be considered in the further planning and design of this proposed project. ADM principles should be included in further detailing of the plans as well. These could lead to a more module oriented implementation of the project that will make it possible to spread the required investments and will leave sufficient flexibility to adapt to technological development, for example in relation to crop rotations and water demand.</li> <li>• There are no hard trade-offs with other policy objectives: In the development of the irrigation projects, the economic and social development normally tend to outweigh the ecological development. When detailing the project, sufficient attention should be paid to nature development and good management of land and water resources as well as the use of chemicals.</li> </ul> <p>In view of the above, with the necessary changes in the project design, this initiative can be classified as a short term project.</p>
State of readiness	<p>There are feasibility studies available for both projects. However, these were done in 2005 and 2012. An updated feasibility study is needed, and should include an EIA and a SIA.</p> <p>According to the the Daily Observer<sup>189</sup>, implementation of Dharla barrage irrigation project in Kurigram is still uncertain due to irregularities in different stages.</p>

	<p>In the first phase, the project was declared abandoned after the implementation period crossed the estimated time following approval in the Executive Committee of the National Economic Council (ECNEC).</p> <p>Despite submission of the Detailed Project Plan (DPP) in the second phase, the project still could not get approval. Later, in the third phase, a corrected DPP was submitted which is now in processing.</p> <p>Meanwhile, nobody can tell when the project would get approval and the implementation work would start. This shows how complex the process is and how difficult it is to get the required approvals to start the implementation.</p> <p>The project needs a comprehensive evaluation of what has been implemented and what has not. This will assure that key lessons will be incorporated into future design and planning.</p>
Additional information or work required	Actualization of the feasibility study with required EIA and SIA is needed. Also the design has to be upgraded to assure that present and possible future developments are included in the design and planning of the implementation.
Results framework and M&E arrangements	<p>In the PCN, little information is given on M&amp;E. In the logframe of the first batch of the BDP2100, there is information on the objectives of the projects, but most objectives have not been made specific or measurable in relation to quality, quantity, and time.</p> <p>A monitoring plan should be developed to support an asset management and maintenance plan and to generate sufficient information to adapt to changing circumstances. If monitoring leads to the conclusion that objectives are not being achieved, either the interventions or the objectives must be adapted.</p>

## 1.6.6 Chattogram Hill Tracts

### CH 9.2 Water Supply and Environmental Sanitation in Seven CHT Pourashavas

<b>Brief Project Description</b>
<p>The purpose of the project is to improve the health and living standard of the people in seven pourashavas (Municipalities) in the Chattogram Hill Tracts area by improving access to safe water supply, hygienic sanitation, and adequate drainage systems.</p> <p><b>Specific Objectives are:</b></p> <ul style="list-style-type: none"><li>• To install, expand, and rehabilitate piped water systems in the pourashavas</li><li>• To install environmentally sustainable sanitation systems in the pourashavas</li><li>• To ensure adequate drainage facilities and improve Solid Waste Management systems</li><li>• To strengthen the capacity of the pourashavas in operation and maintenance of water and sanitation facilities</li><li>• To improve hygiene behavior through community awareness campaigns.</li></ul> <p>The project was first conceptualized in 2009, when a feasibility study was initiated. Preparation of the DPP, however, was delayed until 2015.</p>
<b>Problem/Challenges the Project Aims to Address</b>
<p>The Sector Development Plan (SDP) identifies Chattogram Hill Tracts as a challenging area for the water and sanitation sector considering its difficult geographic and hydrogeological condition. At present, the proposed CHT pourashavas have no piped water supply system and limited access to safe water. Accelerated urbanization has contributed to rapid population growth in the seven pourashavas, compounding the problem.</p> <p>By providing safe water and environmental sanitation facilities in these areas, this project directly contributes to the Government's goal of achieving 100 percent water supply and sanitation coverage as part of their 7th Five Year Plan.</p> <p><b>Main problems are:</b></p> <ul style="list-style-type: none"><li>• Compared to other pourashavas, the water supply, drainage, sanitation, and solid waste management systems in CHT pourashavas are inadequate to meet the public demand. According to Joint Monitoring Programme (JMP), water supply coverage in CHT is 59 percent and sanitation coverage 40 percent, well below the national average of 85.5 percent and 54 percent respectively.</li><li>• It is often difficult to find suitable water sources in the CHT due to its complex hydrogeology and scarcity of water-bearing aquifers for year-round use. Because of this, inadequate water supply is one of the area's primary problems.</li><li>• The Sector Development Plan (SDP) suggests that smaller pourashavas lack both capacity and functional coordination in their water sectors. The smaller the population, the higher the need for capacity building.</li></ul> <p>The project will contribute to achieving the BDP 2100 Goal 2: enhance water security and efficiency of water usages.</p>
<b>Linkages to Existing Policies and Initiatives</b>
<ul style="list-style-type: none"><li>• Links to numerous objectives in the 7th Five Year Plan, including those set out in Chapters 2.2 and 4.2 of Part 1 and the following Chapters of Part 2:<ul style="list-style-type: none"><li>– Agriculture: 4.2, 4.3, 4.6</li><li>– Environment and Climate Change: 8.3, 8.6</li><li>– Housing and Community Amenities: 9.7</li><li>– Social Protection: 14.2, 14.5</li></ul></li></ul>

- Project meets objectives/targets/strategies in National Policy for Safe Water Supply & Sanitation (1998). It links to policy issues such as:
  - Facilitating access of all citizens to basic level of services in water supply and sanitation (Objective A),
  - Reducing incidents of water borne diseases (Objective C),
  - Promoting sustainable water and sanitation services (Objective E),
  - Ensuring proper storage, management and use of surface water and preventing its contamination (Objective F), and ensuring sanitary latrine within easy access of every urban household through technology options ranging from pit latrines to water borne sewerage (Target IV)
- Project fits overall strategy of the National Water Management Plan (NWMP) and links to all three NWMP immediate objectives:
  - 1. Rational management and wise use of Bangladesh’s water resources
  - 2. People’s quality of life improved by the equitable, safe and reliable access to water for production, health and hygiene
  - 3. Clean water in sufficient and timely quantities for multipurpose use and preservation of the aquatic and water dependent ecosystem.
- Links to numerous goals in National Water Management Plan Development Strategy including: Towns and Rural Areas (Water supply and flood protection), Agriculture and Water Management (Flood control/drainage), and Natural Environment and Aquatic Resources (Water management for ecologically sensitive areas and supporting environment measures)
- Links to overall objectives and strategies of National Sanitation Strategy
- Applies to overall objectives of Coastal Development Policy and follow-on Strategy Targets/Strategic Priorities (Ensuring fresh and safe water availability, safety from man-made and natural hazards, optimizing use of coastal lands, promoting economic growth, sustainable and equitable management of natural resources, improving livelihood conditions, and environment conservation), and associated Investment Program.
- Links to National Adaption Programme of Action (2005) adaption needs and intervention measures
- Links to objectives of the National Sustainable Development Strategy in areas such as water resource management, disaster management, and quality health/sanitation services.
- Links to objectives of the National Water Policy (1999) such as harnessing/development of all forms of surface/groundwater as well as being in line with proposed Government actions under Planning and Management of Water Resources, Water for the Environment and, Water Supply and Sanitation.
- Helps to achieve the objectives of a number of the programmes outlined in the Bangladesh Climate Change Strategy and Action Plan 2009 Annex, principally under the Food Security, Social Protection and Health and Infrastructure pillars/themes.
- Links to the National Food Policy 2006 Plan of Action 3.5: safe drinking water and improved sanitation

**Technical Assessment**

Technical description of project	The project will: <ul style="list-style-type: none"> <li>• Improve sources of drinking water, either by extraction from the ground or lifting from surface-water sources or both</li> <li>• Build new treatment plants or upgrade existing plants as needed</li> </ul>
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	<ul style="list-style-type: none"> <li>• Provide public, school, and community latrines. This will improve public health by reducing the risk of spreading diseases such as diarrhea and cholera</li> <li>• Install pipe networks through the right of way, minimizing the chances of land acquisition and resettlement problems</li> <li>• Conduct awareness campaigns to educate populations on the sustainable use of water and sanitation infrastructure.</li> </ul>
Evaluation of project feasibility	<ul style="list-style-type: none"> <li>• From a technical point of view, the project is feasible, but feasibility from the social and economic point of view remains to be assessed.</li> <li>•</li> <li>• Each pourashava will bear responsibility for the operation and maintenance of the systems once built. Because rural water supply and sanitation projects are extremely sensitive to operation and maintenance, the long-term feasibility of the project will depend on the institutional and financial constraints of each setting.</li> </ul>
<b>Costs</b>	
Capital costs	<ul style="list-style-type: none"> <li>• Based on the DPP, as reported in PCN:</li> <li>• 5432.7 million BDT (2015 prices)</li> </ul>
O&M costs	<ul style="list-style-type: none"> <li>• Based on the DPP, as reported in PCN:</li> <li>• O&amp;M costs after implementation of the project would be borne by the budget of the respective pourashavas and therefore are not reflected in the DPP. These should however be included in the CBA, regardless of who pays for them.</li> </ul>
Evaluation of financial estimates	<p>The financial estimates, and feasibility study in general, should be strengthened or redone before continuing with the project.</p> <p>In the DPP, the projected benefits are not valued and hence no IRR or benefit/cost ratio is stated. However, the PCN features several remarks regarding the valuation of these benefits, indicating that a valuation was done in a different feasibility study or updated DPP. We make the following specific observations:</p> <ul style="list-style-type: none"> <li>• The O&amp;M costs are missing. These should be included in the Cost Benefit Analysis (CBA) regardless of who pays for them</li> <li>• PCN remarks on valuation of benefits are as follows: <ul style="list-style-type: none"> <li>– The initial year in which benefits are likely to be realized should be re-evaluated</li> <li>– The value of water (based on the tariff applied) should be calculated as a financial benefit, not an economic benefit</li> <li>– The main economic benefits should be based on comparing the “with the project” and “without the project” scenarios. Possible economic benefits include time saved that would have been spent getting water, avoided health costs, etc. An alternative, to avoid double counting, is to take the willingness to pay (WTP) as a proxy.</li> <li>– The reported EIRR shows a range of 7 to 23 percent, but the corresponding NPVs are all negative. This seems methodologically erroneous.</li> </ul> </li> </ul>
Potential environmental costs	--
Potential socio-economic costs	--



<b>Benefits</b>		
Potential benefits	environmental	<ul style="list-style-type: none"> <li>Improved sanitation, leading to less pollution</li> </ul>
Potential benefits	socio-economic	<p>Benefits include improved public health, avoided costs of illness, and better earning potential resulting from</p> <ul style="list-style-type: none"> <li>Increased availability of safe drinking water</li> <li>Improved sanitation</li> <li>Improved drainage and solid waste management facilities.</li> </ul> <p>These benefits have been partly valued. Refer to observations above.</p>
<b>Linkages to Other Projects</b>		
<p><b>Linkage with other projects:</b></p> <ul style="list-style-type: none"> <li>UNDP's Chattogram Hill Tracts Development Facility (CHTDF), aiming to strengthen the capacity of CHT institutions to effectively manage services, and to encourage communities to take charge of their own development based on the principles of local participation and decentralized development</li> <li>ADB's Second Chattogram Hill Tracts Rural Development Project, aiming at: <ul style="list-style-type: none"> <li>Institutional development and capacity building</li> <li>Rural roads and markets development</li> <li>Community based water and sanitation infrastructure</li> <li>Micro Agribusiness Development (MAD)</li> <li>Project management.</li> </ul> </li> </ul>		
<b>ADM Principles</b>		
<p>Using smaller water and sanitation systems is more flexible but could also be costlier. Project planners should develop different scenarios to estimate the impact on operations of variables such as:</p> <ul style="list-style-type: none"> <li>Demographic development</li> <li>Institutional capacity</li> <li>Quality of water and type of contaminants to be treated, e.g. in the case of local industry development.</li> </ul>		
<b>Linkages to Climate Change Adaptation</b>		
<p>Well-designed systems will be adaptable to changes in climate. For example, if the storm water drainage system is combined with the sewerage system, the system can be dimensioned in such a way that it will handle future rainfall intensities and durations.</p>		
<b>Private Sector Financing Potential</b>		
<p>Given the low tariffs for water supply across Bangladesh and the political and social issues surrounding collection of outstanding dues, it is unlikely that retail water supply operations will be financially viable in the near term. However, PPPs could be used to develop water treatment or sewerage treatment plants. PPPs are a well-established way for developing treatment plants in several parts of the world. Even countries like India with similar social and tariff issues are starting to develop a reasonable track record of developing PPPs for water treatment plants.</p> <p>It is possible that the WASAs may need to finance part of the capital costs to keep the tariffs low. However, on an overall lifecycle cost basis, PPPs are likely to be cheaper even with this contribution since the projects are likely to be maintained properly and will, therefore, need lower replacement costs. This is particularly true for sewerage treatment plants since, apart from Dhaka WASA, no other WASAs in the country have the experience of operating and maintaining such plants.</p>		

<b>Policy and Institutional Reform</b>	
Main implementing agencies	Department of Public Health Engineering
Required coordination mechanisms	The pourashavas (co-implementation and O&M): Pourashavas are responsible for providing water supply and sanitation services to the community on behalf of GoB. Facilities constructed and installed under this project will be handed over to the pourashavas, which will operate and maintain them along with representatives from the community. DPHE will sign an MOU concerning the allocation of responsibilities with the concerned pourashava prior to installation or construction of new facilities.
Existing policies/institutions to facilitate implementation	<ul style="list-style-type: none"> <li>Chapter 10.1 of the Seventh FYP indicates that the GoB will implement health services tailored to the CHTs' particular circumstances. Chapter 14.5 (Part 2) provides that the GoB will take measures to prevent malaria, diarrhea and other diseases in hill tracts and provide sanitation facilities to the people</li> <li>CHT tribal leadership / Jana Samhati Samiti may assist with implementation</li> <li>MoWR Task Force established to develop new institutional framework for WRM</li> <li>The general thrust of all recommended actions under the Bangladesh Climate Fiscal Framework 2014 is to facilitate access to climate finance, and to ensure that climate change finance is deployed in the most effective way. So, to the extent that this project seeks to address the impact of climate change, and is of sufficiently high priority, this policy should help to ensure it gets funded. Appendix 2 classifies water supply / sanitation projects as being somewhat relevant to CC mitigation/adaption (third highest ranking)</li> <li>Bangladesh Climate Change Strategy and Action Plan 2009 includes projects like this within its action plan, and accordingly facilitates the project's implementation (refer to the Annex).</li> <li>National Environment Committee, National Steering Committee on Climate Change, Inter-Ministerial Disaster Management Committee, National Disaster Management Advisory Committee each may assist with implementation</li> </ul>
Desirable capacity building initiatives	<ul style="list-style-type: none"> <li>Training at the pourashava level and for DPHE.</li> <li>Financial and personnel support for the pourashavas.</li> </ul>
Required policy/regulatory reforms	<ul style="list-style-type: none"> <li>Implementation of the recommendations in the November 2014 Final Report on Institutional Improvement of BWDB</li> </ul>
<b>Overall Project Assessment</b>	
Priority	<p>Project priority is high. Water and sanitation projects such as these contribute directly to the SFYP and the Sustainable Development Goals. This and similar projects are also included in the list of short term interventions of the Delta Plan.</p> <ul style="list-style-type: none"> <li>Direct or indirect benefits offset implementation costs in all delta scenarios: The NPV of this project is estimated to be BDT -82 million.</li> </ul>

	<ul style="list-style-type: none"> <li>• Implementing agencies have the knowledge base to implement these types of projects locally (with some limited guidance and support if needed). The responsibility for implementing this project lies with the Public Health Engineering Department. Each pourashava will bear responsibility for the operation and maintenance of the systems, once built. Because rural water supply and sanitation projects are extremely sensitive to operation and maintenance, the long-term feasibility of the project will depend on the institutional and financial constraints of each setting. Training at the pourashava level as well as within DPHE is required.</li> <li>• Implementing the project will reduce vulnerability to future uncertainties such as sea level rise and flooding. The purpose of the project is to improve the health and living standard of the people in seven pourashavas (Municipalities) in the Chattogram Hill Tracts area by improving access to safe water supply, hygienic sanitation, and adequate drainage systems. It is difficult to consider future uncertainties if required conditions of today are not met. The first objective is to meet these requirements while keeping in mind the criteria of ADM to ensure that interventions will be able to adapt to future developments. The interventions proposed will work under each of the development scenarios described in the Delta Plan.</li> <li>• There are no hard trade-offs with other policy objectives. In providing drinking water, sanitation and adequate drainage capacity, there are no hard trade-offs with other policy objectives.</li> </ul> <p>In view of the above, with the necessary changes in the project design, this initiative can be labelled as a short term project.</p>
State of readiness	<p>Some pourashavas have installed tube wells in locations where groundwater sources are available. Some have also built connections to available surface water sources.</p> <p>A feasibility study was published in 2009, and costs have been updated to 2015 levels. The study includes details on bore logs and pumping tests, but does not include an Environmental Impact Analysis, a Social Impact Analysis, or a Cost-Benefit Analysis. These analyses must be carried out before a next step can be taken.</p>
Additional information or work required	<ul style="list-style-type: none"> <li>• Re-design project to incorporate Adaptive Delta Management (ADM)</li> <li>• Address sectoral components</li> <li>• Address risks such as landslides, flash floods, etc.</li> <li>• Integrate the project with related projects in the area, contributing to a more comprehensive plan for management of land, water, agriculture, and biodiversity in the Chattogram Hill Tracts area.</li> <li>• Develop a monitoring plan to support maintenance and asset management and to provide data for subsequent ADM decisions.</li> </ul>
Results framework and M&E arrangements	<ul style="list-style-type: none"> <li>• The PCN provides little information concerning M&amp;E. The BDP2100 Batch 3 log frame presents the Goals and Purpose of the project, but these are very general and should be developed and refined. Criteria on input and output are straightforward, but may need adjustments for ADM-related design changes. The PCN specifies no criteria for quality and time, and lacks a monitoring plan.</li> </ul>

## I.7 BDP2100 Proposed Projects

Table I.13 lists the projects provided by GED to the Investment Plan team for consideration in the Investment Plan. Team A prepared project concept notes for each of these projects. Of the 34 projects received, 26 had enough detailed information to conduct a full project assessment as presented in this report. Two projects (CC 9.4 and 9.5) were excluded at GED's request because they are already in advanced stages of consideration for implementation. An additional three projects (CZ 1.9, CZ 1.10, DP 1.6) were excluded because they are already at advanced stages of approval with funding secured for implementation. GED also requested that projects HR 2.1 and HR 2.2 be combined and assessed as one holistic project. The same is true for projects DP 1.4 and DP 1.5. This leaves a total of 19 projects for detailed evaluation.

**Table I.13: Projects Received through the BDP2100 Process**

#	Project Code	Project Name	Batch	Project Type	Detailed Info	Implemented?	Full Assessment
1	MR 1.1	River Bank Improvement Program	1	Infrastructure	Yes	No, waiting approval from ECNEC	Yes
2	MR 1.2	Integrated River System Management and Protection of Accreted Land	3	Knowledge	No	No	No
3	MR 1.5	Harnessing of Brahmaputra Water	3	Knowledge	No	No	No
4	MR 1.6	Development of Chandona-Barasia River Basin System	2	Infrastructure	Yes	No	Yes
5	MR 3.1	Sustainable Restoration of Connectivity of Major Navigation Routes	1	Infrastructure	Yes	No	Yes
6	CZ 1.1	Construction of Ganges Barrage and Ancillary Works	1	Infrastructure	Yes	No	Yes
7	CZ 1.3	Char Development and Settlement Project- V	2	Infrastructure	Yes	No	Yes
8	CZ 1.4	Integrated Management of Drainage Congestion for Greater Noakhali	3	Knowledge	No	No	No
9	CZ 1.5	Tidal River Management	3	Knowledge	No	No	No
10	CZ 1.6	Integrated Land Reclamation Project of Hatiya-Dhamar Char-Nijhum Dwip	1	Infrastructure	Yes	No	Yes

#	Project Code	Project Name	Batch	Project Type	Detailed Info	Implemented?	Full Assessment
11	CZ 1.7	Urirchar-Noakhali Cross Dam Project	2	Infrastructure	Yes	No	Yes
12	CZ 1.8/ CZ 1.21	West Gopalganj Integrated Water Management Project	1	Infrastructure	Yes	No (Phase 2)	Yes
13	CZ 1.9	Sureswar Flood Control, Drainage and Irrigation Project	1	Infrastructure	Yes	Yes, approved by ECNEC 4/10/2016	No
14	CZ 1.10	Rehabilitation of Polder 36/1	1	Infrastructure	Yes	Yes	No
15	CZ 1.11	Improved Drainage in the Bhabadha Area	2	Infrastructure	Yes	No	Yes
16	CZ 1.26	Development of Water Management Infrastructure in Bhola Island	3	Infrastructure	Yes	No, but expected to be funded by ORIO pending approval of DPP	Yes
17	CZ 1.38	TRM of 7 Beels in Coastal Zone	3	Infrastructure	No	No	No
18	UA 1.1	Protection of Rivers System around Dhaka City with Their Ecological Restoration	1	Infrastructure	Yes	No	Yes
19	UA 1.2	Dhaka Integrated Flood Control Embankment cum Eastern Bypass Road Multipurpose Project	1	Infrastructure	Yes	No	Yes
20	UA 1.3	Drainage Improvement of Dhaka-Narayangonj-Demra Project (Phase 2)	3	Infrastructure	Yes	No	Yes
21	UA 9.1	Greater Dhaka Integrated Water and Sewage Improvement Project	3	Infrastructure	No	No	No

#	Project Code	Project Name	Batch	Project Type	Detailed Info	Implemented?	Full Assessment
22	UA 10.1	Improvement of Drainage Congestion and Flood Control for Chattogram City Corporation Area	2	Infrastructure	Yes	No	Yes
23	HR 2.1*	Village Protection against Wave Action in Haor Area	1	Infrastructure	Yes	No	Yes
24	HR 2.2*	Improved Water Management in Haor Basins	1	Infrastructure	Yes	No	Yes
25	DP 1.1	North Rajshahi Irrigation Project	1	Infrastructure	Yes	No	Yes
26	DP 1.2	Revitalization and Restoration of Beel Halti	2	Infrastructure	Yes	No	Yes
27	DP 1.3	Revitalization and Restoration of Hurasagar and Atrai rivers	2	Infrastructure	No	No	No
28	DP 1.4**	Kurigram Irrigation Project (South Unit 2nd Phase)	1	Infrastructure	Yes	No	Yes
29	DP 1.5**	Kurigram Irrigation Project (North Unit )	1	Infrastructure	Yes	No	Yes
30	DP 1.6	Teesta Irrigation Project (Phase-2)	2	Infrastructure	Yes	Yes	No
31	CH 9.2	Water Supply and Environmental Sanitation in Paurashavas under Chattogram Hill Tracts	3	Infrastructure	Yes	No	Yes
32	CC 1.2	Development of Small-Scale Water Reservoir and Revitalization of Water Bodies, Khals, etc.	3	Infrastructure	No	No	No
33	CC 9.4***	Water Supply, Sanitation, Drainage, and Solid Waste Management for 23 Small Paurashavas	3	Infrastructure	Yes	Yes	No

#	Project Code	Project Name	Batch	Project Type	Detailed Info	Implemented?	Full Assessment
34	CC 9.5***	Water Supply and Environmental Sanitation Including Faecal Sludge Management in 31 Paurashavas	3	Infrastructure	Yes	Yes	No

\*GED indicated that these two projects should be combined and assessed together as one project

\*\*GED indicated that these two projects should be combined and assessed together as one project

\*\*\*Project already in advanced stages of consideration for implementation. GED indicated this project should not be considered for the Investment Plan

## I.8 Additional Batch 4 Project Proposals

Table I.14 shows additional project concept ideas that were received in the fourth batch of project proposals on 24 September, 2016. These are all very initial project ideas that do not yet have enough information to conduct a full project assessment. These projects will be evaluated in the Investment Plan as potential future projects for application of multi-criteria analysis.

**Table I.14: Additional Batch 4 Project Proposals**

Project #	Project Name
<b>Final Draft Concept Notes</b>	
UA 9.3	Project for improvement of storm water drainage facilities in the city corporation area
UA 9.2	Improvement of sanitation system in city corporation areas of Bangladesh
UA 9.1	Water Supply project for the city corporation areas in Bangladesh (Phase I & II)
UA 3.1	Improvement of drainage network, flood control and solid waste management for Khulna City
UA 23.2	Financial performance improvement of a Water Utility in a medium size city
UA 23.1	Khulna Water Supply Project Phase II
UA 11.1	Improvement of drainage congestion, canal dredging and flood control for Barisal City Corporation area
MR 15.2	Eco-management zoning of Charland Ecosystem for Biodiversity Protection
HR 2.4	Elevated Village Platforms for the Haor Areas
HR 14.3	Management of Commercially Important Wetland Ecosystem
HR 14.1	Ecosystem habitat preservation program for plants, wildlife, fisheries and migratory birds
DP 3.2	Establishment of Inland Container Terminals at Nagarbari / Baghabari and Balashi / Chilmari in the northern region of Bangladesh
DP 25.3	Development of WMOs and Participatory Scheme Management Model, with Cost Recovery for O&M for the Kurigram Irrigation Schemes (I & II)
DP 25.2	Development of Scheme WMOs and Agreement with Individual LLP Owners/ Operators for Cost Recovery for O&M for the Mahananda Irrigation Scheme



Project #	Project Name
<b>Final Draft Concept Notes</b>	
DP 25.1	Development of WMOs and Participatory Scheme Management Model, with Cost Recovery for O&M under the North Rajshahi Irrigation with Ganges Barrage
CZ 4.1	Development of Climate Smart Integrated Coastal Resources Database (CSICRD).
CZ 17.1	Exploration of the Production Potential of Coastal Saline Soils of Bangladesh
CZ 14.7	Restoration of Ecologically Important Coastal Islands
CZ 12.6	Integrated Coastal Zone Landuse Planning in Bangladesh using GIS and RS Technology
CZ 1.39	Morphological Dynamics of Meghna Estuary for Sustainable Char Development
CZ 1.30	Rehabilitation of Water Management Infrastructure in Bhola District
CZ 1.12	Construction of 11 Cross Dams in the Meghna - Tetulia Estuary
CH 26.2	Development Catchment and Sub-catchment Management Plans
CH 26.1	Kaptai Lake rehabilitation Study and Pilot Project
CH 1.1	Prospects for Promoting Soil Conservation and Watershed Protection in CHT
CC 9.18	Project for improvement of storm water drainage facilities in pourasava (Phase I)
CC 9.17	Project for improvement of water supply and sanitation facilities in char area
CC 9.16	WASH education and facilities in Primary Schools & Madrashas
CC 9.15	WASH education and facilities in secondary schools
CC 9.13	Village Piped water supply system project (Phase I & II)
CC 9.12	Improvement of sanitation system in urban area of Bangladesh
CC 9.11	Water Supply project in the Urban areas of Bangladesh (secondary towns)
CC 9.10	Piped Water Supply project in 100 Pourasavas
CC 3.9	Development and Rehabilitation of Existing Ferry Points at Road- Heads
CC 3.8	Maintenance Navigability of 88 River Routes of IWT Network.
CC 3.7	Digitization of Gauge Stations and Collection of Data from Gauge Stations through Global System for Mobile (GSM)
CC 3.6	Modernizing Existing DGPS System and Replacement of Electronic Positioning System of BIWTA
CC 3.14	Origin-Destination (O-D) survey of IWT Traffic in Bangladesh waterways.
CC 3.13	Development and Modernization of 24 Inland River Ports in Bangladesh
CC 3.12	Development & Improvement of 1200 way side landing stations in the rural areas of Bangladesh
CC 3.11	Institutional readiness for implementation of the Delta Plan 2100: Proposal for restructuring BIWTA for present and future needs
CC 3.10	Charting of Inland Waterways through Comprehensive Hydrographic Survey
CC 25.9	Establishment of Governance Framework for Enhancement of 'Blue Economy'
CC 25.8	Evolving Governance Framework for Decentralised and Devolved Water Resources Management
CC 25.7	Macro Planning in the Water Sector: Supporting Dialogue to Re-establish Place and Position of WARPO
CC 25.6	Capacity Building for Delta Commission Personnel and related Committees
CC 25.5	Development and Setting up of Geo- Management Information System (GMIS) and Digital Office of the Bangladesh Delta Commission

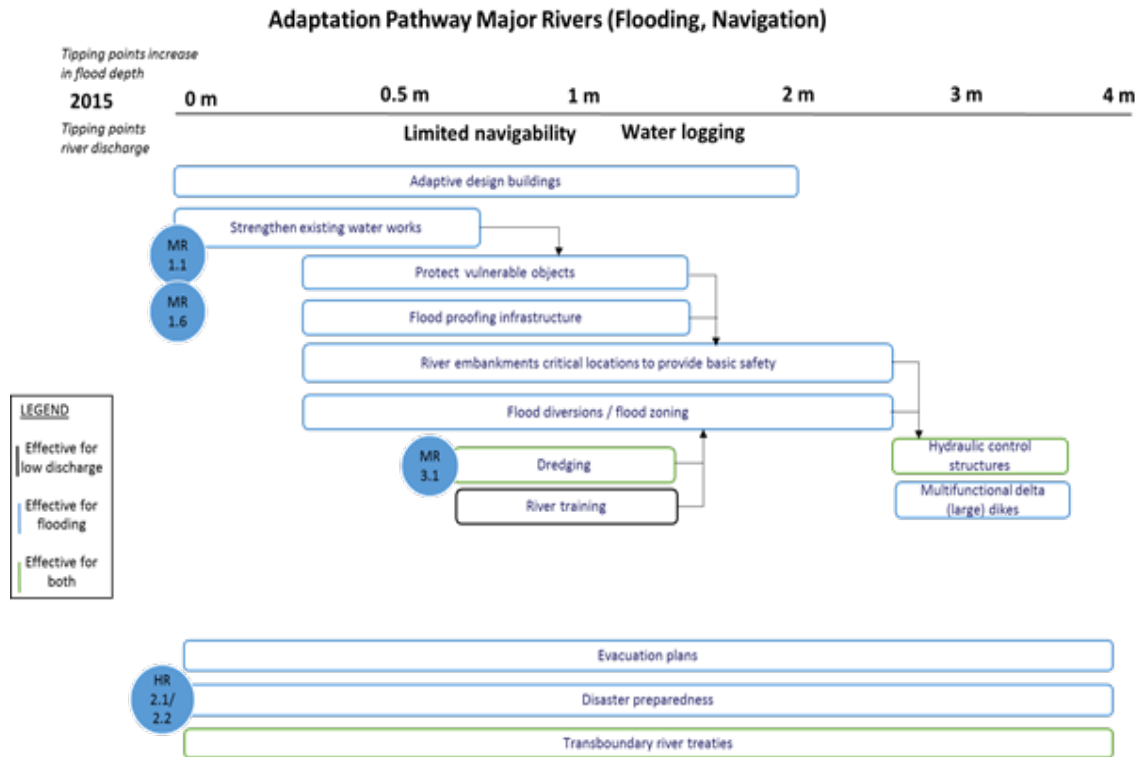
Project #	Project Name
<b>Final Draft Concept Notes</b>	
CC 25.4	Integrated Modelling to Support Adaptive Delta Management (ADM) for Water Sector
CC 25.4	Support to the Establishment of the Delta Commission to Implement the BDP 2100
CC 25.3	Developing Green Climate Fund Strategy & Facility (GCF project readiness support facility & financial Instrument)
CC 25.2	Feasibility Study for Innovation & Demonstration Fund for Water Projects Bangladesh
CC 25.18	Develop Institutional Arrangement and Coordination Mechanism at Local Government (rural level) for Adaptive Delta Management
CC 25.14	Strengthening of Coast Guard for Improvement of Safety and Security Supporting the Newly Emerging 'Blue Economy'
CC 25.13	Digitisation of Land Records of Newly Accreted Riverine and Coastal Areas, Erosion prone Areas and Coastal & Riverine Chars and Islands under the BDP 2100 Programme Supporting on-going National Efforts
CC 25.12	Establishment of Issue Based Problem Solving Coordination Mechanism at Field Level
CC 25.11	Revitalised and New Look BWDB – Strengthening of Functionalization
CC 25.10	Providing Delta related Information at Community Doorsteps through Union Digital Centres (UDCs) Supporting E- governance and Decentralisation
CC 25.1	Delta Projects Enabling PPP Facility
CC 18.9	Capacity Building of Upazila Parishads for Adaptive Delta Management
CC 1.47	Institutional and policy reform Initiatives for coordinated Ground Water Management
CC 1.46	Managed Aquifer Recharge for Artificial Storage (MARAS) of Water to Improve Groundwater Table and Quality Conditions in Vulnerable Areas of Bangladesh
CC 1.45	Expansion and Modernization of Monitoring Network and Tools for Sustainable Development, Management and Governance of Groundwater in Bangladesh
CC 1.44	Institutional Capacity Building for Groundwater Management and Preparation of Water Budget and Water Allocation Plans at Upazila Level of Bangladesh
CC 1.4	Development/Improvement of Multi-purpose Disaster Shelters and its Management Information System (MDS&MIS)
CC 1.3	Dynamic Climate Smart Knowledge Portal and Hydro-geological Database for MoWR and BWDB.
<b>Draft Concept Notes</b>	
UA 27.9	Vision development for sustainable urban areas
UA 27.8	Prioritizing economic zones
UA 27.7	National Comprehensive Development Planning Interfaced Landuse Plan for the Whole Country
UA 27.6	National and regional spatial strategies
UA 27.5	Integrated sustainable wetland Development
UA 27.4	Integrated Waterfront development
UA 27.3	Integrated strategy for urban drainage, including increasing the urban water storage capacity
UA 27.2	Capacity development for integral urban design and spatial planning
UA 27.1	Creating integrated base maps
MR 12.1	Enhancement of Agricultural Productivity towards Food Security in Char Lands

Project #	Project Name
<b>Final Draft Concept Notes</b>	
HR 1.1	Program for Implementation of Rationalized Water Related Interventions in Upper Meghna Basin
DP 1.21	Program for Implementation of Rationalized Water Related Interventions in Hurasagar Basin
CZ 12.8	Southern Agricultural Improvement Project (SAIP)
CZ 1.53	Structural Interventions for Managing Sea Level Rise: Preparatory Surveys & Studies
CZ 1.52	Land beyond Land, efforts to reclaim lands at near coast; Preparatory Surveys and Studies
CZ 1.48	Program for Implementation of Rationalized Water Related Interventions Gumti -Muhuri Basin
CZ 1.47	Rationalization of Polders in Gumti - Muhuri Basin
CZ 1.45	Program for Implementation of Rationalized Water Related Interventions in Baleswar- Tentulia Basin
CZ 1.44	Rationalization of Polders in Baleswar - Tentulia Basin
CZ 1.41	Program for Implementation of Rationalized Water Related Interventions in Gorai-Passur Basin
CZ 1.40	Rationalization of Polders in Gorai - Passur Basin
CH 26.5	Flow control and water storage structures for water availability in the dry season
CH 26.4	Promoting Sustainable cultivation practices, including agro- forestry
CH 26.3	Sustainable tourism CHT feasibility study
CH 12.4	Enhancement of Livelihood in the Chattogram Hill Tracts Through Good Agricultural Practices
CH 1.11	Program for Implementation of Rationalized Water Related Interventions in Chattogram Coastal Plain Basin
CH 1.10	Rationalization of Polders in Chattogram Coastal Plain
CC1.43	Revitalization of Khals all over the country
CC 18.5	Improvement of Urban Drainage in District and Upazila level municipalities of Bangladesh
CC 12.37	Integrated Agricultural Development in moderately Cyclone affected area
CC 1.41	Program for Implementation of Rationalized Water Related Interventions in Dhaleswari Basin

## I.9 Adaptive Pathways

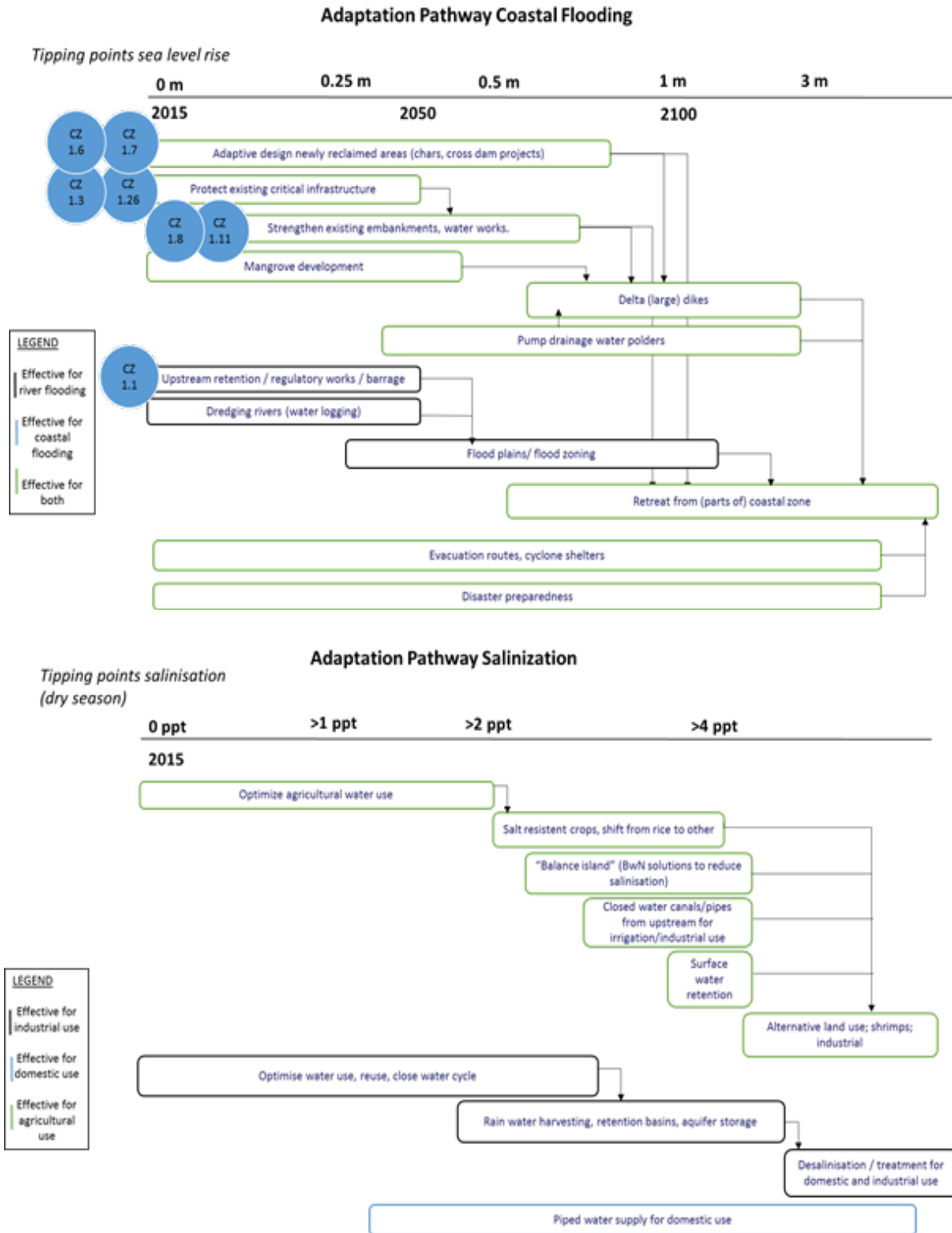
This Appendix shows the adaptive pathways and describes how projects fit on the pathways.

Figure I.5: Major Rivers Adaptive Pathway



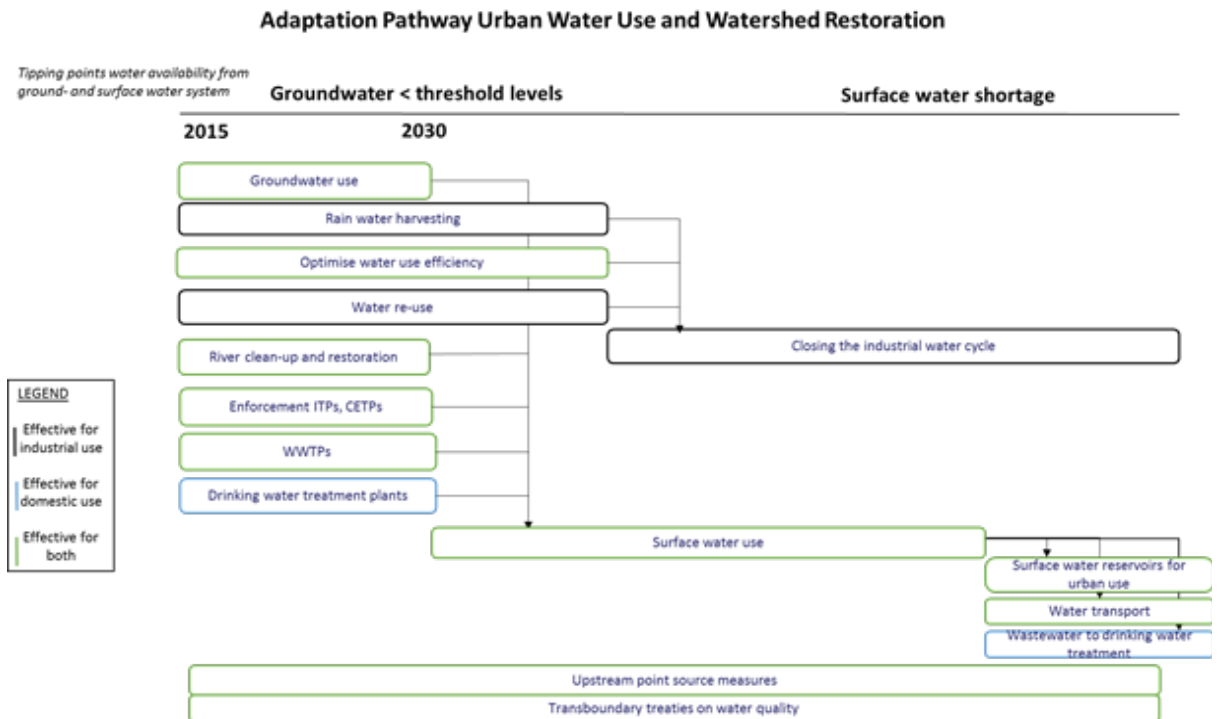
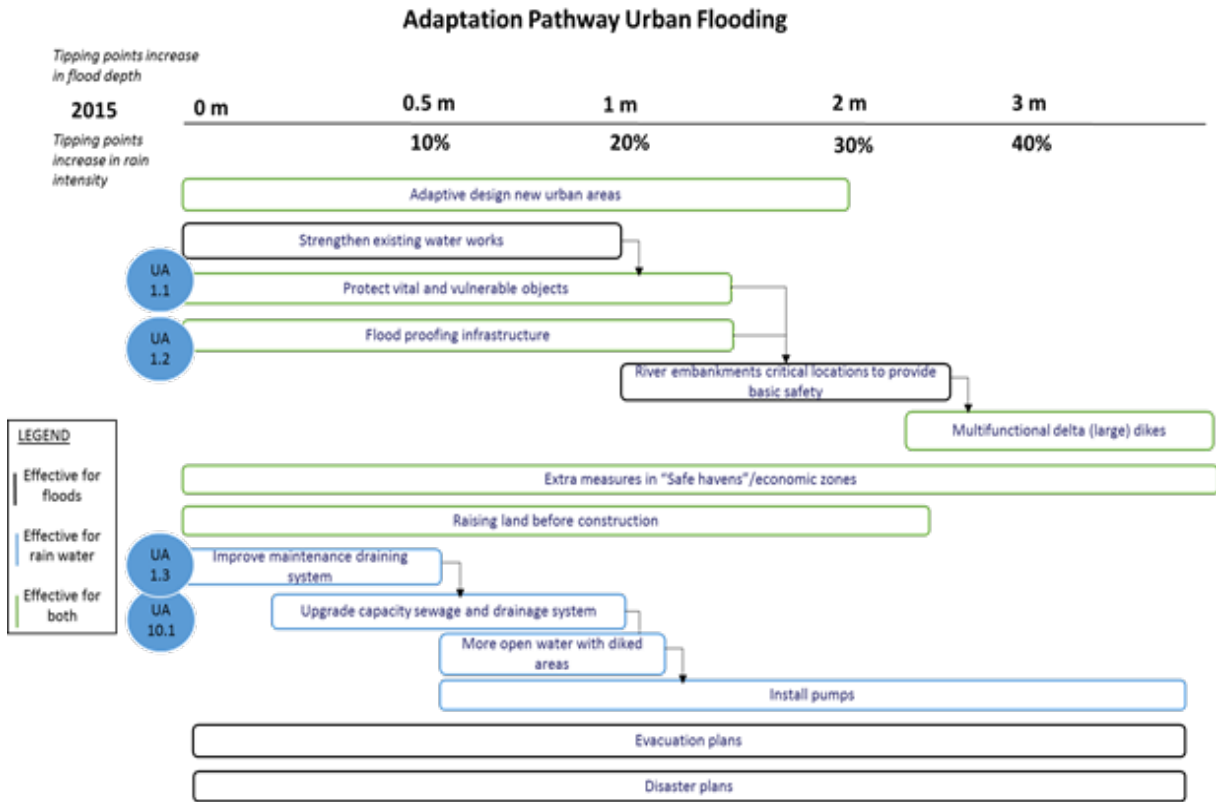
- MR 1.1 River Management Improvement Program Reconstruction of flood embankments is part of strengthening existing water works
- MR 1.6 Development of Chandana-Barasia River Basin System Excavating offtake canals of the Chandana River is part of strengthening existing water works
- MR 3.1 Sustainable Restoration of Connectivity of Major Navigation Routes Dredging is part of flood diversion/flood zoning
- HR 2.1/2.2 Village Protection against Wave Action and Improved Water Management This intervention is part of strengthening existing water works and disaster preparedness

Figure I.6: Coastal Zone Adaptive Pathways



- CZ 1.1 Construction of Ganges Barrage and Ancillary Works Constructing a barrage across the Ganges river is part of upstream retention /regulatory works/barrage
- CZ 1.3 Char Development and Settlement Project-V-Structural interventions to manage water and land use is part of protecting existing critical infrastructure and disaster preparedness
- CZ 1.6 Integrated Land Reclamation Project of Hatiya-Dhamar Char-Nijhum Dwip Constructing a cross-dam is part of adaptive design newly reclaimed areas and disaster preparedness
- CZ 1.7 Urirchar-Noakhali Cross Dam Project Constructing a cross-dam is part of adaptive design newly reclaimed areas and disaster preparedness
- CZ 1.8/1.21 West Gopalganj Integrated Water Management Project Constructing embankments and other structures is part of strengthening existing embankments and water works
- CZ 1.11 Improved Drainage Problem in the Bhabadha Area Construction of embankment, repair of regulators and excavation of drainage channels is part of strengthening existing embankments and water works
- CZ 1.26 Development of Water Management Infrastructure in Bhola Island Construction of embankments and implementing an Early Erosion Warning System are part of protecting existing critical infrastructure and disaster preparedness

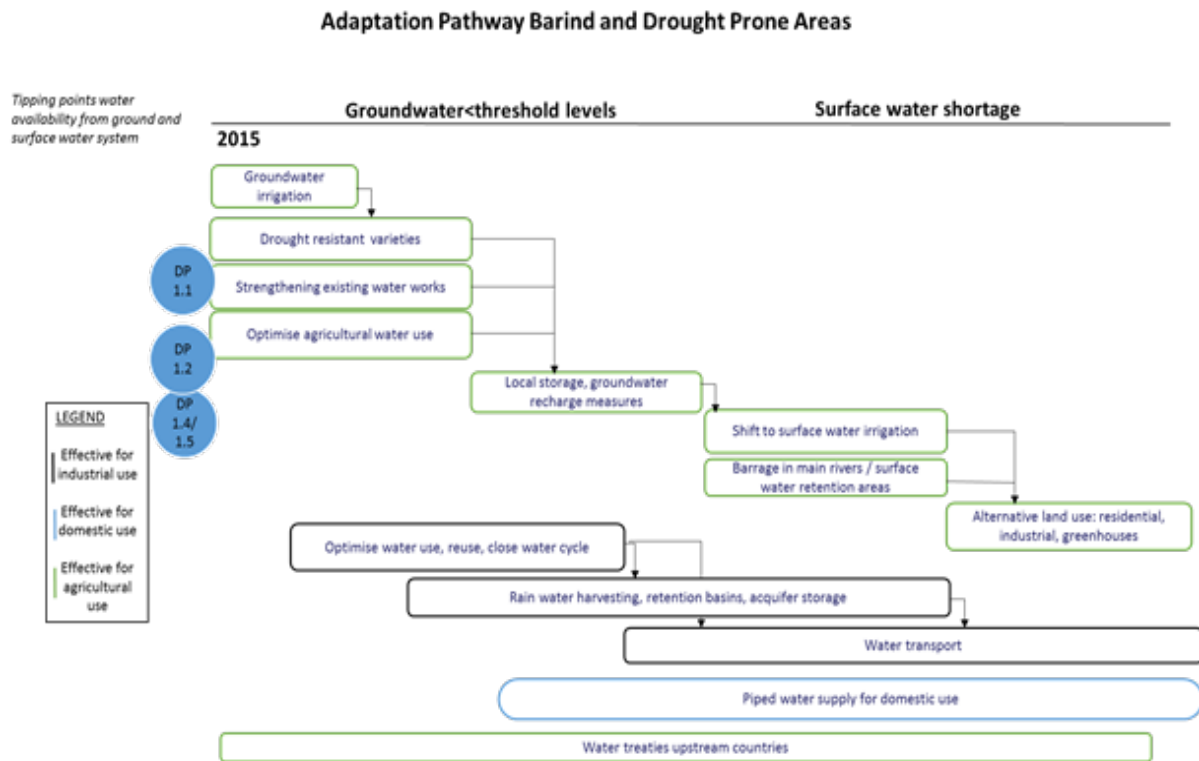
Figure I.7: Urban Areas Adaptive Pathways





- UA 1.1 Protection of Rivers System around Dhaka with Their Ecological Restoration Connecting rivers to neighboring rivers and restoring surrounding ecosystems is part of protecting vital and vulnerable objects
- UA 1.2 Dhaka Integrated Flood Control Embankment cum Eastern Bypass Road Multipurpose Project Constructing embankments and bypass roads are part of flood-proofing infrastructure and disaster plans
- UA 1.3 Drainage Improvement of Dhaka-Narayanganj-Demra Project (Phase 2) Improvement of drainage systems is part of improving maintenance drainage system and upgrading the capacity of sewage and drainage systems
- UA 10.1 Improvement of Sanitation, Drainage, Congestion, and Flood Control for Chattogram City Corporation Area Improvement of drainage systems is part of improving maintenance drainage system and upgrading the capacity of sewage and drainage systems

Figure I.8: Barind and Drought Prone Areas Adaptive Pathway



- DP 1.1 North Rajshahi Irrigation Project Expansion of irrigation and drainage networks is part of strengthening existing water works and groundwater irrigation
- DP 1.2 Revitalization and Restoration of Chalan Beel (Beel Halti) Interventions to improve irrigation, flood management and drainage are part of groundwater irrigation and optimizing agricultural water use
- DP 1.4/1.5 Kurigram Irrigation Project Constructing canals, barrages, and associated works for expanding irrigation coverage is part of optimizing agricultural water use

## I.10 Research and Consultations

In addition to reviewing the information in the PCNs, the Team engaged in extensive additional research and consultations to gather information for the project assessments. The Team also conducted field visits around Dhaka, the Haor Region, the Padma River, and polders in southwest Bangladesh around Khulna. The team conducted additional analysis including:

- Extending the technical evaluation of projects
- Applying ADM principles
- Broadening project scope to cross-cutting themes
- Forming an overall project assessment (priority, state of readiness).

Table I.15 lists the research the Team undertook that applied broadly across all the projects.

**Table I.15: General Research for Project Assessment**

<b>National Laws/Regulations/Policy</b>
Bangladesh Water Act 2013
National Adaptation Programme of Action 2005
National Agricultural Extension Policy 2013
National Agriculture Policy 1999
National River Protection Commission Act 2013
National Sustainable Development Strategy 2013
National Water Management Plan 2004
National Water Policy 1999
National Policy for Safe Water Supply and Sanitation
<b>Plans and Strategies</b>
Seventh 5-Year Plan
MoA FAO Agriculture Masterplan
USAID FAO CIP
Bangladesh SREP IP FINAL
Road Master Plan 2009
Bangladesh Climate Fiscal Framework 2014
Bangladesh Climate Change Strategy and Action Plan 2009
New Port Development South West Bangla - Investment Plan
WB Inland Water Transport Strategy
MOWR National Water Management Plan (NWMP)
National Sanitation Strategy
Coastal Development Strategy
MOWR BHWDB Master Plan of Haor Area

<b>Reports</b>
<b>Adaptive Delta Management</b>
Deltares Delta Alliance Comprehensive Framework for ADM
Deltares Trends and Responds in Deltas Report: Towards sustainable development of deltas, estuaries, and coastal zones: trends and responses
Mekong Delta ADM Case Study
Mekong Delta Presentation Aug2014
Delta Alliance Comparative Assessment of the Vulnerability of 10 Deltas
Comparative Assessment of the Vulnerability of 14 Deltas
Delta Alliance No. 4 - Enabling Delta Life
Dynamics and Vulnerability of Delta Systems
GEF TWAPRB SPM - Transboundary River Basins: Status and Trends
Protect the world's deltas - Liviu Giosan
The Major River Deltas of the World
Towards sustainable development of delta estuaries and coastal zones from Delatares
MoWR Guidelines for Integrated Planning for Sustainable Water Resources Management
<b>Country Background</b>
IMF Progress Report - Poverty Reduction Strategy
Major World Delta a Perspective from Space
Dynamics of Rural Growth in Bangladesh
Bangladesh Development Update (April 2015)
Bangladesh Development Update (April 2016)
Bangladesh Country Snapshot Oct 2015
WB Systematic Country Diagnostic Oct 2015
MDGs Bangladesh Progress Report September 2015
World Food Programme Strategic Review of Food Security
WB Reaching Across Waters
2030 WRG Bangladesh WRM Report
<b>Climate Change</b>
Impact of Climate Change in Bangladesh
IFC Climate Risk and Financial Institutions
Cost-Benefit Analysis of Adaptation Strategy in Bangladesh
Facing the Hungry Tide
Turn Down the Heat - Climate Resilience
WB CC Poverty Impact - Policy Research Talk May 2016

UN Climate Adaptation Financing Report
Climate proofing infrastructure in Bangladesh
Climate Resilient Infrastructure - UK
PPIAF Climate Resilience Issue Brief
Mainstreaming Adaptation to Climate Change into National Policy
<b>Financing</b>
Blending Climate Finance Through National Climate Funds
WEF Blended Finance Primer 2015
Innovative finance water sector NWP Ecorys Rapportage
Public Expenditure Review Update (June 2015)
DFID Private Sector Resilience Scoping Study
<b>Technical</b>
Land and Water Sector Study, 1972
More Food with Less Water - ADB
Strengthening the Resilience of the Urban Water Supply, Drainage, and Sanitation to Climate Change in Coastal Towns
Climate change, salinization and high-yield rice production in coastal Bangladesh (February 2016)
Climate change and soil salinity: the case of coastal Bangladesh, Ambio-Dasgupta et al (2015)
Bangladesh National Level GIS database
Bangladesh's dynamic coastal regions and sea-level rise, Hugh Brammer (Dec 2013)
BRB Modeling and Nexus
Buriganga Modelling of Offtake Management
Cities and Flooding: A Guide to Integrated Flood Risk Management for the 21st Century
Climate change and development in Bangladesh, Hugh Brammer
Climate change, groundwater salinization, and road maintenance costs in coastal Bangladesh (December 2014)
Impact of Climate Change and aquatic Salinization on Mangrove Species and Poor Communities in Bangladesh Sundarbans (April 2016)
Cyclone Sidr in Bangladesh - Damage Loss and Needs Assessment
Cyclones in a changing climate: the case of Bangladesh, Susmita Dasgupta et al
Development of Hazard Zoning Maps using CRA Process - CEGIS
Effective sea-level rise and deltas
Flood Risk of Natural and Embanked Landscapes
Implications of CC Groundwater in Coastal Aquifers of Bangladesh
Intergovernmental Panel on Climate Change Working Group report on impact of climate change in Asia (Oct 2013)
BWDB Meghna Estuary Study (April 1997)

Assessing changes in the landform and geomorphology due to sea level rise in the Sundarbans (Pethick, February 2012)
River Salinity and Climate Change--WB Policy Research Working Paper
Sinking deltas due to human activities, James Syvitski et al
Social-Ecological Resilience to Coastal Disasters
Taming floods - Dutch experiences - Zevenbergen et al
Vulnerability Analysis of Central CZ, Ataur Rahman and Faisal Mohammad Alvee
Presentation by Department of Disaster Management on water logging situation and investment needs
WEP - Salinity and Road Maintenance - Nov 2015
WP5 model descriptions Jan 2014
WEP Drinking Water Salinity and Infant Mortality
Bangladesh Urban Flooding, Susmita Dasgupta
Urban Wastewater PPP White Paper
<b>Policy</b>
Institutional Strengthening for WRM by Peter Ravenscroft
Water Governance by Laila Petrie, WWF
Water Pricing & Incentives by Phillia Restiani, SIWI
DPP Manuals and Annexes
IMED Manuals
<b>BDP2100 Baseline Studies</b>
<b>Project Information</b>
2030 Water Resources Group
Bangladesh Water Multi-stakeholder Partnership
Concept Note on Agricultural Water
Concept Note on Economic Incentives for Sustainable Water Management
Concept Note on Strengthening of Institutional Framework for WRM
<b>World Bank</b>
Climate Change Adaptation for Sundarbans
Background Document No. 5: Effectiveness of Early Warning Systems
Background Document No. 10: Spatially Blind Policies to Promote Human Development
CIF Strategic Program for Climate Resilience
Country Partnership Framework Bangladesh
WB Water Country Assistance Strategy
WB PID Bangladesh Regional Waterway Transport Project 1
SPEMP-PIM Review Reform Roadmap

BWDB Institutional Improvement (November 2014)
Bangladesh Responsible Sourcing Initiative
National Minor Irrigation Development Project
<b>ADB</b>
Making renewable energy success
Irrigation Management Improvement Investment Program
<b>UNDP</b>
Coordination of Cyclone Rehabilitation (1991)
Pollution abatement strategies for river and wetland (2010)
<b>Other</b>
Flood Action Plan 20-yr Review (July 2011)
BRE North-South Motorway (Oct 2013)
Dhaka Beltway Note
Dhaka Bypass Ring Road (Sep 2013)
Earthquake Resilience Project Dissemination Workshop Presentation (Dec 2013)
Gorai River Restoration Project - Main Report
BWDB Gorai River Restoration Project - Project Concept Note
Maximizing Benefits of the Padma Bridge in SW Bangladesh
Mongla Seaport Note
Planning and Design for Muhuri Irrigation Project
Bangladesh Regional Water Transport Project ESA
Capital Dredging - FSCD SRMB Total by BWDB (April 2014)
DWASA Sewerage Master Plan
DWASA 5-Year Corporate Plan (Dec 2015)
Water Management Improvement Project Final Evaluation Report

In addition to document research, the Team also consulted with multiple agencies and stakeholders. The Team undertook general consultations with the following organisations that applied broadly across the projects.

- GED
- Ministry of Water Resources
- Ministry of Fisheries and Livestock
- Ministry of Environment and Forests
- Ministry of Agriculture
- Ministry of Disaster Management and Relief
- Ministry of Land
-



- Ministry of Finance
- Ministry of Local Government, Rural Development and Cooperatives
- Cabinet Division
- International Advisor to the Prime Minister
- Economic Relations Division
- Water Resources Planning Organization (WARPO)
- Bangladesh Water Development Board (BWDB)
- Department of Agriculture Extension
- Department of Livestock
- Department of Urban Development
- Bangladesh Inland Water Transport Authority
- Bangladesh Inland Water Transport Corporation
- Local Government Engineering Department
- Department of Fisheries
- Department of Environment
- Joint River Commission
- Ministry of Roads and Bridges
- Center for Environmental and Geographic Information Services
- Institute of Water and Flood Management (IWFM) at Bangladesh University of Engineering and Technology (BUET)
- Bangladesh University of Engineering and Technology
- Bangladesh Institute of Development Studies
- International Rice Research Institute
- Institute of Water Modelling
- Embassy of the Netherlands
- Islamic Development Bank
- United Nations World Food Programme
- Japan International Cooperation Agency
- Department for International Development
- European Union
- Agence Française de Développement
- Embassy of the People's Republic of China
- Grameen Bank
- World Bank Group
- UNDP
- ADB
- KfW
- GIZ
- FAO
- Green Climate Fund

The Team also consulted with the following organizations in collaboration with the 2030 Water Resources Group:

- Public Private Partnership Authority

- BRAC Bank
- BRAC EPL Investments Ltd.
- City Capital Investment Bank
- Standard Chartered Bank
- Infrastructure Development Company Limited
- Ecoflag Bangladesh
- BGMEA
- DBI Group
- Dhaka WASA
- International Chamber of Commerce
- Bangladesh Infrastructure Finance Fund Ltd. (BIFFL)
- Abdul Monem Ltd
- Sigma Pumps
- Orion Group
- Bangladesh Bank
- Metro Group
- Bangladesh Economic Zones Agency
- ETBL Holdings.

Table I.16 details the additional project-specific research and consultations that were conducted to gather information for the project assessments.

**Table I.16: Additional Project-Specific Research and Consultations for Project Assessment**

#	Project Code	Project Name	Documents Reviewed
1	MR 1.1	River Bank Improvement Program	<ul style="list-style-type: none"> <li>Detailed Concept Note</li> <li>Log frame</li> <li>Basic costs spreadsheet</li> <li>World Bank Project Appraisal Document</li> <li>Annex 1: Institutional Assessment</li> <li>Draft final report RBIP CGE analysis 30th December 2015</li> </ul>
2	MR 1.2	Integrated River System Management and Protection of Accreted Land	<ul style="list-style-type: none"> <li>Idea Concept Note</li> </ul>
3	MR 1.5	Harnessing of Brahmaputra Water	<ul style="list-style-type: none"> <li>Idea Concept Note</li> <li>Basic spreadsheet of costs for conducting a FS and EIA</li> </ul>
4	MR 1.6	Development of Chandona-Barasia River Basin System	<ul style="list-style-type: none"> <li>Detailed Concept Note</li> <li>Log frame</li> <li>Basic costs and benefits spreadsheet with 2011-12 and 2014-15 prices</li> </ul>
5	MR 3.1	Sustainable Restoration of Connectivity of Major Navigation Routes	<ul style="list-style-type: none"> <li>Detailed Concept Note</li> <li>Log frame</li> <li>Basic costs and benefits spreadsheet with 2010-11 and 2015 prices</li> </ul>
6	CZ 1.1	Construction of Ganges Barrage and Ancillary Works	<ul style="list-style-type: none"> <li>Detailed Concept Note</li> <li>Log frame</li> <li>Basic costs and benefits spreadsheet in 2010-11 and 2014-15 prices</li> </ul>
7	CZ 1.3	Char Development and Settlement Project-V	<ul style="list-style-type: none"> <li>Detailed Concept Note</li> <li>Log frame</li> <li>Basic costs and benefits spreadsheet in 2012-13 and 2014-15 prices</li> </ul>
8	CZ 1.4	Integrated Management of Drainage Congestion for Greater Noakhali	<ul style="list-style-type: none"> <li>Idea Concept Note</li> <li>Basic cost information spreadsheet for conducting an ESIA</li> </ul>
9	CZ 1.5	Tidal River Management	<ul style="list-style-type: none"> <li>Idea Concept Note</li> </ul>
10	CZ 1.6	Integrated Land Reclamation Project of Hatiya-Dhamar Char-Nijhum Dwip	<ul style="list-style-type: none"> <li>Detailed Concept Note</li> <li>Log frame</li> <li>Basic costs and benefits spreadsheet in 2006 prices</li> </ul>

#	Project Code	Project Name	Documents Reviewed
11	CZ 1.7	Urirchar-Noakhali Cross Dam Project	<ul style="list-style-type: none"> <li>Detailed Concept Note</li> <li>Log frame</li> <li>Basic costs and benefits spreadsheet in 2013-14 and 2014-15 prices</li> <li>Feb 19, 2015 - Cross Dam Guidance Note</li> </ul>
12	CZ 1.8/ CZ 1.21	West Gopalganj Integrated Water Management Project	<ul style="list-style-type: none"> <li>Detailed Concept Note</li> <li>Log frame</li> <li>Basic costs and benefits spreadsheet in 2010-11 and 2015 prices</li> </ul>
13	CZ 1.9	Sureswar Flood Control, Drainage and Irrigation Project	<ul style="list-style-type: none"> <li>Detailed Concept Note</li> <li>Log frame</li> <li>Basic costs and benefits spreadsheet in 2012 and 2015 prices</li> </ul>
14	CZ 1.10	Rehabilitation of Polder 36/1	<ul style="list-style-type: none"> <li>Detailed Concept Note</li> <li>Log frame</li> <li>Basic costs and benefits spreadsheet in 2011-12 and 2014-15 prices</li> <li>DPP and annexes</li> <li>ESIA</li> </ul>
15	CZ 1.11	Improved Drainage in the Bhabadha Area	<ul style="list-style-type: none"> <li>Detailed Concept Note</li> <li>Log frame</li> <li>Basic costs and benefits spreadsheet with original and 2014-15 prices</li> </ul>
16	CZ 1.26	Development of Water Management Infrastructure in Bhola Island	<ul style="list-style-type: none"> <li>Detailed Concept Note</li> <li>Log frame</li> <li>Basic costs and benefits spreadsheet</li> </ul>
17	CZ 1.38	TRM of 7 Beels in Coastal Zone	<ul style="list-style-type: none"> <li>Idea Concept Note</li> <li>Basic costs information spreadsheet</li> </ul>
18	UA 1.1	Protection of Rivers System around Dhaka City with Their Ecological Restoration	<ul style="list-style-type: none"> <li>Detailed Concept Note</li> <li>Log frame</li> <li>Basic costs and benefits spreadsheet with 2004 and 2015 prices</li> <li>PDP on ecological restoration of four rivers around Dhaka</li> </ul>
19	UA 1.2	Dhaka Integrated Flood Control Embankment cum Eastern Bypass Road Multipurpose Project	<ul style="list-style-type: none"> <li>Detailed Concept Note</li> <li>Log frame</li> <li>Basic costs and benefits spreadsheet in 2006 prices</li> </ul>

#	Project Code	Project Name	Documents Reviewed
20	UA 1.3	Drainage Improvement of Dhaka-Narayangonj-Demra Project (Phase 2)	<ul style="list-style-type: none"> <li>Detailed Concept Note</li> <li>Log frame</li> <li>Basic costs and benefits spreadsheet</li> </ul>
21	UA 9.1	Greater Dhaka Integrated Water and Sewage Improvement Project	<ul style="list-style-type: none"> <li>Idea Concept Note</li> </ul>
22	UA 10.1	Improvement of Drainage Congestion and Flood Control for Chattogram City Corporation Area	<ul style="list-style-type: none"> <li>Detailed Concept Note</li> <li>Log frame</li> </ul>
23	HR 2.1*	Village Protection against Wave Action in Haor Area	<ul style="list-style-type: none"> <li>Detailed Concept Note</li> <li>Log frame</li> <li>Basic costs spreadsheet</li> </ul>
24	HR 2.2*	Improved Water Management in Haor Basins	<ul style="list-style-type: none"> <li>Detailed Concept Note</li> <li>Log frame</li> <li>Basic costs and benefits spreadsheet in 2011 and 2015 prices</li> </ul>
25	DP 1.1	North Rajshahi Irrigation Project	<ul style="list-style-type: none"> <li>Detailed Concept Note</li> <li>Log frame</li> <li>Basic costs and benefits spreadsheet</li> </ul>
26	DP 1.2	Revitalization and Restoration of Beel Halti	<ul style="list-style-type: none"> <li>Detailed Concept Note</li> <li>Log frame</li> <li>Basic costs and benefits spreadsheet with original and 2014-15 prices</li> <li>DPP October 2011 with Annex of costs</li> </ul>
27	DP 1.3	Revitalization and Restoration of Hurasagar and Atrai rivers	<ul style="list-style-type: none"> <li>Idea Concept Note</li> </ul>
28	DP 1.4**	Kurigram Irrigation Project (South Unit 2nd Phase)	<ul style="list-style-type: none"> <li>Detailed Concept Note</li> <li>Log frame</li> <li>Basic costs and benefits spreadsheet in 2011 and 2015 prices</li> </ul>
29	DP 1.5**	Kurigram Irrigation Project (North Unit)	<ul style="list-style-type: none"> <li>Detailed Concept Note</li> <li>Log frame</li> <li>Basic costs and benefits spreadsheet in 2011 and 2015 prices</li> </ul>
30	DP 1.6	Teesta Irrigation Project (Phase-2)	<ul style="list-style-type: none"> <li>Detailed Concept Note</li> <li>Log frame</li> </ul>

#	Project Code	Project Name	Documents Reviewed
31	CH 9.2	Water Supply and Environmental Sanitation in Paurashavas under Chattogram Hill Tracts	<ul style="list-style-type: none"> <li>Detailed Concept Note</li> <li>Log frame</li> <li>DPP</li> </ul>
32	CC 1.2	Development of Small-Scale Water Reservoir and Revitalization of Water Bodies, Khals, etc.	<ul style="list-style-type: none"> <li>Idea Concept Note</li> </ul>
33	CC 9.4***	Water Supply, Sanitation, Drainage, and Solid Waste Management for 23 Small Paurashavas	<ul style="list-style-type: none"> <li>Detailed Concept Note</li> <li>Log frame</li> <li>DPP and annexes</li> </ul>
34	CC 9.5***	Water Supply and Environmental Sanitation Including Faecal Sludge Management in 31 Paurashavas	<ul style="list-style-type: none"> <li>Detailed Concept Note</li> <li>Log frame</li> <li>DPP and annexes</li> </ul>

\*GED indicated that these two projects should be combined and assessed together as one project

\*\*GED indicated that these two projects should be combined and assessed together as one project

\*\*\*Project already in advanced stages of consideration for implementation. GED indicated this project should not be considered for the Investment Plan

## I.11 Select International Examples of Project Prioritization Approaches

**Table I.17: Project Prioritization Approaches in Select Countries**

Country	Approach
United Kingdom	The UK National Infrastructure Plan, managed by the Treasury’s infrastructure unit, specifies an Infrastructure Top 40 list of projects marked for priority government support and investment. These projects are grouped by sector, but not listed in order of importance. Projects are chosen by the following criteria: Strategic importance (SI): significant contribution towards an objective Capital value (CV): significant capital value Regional priority (RP): high strategic importance or capital value in a region Demonstrator (D): innovative or novel and could improve future delivery Unlocking investment (UI): enables significant private sector investment. (HM Treasury, 2014)
Australia	Infrastructure Australia, a federal statutory board established under the Department of Infrastructure and Transport, is tasked with planning and coordinating cross-state road and public transport projects. To prioritize proposed projects, the agency applies a two-state process of project “profiling” and “appraisal.” Profiling, as a first filter, qualitatively assesses the compatibility of proposed initiatives to strategic infrastructure priorities (i.e. key issues and problems) along a scale of “highly beneficial” to “highly detrimental” with respect to stated policy goals. Thereafter, CBA is employed as the primary tool for project appraisal, including estimates of Wider Economic Benefits (WEBs), such as those related to agglomeration. Advice on calculating WEB is based on the UK government’s Transport Analysis Guidance (2014). Following CBA, the process requires that assessors qualitatively discuss benefits and costs that generally cannot be monetized (e.g. visual/landscape, social cohesion, heritage, or cultural impacts) and thereafter classify each non-monetized item along a spectrum from “highly beneficial” to “highly detrimental.” These two inputs are used to inform selection, which is based on expert review and consensus of a panel of 11 members.
New South Wales, Australia	New South Wales has developed a Major Projects Assurance Framework inclusive of an additive multi-criteria model. The framework assesses proposed projects at several stages of project planning and prioritizes projects according to assessed performance along two dimensions. Performance with respect to strategic objectives is measured by alignment with NSW’s investment themes, value for money, the project’s ability to afford citizens “a better life” (by reducing cost of living and improving livability), and economic efficiency. Performance with respect to the ‘Infrastructure NSW Project Assurance’ objective is based on sufficiency of the analysis, cost-benefit analysis, professional assessments of the suitability of project management, and risk assessment. CBA is augmented by professional review and qualitative inputs. Qualitative assessments are numerically scored on a scale from 3 (strongly positive) to -3 (strongly negative) and added using a system of weights decided by a panel of professionals within Infrastructure NSW. Similar to the proposed IPF, projects are plotted on a two-dimensional plane, with axes defined by the Strategic Objective and Project Assurance Objective scores. Projects are classified as short-, medium-, and long-term, depending on their collective scores.
South Korea	South Korea employs a cost benefit analysis supplemented by multi-criteria decision methods to prioritize a large number of projects across sectors. Using the analytic hierarchy process (AHP) structured expert pairwise technique, experts decide the weights of decision criteria, including social cost/benefit analysis (SCBA). AHP has also been used to rank projects sub-sectorally (primarily in transport) in the US, Indonesia, China, Turkey, India, and Palestine, but is not (to our knowledge) used as a national prioritization framework outside of Korea.



Country	Approach
Indonesia	During 2014-2015, Indonesia’s Committee for Acceleration of Priority Infrastructure Delivery (KPPIP) employed a three-level infrastructure prioritization approach, including multi-criteria analysis. Following a screening for basic project requirements, an additive multi-criteria model was developed to identify 22 priority infrastructure projects from among thousands of proposed projects. The indicators for project scoring and ranking (with associated additive weights) included project purpose (25%); feasibility of implementation (30%); socio-economic impact (30%); and environmental impact (15%). The scoring and ranking outcomes were used as a basis of “committee discussion” that resulted in the shortlisting of 22 projects.

*Source: An Alternative Approach to Project Selection: The Infrastructure Prioritization Framework, Darwin Marcelo, Cledan Mandri-Perrott, Schuyler House, Jordan Z. Schwartz, World Bank PPP Group, April 2016*

## I.12 Scoring of Projects on ADM criteria

### I.12.1 MR 1.1: River Bank Improvement Program

The project can be adapted/scaled up when circumstances require

**Score: 2**

#### **Assessment**

This structural intervention includes construction of revetments. The main objective of this intervention is to reduce the risk of flooding. Whether this objective is achieved now and in the future depends on the design of the intervention, the decisions related to the acceptable flood risk (what is the acceptable return period of flooding), and the effect of climate change on peak discharges and how often these peak flows occur. Therefore, it is important that the interventions consider these climate change effects even though they are highly uncertain for Bangladesh. Embankments can be adapted to changing circumstances (such as climate change and changing flood risk levels). However, once a dam or revetment is built, it will require considerable investments to change the dimensions. If additional works need to be done, it might well be cheaper to include these additional works in the initial intervention.

Additional costs include not only construction costs, but also the cost of additional measures that are needed when the dam serves multiple uses (such roads are being built on the dams). This is the case in many parts of the planned intervention. Dams and revetments have long life cycles, and uncertainties of developments during the functional life of these constructions must be considered. Hence, adaptation of the intervention is possible, but the organizational and financial consequences are considerable.

#### **Recommendation**

When detailing the design, it is important that climate change models are used in an optimal manner to simulate effects on discharges and river stages, and to consider these changes. Furthermore, decisions must be taken up front in relation to the flood risk level that should be achieved with these interventions, considering eventual changes in land use behind the dike and required flood risk levels. A modular design of the embankment could make it more feasible to adapt the measure. This could be considered as one of the criteria to address in the tender procedure. Furthermore, monitoring and maintenance of the works must be included in the project design, as well as the development and applications needed to control land use on the dam.

### **The intervention can be combined with additional measures to increase effectiveness**

**Score: 3**

#### **Assessment**

It is possible to combine this intervention with additional interventions if required. Possible combinations are the creation of a second defense line behind the existing dikes, or providing additional space on the other side of the river. With a second defense line, the flood risk between the dike and the second defense line can increase due to changing circumstances, such as climate change, but the flood risk behind the second defense line will remain on a higher level. These combinations would improve the flexibility and robustness of the projects. Other additional measures can be found in changing land use, spatial planning (location of strategic installations),

and preparation for a dike breach. This concept of multiple safety levels can be implemented over time, decreasing the effect of flooding and the risk. Risk is defined as the probability of flooding multiplied by potential damage caused by flooding.

If there is a transition from increasing the dikes towards providing more room for the river, the dikes could become a barrier, which may result in the destruction of capital. However, at this moment, interventions are mainly planned on one side of the river, and room can always be created on the other side. Before providing additional room for the river, additional studies on the morphology of the river should be carried out to determine if these interventions cause negative effects on discharge capacity, stability of the riverbed, and navigation. Also, in the light of the pressure on land and the fact that rivers already take up a lot of space, the support for these types of measures is very limited.

### Recommendations

The above-mentioned interventions should be considered in project development to ensure that the design itself, the location of the interventions, and the materials used in the construction do not obstruct the implementation of these additional measures.

### The intervention allows for adopting technological innovations after implementation

**Score: 4**

#### Assessment

Whether technological development can be implemented easily depends on the precise design of the intervention and the materials used. The existing strengthening of dikes are flexible and can be adapted using innovative technologies. These innovative technologies include using different, more sustainable materials; using different types of interventions that strengthen the core or the surface of dikes, and using monitoring equipment to facilitate real-time assessment of the stability of a dike for an early warning system.

#### Recommendation

The project design does not include innovative developments on monitoring the stability of the dikes. Concepts like smart dikes could improve the maintenance of the dikes. The information that will be gathered can also be used for early warning systems related to potential dike breaches. This type of technological innovation will also need room on the dike. This could become complex when squatters occupy the room on the dike. Internationally, several technologies are being developed to further increase the stability of dikes, and these can be used in Bangladesh. However, financial consequences and costs and benefits should be analyzed to determine if this is economically feasible.

### **Box I.3: Dike Technologies**

Re-enforcing dikes and dams can increase their stability and resistance against dike breaching, such as by strengthening the inner core of the dike, or improving characteristics of the dike's surface that contribute to the overall stability of the dike. Overtopping resistant dikes are wide and less steep than traditional dikes, and can be multifunctional (for example, for agriculture, recreation or transport).

Dike design can have the aim of allowing water in certain conditions to overtop them without breaching. This is usually achieved by strengthening the inner wall of the dike, by dike broadening, or by developing a parallel dike system with enclosed retention polder.

Another option to reduce flood risk, other than strengthening the primary water defense structures, is to compartmentalize the region to be protected in zones, for example by diking areas. Compartmentalization either or both protects critical functions in the flood-prone area and reduces the flooded surface area. It diminishes the flood effects by dividing the area into compartments with the use of dikes.

High tech innovations like Dike pins (steel anchor rods encased in cement) can also be used, but applicability in Bangladesh at this moment might be reserved for the urban areas where the risk is high. These Dike pins are inserted into the underlying layer of sand and prevent the possibility of the dike collapsing during floods.

Strengthening dikes with information is the essence of the innovative 'Smart Levees' concept. Information plays a central role in the approach to keeping levees strong and safe. By monitoring a series of parameters real time, management agencies can tailor designs, optimize levee upgrades, and adjust management plans in line with the condition of a levee, but also make the most of the opportunities to predict the behavior of the levee in extreme circumstances. In this way, smart levees help to make management smarter and more reliable.

*Sources: European Climate Adaptation Platform: <http://climate-adapt.eea.europa.eu/metadata/adaptation-options/adaptation-or-improvement-of-dikes-and-dams>; <http://www.dijkmonitoring.nl/en>*

## **The intervention is synchronized with developments in other sectors**

**Score: 3**

### **Assessment**

In the project design, a 150km road is planned on the new dike. This synchronization of the plans from the transportation sector can decrease the overall costs of all involved sectors. This project is linked to the embankments of Kurigram Irrigation Project in the North and the Pabna Irrigation and Rural Development Project in the South. In the future, it can be extended to the Kurigram Irrigation Projects (North and South units) over a new bridge across the Teesta river and FRERMIP (Flood and Riverbank Erosion Risk Management Investment Program), which will cover Jamuna Bridge to Chandpur.

### **Recommendation**

Other uses of the room on the dike can be thought of (e.g. roads, ecological development or, if permitted, housing) but this has to be controlled and opportunities will depend on the way the dam is constructed. The construction of the dike should consider plans for offtakes for irrigation projects in the area, for new bridges and for the construction of reservoirs to retain water for irrigation or drinking water or constructions to re-direct water-flows. There are numerous possibilities to combine work that has to be carried out in different sectors, this has to be taken in to consideration when further detailing of the design takes place.

## I.12.2 MR 1.6: Development of Chandana-Barasia River Basin System

### The project can be adapted/scaled up when circumstances require

**Score: 2**

#### **Assessment**

The project comprises solely structural interventions, including excavation of a 3620m off-take channel from Ganges to the Chandana Regulator for carrying water up to the Chandana Regulator, the excavation of 30km of lateral canals, and the construction of water control structures. The objective is to increase the water availability in the system fed by the Chandana River. This intervention is not flexible and cannot be adjusted if water demand rises above the maximum discharge that was used for the dimensions of the control structures. Therefore, uncertainties related to the developments downstream and the water demand must be taken into account in the design. Control structures cannot be adapted once constructed. The canal can be adapted to increase the discharge and retention capacity, but this will have limited added value to the objectives of the project if hard structural works (such as gates, sluices, regulators) cannot be adapted.

#### **Recommendation**

The design of the canal and the water control structure should be based on a detailed study of the water demand in the service area. Furthermore, the possible effects of climate change and effects of developments in land use and demographics on water demand should be assessed to ensure that the interventions are robust. Therefore, an economic, social, and ecological impact assessment is required to collect the information needed to construct the intervention with the optimal dimensions.

### The intervention can be combined with additional measures to increase effectiveness

**Score: 4**

#### **Assessment**

As long as there is sufficient water flowing through the Ganges, additional measures are possible to increase the water availability in the service area. Control structures can be constructed parallel, and other rivers in the region can also be tapped. However, these will be more expensive, as the optimal location has already been selected for this intervention.

The water that is diverted by the connection can be used in multiple ways. This means that whenever a transition takes places related to land use, the water can be very well used for other purposes (industry, consumption, fish culture, etc.) Water demand in the service area can also be changed using more efficient technologies or by changing to other crop rotation practices. Water diversion structures can also be built in a phased way, depending on the demand. This will reduce capital demand.

#### **Recommendation**

Additional measures are possible. However, underinvestment in the implementation of the planned intervention should be avoided where possible. Increasing the diversion capacity of the original intervention will be less expensive than implementing additional measures. If climate change or upstream interventions reduce the availability of water, measures will be needed either to increase the buffer capacity to retain sufficient water during the wet season or to reduce the water demand in the service area through more efficient water use or land use changes.

### The intervention allows for adopting technological innovations after implementation

**Score: 1**

#### Assessment

Once the canal is excavated and the water control structures have been constructed, it will no longer be possible to adopt technological innovations without capital destruction of the implemented intervention. On the demand side, technological development could change efficiency of water use and, hence, the amount of water required in the service area. This is not considered in the project design.

#### Recommendation

Where possible, flexible or soft structures should be used to assure that technical innovations can be used to improve the design and to adapt to changing circumstances. Furthermore, a comprehensive evaluation of the land use and water demand in the service area might lead to the needed insight on opportunities to use the water in a more efficient manner. Including these recommendations in the project design would increase the score of this project on this criterion.

### The intervention is synchronized with developments in other sectors

**Score: 2**

#### Assessment

The design of the preferred solution is based on a FS/EIA/SIA (2012). Therefore, it is to be expected that an inventory has been made of the planned developments in the Chandana-Barasia Basin. In the available project documentation, there are no indications of win-win combinations with interventions from other sectors. The project facilitates in a one-dimensional manner the development of the agricultural sector, the supply of drinking water, and addressing water demand from the industrial sector.

#### Recommendation

Additional synchronization is possible, especially in relation to infrastructure, drinking water supply, and fish culture. These multidimensional uses of the water system should be assessed, and adaptation of the design should be considered to ensure that the available resources (financial, spatial, human resources, etc.) are used in an optimum manner.

### I.12.3 MR 3.1: Sustainable Restoration of Connectivity of Major Navigation Routes

#### The project can be adapted/scaled up when circumstances require

**Score: 5**

#### Assessment

The restoration of connectivity of major navigation routes is a project that can develop in a continuous manner. Interventions and maintenance should be planned well in advance, but flexibility is needed to ensure that the focus of interventions facilitate development where this is needed. Economic development, climate change, river morphology, etc. must be monitored constantly to ensure that plans adapt accordingly. Many different choices (dimensions and locations) can be made in implementation and maintenance, depending on economic development scenarios, transportation opportunities, etc. This project allows for all sorts of additional interventions in the programming of the planned interventions if decision making is sufficiently flexible.

### **Recommendation**

To ensure that this intervention adapts to changing circumstances, a comprehensive monitoring and evaluation initiative is needed that will provide the necessary information to plan and, where needed, revise existing plans. As for the other projects, procedures need to allow for flexible planning/programming of interventions. Assessments are needed of the morphology of the rivers and the silt deposition rate. This is to evaluate what the intensity of dredging should be, and whether this is economically feasible. Disposal of silt has proven to be a sometimes costly challenge. Efforts should be made to convert dredging ‘spoils’ into economic good by using them as land fill, or as raw material in cottage industries run by potters. Recently, it has been reported that some countries have expressed interest in importing these materials.

### **The intervention can be combined with additional measures to increase effectiveness**

**Score: 5**

#### **Assessment**

Since this project comprises a modular approach, additional measures are very well feasible. The main objective is to increase opportunities for transport of people and cargo. This can also be achieved by other means of transport via road or rail. Therefore, this intervention is fully in compliance with the concept of ADM as long as planning procedures are sufficiently flexible.

### **Recommendation**

A regional/national study on river transport, in combination with opportunities for modal shifts, will improve insight on which additional measures could improve the effectiveness of the transportation system. A similar regional study may also be conducted for trans-boundary silt transport/management.

### **The intervention allows for adopting technological innovations after implementation**

**Score: 4**

#### **Assessment**

Dredging requires investment in equipment, and this equipment can be replaced when technological innovations are available. Under/over investment in equipment is a risk and should be assessed properly. Types of dredging equipment to be purchased depends mainly on the dimensions of the waterways to be dredged. However, uncertainties in economic development and, hence, need for transportation capacity, do influence the quantity of equipment that should be purchased. PPP constructions and long-term planning that considers these uncertainties will reduce the risk of over- and under-investment.

### **Recommendation**

Changes in equipment to be used can only be facilitated by flexible procedures. Procedural flexibility is also needed in achieving functional objectives. Working with functional service levels agreements, instead of detailed design criteria, will facilitate the operator to optimally use technical innovations. Riverine transports can be charged a fee for dredging to finance (partially) operation and maintenance of the fluvial transport system.



### The intervention is synchronized with developments in other sectors

**Score: 3**

#### Assessment

Development of other sectors will be facilitated by the dredging. The needs have been identified when planning the interventions. Another way to synchronize is to ensure that the dredged material is used in an optimum manner, for example in landfills or as construction material. In agriculture, there is only very little interest to use these soils, as experience has shown that the dredged soils reduced the fertility of the land in many cases. For planning dredging activities, the potential of multiple use of the dredged materials should be considered as an important criterion, since this improves the potential for cost recovery.

#### Recommendation

For synchronization, procedures need to be flexible, since many opportunities will only present themselves over the years. With a comprehensive monitoring and evaluation initiative, these opportunities will be identified in time. A decision making mandate is also needed to change planning of dredging activities.

### I.12.4 CZ 1.1: Construction of Ganges Barrage and Ancillary Works

#### The project can be adapted/scaled up when circumstances require

**Score: 1**

#### Assessment

This project, once carried out, is difficult or very costly to adapt. Construction of the barrage is a long-term investment. Considering the uncertainties (climate change, international agreements, water demand, etc.) in the Bangladesh Delta over the life span of a barrage, the risk of over- or under-investment is considerable.

#### Recommendation

The risk of over- or underinvestment can be reduced by assessing in detail the different uncertainties that might affect the functioning of the dam and ensuring that all the information available is used optimally to support decision making. This should be done on the level of the dam itself, as well as for the area that is affected (supply/demand) by the effects of the dam. Changes in international (water service) agreements can have serious impact on the water availability and, hence, the dimensions needed for such a reservoir. The effect of some of the uncertainties can be mitigated by changing the preconditions used in the development of the operational protocol of the reservoir. However, this will affect the effectiveness of projected uses (hydropower, agriculture, flood risk management, drinking water, recreation, etc.) of the dam, reservoir, and water retained.

## The intervention can be combined with additional measures to increase effectiveness

**Score: 3**

### Assessment

Once the barrier is built, additional measures will be possible to ensure that the southwest of the country receives water for irrigation and to stop salt water intrusion. However, most of the infrastructure only facilitates supplemental irrigation to the Aman (Khaif-II) paddy in case of a drought event and is not designed for fully irrigated dry season paddy. Adaptation of the infrastructure will be a complex and costly intervention. Supplemental irrigation water is supplied through nearly 1.5 million ground water based shallow tube wells. Switching from ground water to surface water irrigation will need a cultural shift amongst the farmers. Transition in the pathway will be very expensive, as the initial investment to construct the dam is extremely high. Additional measures are possible if policy objectives are not achieved sufficiently with the use of the dam because of changing circumstances. Flood risks can be reduced by additional or higher dikes. Diversion of water to the southwest can be achieved by other smaller interventions, and electricity production can also be upgraded with other measures in other regions.

### Recommendation

The functioning of the dam and its operational protocol should be monitored and evaluated at all times to ensure that with the dam's policy objectives are achieved. If M&E leads to the conclusion that these objectives will not be achieved in the future, decisions should be made in time to implement additional interventions.

## The intervention allows for adopting technological innovations after implementation

**Score: 2**

### Assessment

Once carried out, technological development will only improve effectiveness in relation to certain objectives of the dam. Water availability and flood risk management will improve with the ability to forecast climate changes with longer lead times, and this will optimize the operational protocol of the reservoir. Technological innovation can also change the water demand in the downstream area.

### Recommendation

A sequenced program of interventions with smaller dams in principle will allow for more opportunities to adopt technological innovations as they develop. However, given the fact that the projected Ganges barrage is designed on the already existing water demand in the downstream area, a modular development of smaller reservoirs along the Ganges to answer to that demand has to be carried out in an as short as possible a period, limiting the possibilities to adopt technical innovations during implementation.

## The intervention is synchronized with developments in other sectors

**Score: 3**

### Assessment

The dam will be constructed to facilitate socio-economic and ecological development in the downstream area, but the diversion of water will also have effects on the discharge of the water to the areas that are now receiving these volumes of fresh water. Hence, this intervention is synchronized with developments in other sectors, but further study is required to ensure that irreversible effects are mitigated, and other effects are being compensated where needed. An important aspect in this synchronization after construction is the operational protocol. This protocol should ensure that the development of the sectors that depend on the available water is facilitated in an optimal manner. Studies that assess the sectoral developments in the downstream areas will improve the level to which the dam provides the preconditions needed for these developments. Aside from using the water that will be retained in the reservoir, the construction of the dam will provide opportunities for other sectors as well. The dam will be used for electricity generation and some minor infrastructural works (road/railroad) have been included.

### Recommendation

Synchronization with developments in other sectors is to be based on development prospects and visions in other sectors. The barrage is expected to have a positive impact on aqua culture, improve navigation routes in the dry season, and reverse saline water intrusion, thus having positive impacts on agricultural production and easing scarcity of drinking water in coastal areas. It will also recharge ground water, helping dry season crop production.

Information on these developments is needed to design the dam and its operational protocol in an optimal manner. Rail and road connections can be included as well as the construction of the required electricity infrastructure. Many possibilities exist to improve the design of the dam and to ensure that where possible, potential win-win interventions are included. This should be done in the initial planning and design stage.

## I.12.5 CZ 1.3: Char Development and Settlement Project

### The project can be adapted/scaled up when circumstances require

**Score: 2**

### Assessment

The development of Chars has been taking place for some decades already. Once a specific design is implemented, it will be possible to adapt the design, but this has significant economic consequences. Increasing the size of the polder is only possible at the upstream side of the polder. To heighten the ground level of the polder, tidal river management is needed, which has significant socio-economic consequences. Polder sections that are opened for tidal river management will not be available for an extended period. The dikes surrounding the polder can be heightened if this is required because of climate changes, but this will take up more space and will be costly. This can be facilitated by constructing a broader base to ease an eventual increase of the height of the dam. However, this will not improve the sustainability of the polder. Damage will be even bigger in case of a dam breach, and the problem of water logging will also increase.

### **Recommendation**

Bangladesh has a long history of developing new polders, and many challenges exist in improving the sustainability of these polders. These challenges are related to the physical development of the polder, and, equally important, the organization of responsibilities to ensure that the polder is maintained. Local WMOs can be established, but the functioning of these WMOs has not been successful in all locations. Lessons learned are of great value to improve the long-term operation and maintenance of these polders. Long-term operation and maintenance depend on the availability of financial resources. For this, it is important to develop business cases including participation of the private sector and NGOs that enable the creation of revolving funds.

### **The intervention can be combined with additional measures to increase effectiveness**

**Score: 3**

#### **Assessment**

Once carried out, there will be only little opportunities to implement additional measures to maintain the flood security in the polder area. Dikes surrounding the polder can be heightened, but this will increase the potential damage once there is a dam breach. More feasible alternatives are spatial planning and measures to increase resiliency. The risk of capital destruction is present when challenges related to water logging, salinization, and flood risks cannot be overcome anymore, and a polder has to be given back to the sea.

### **Recommendation**

There is a dire need for practices that increase the sustainable use of the existing polders. The knowledge and experiences gained with implementing these practices can be used to decide upon creating new polders and on how to manage those (Rice Today, September 2013, Vol-12 No-3, Catching up in southwestern Bangladesh). Therefore, it is important to collect available information on evaluations and, where needed, carry out additional M&E activities. With this knowledge, there will be more information available for sound decision making on design, construction, operation, and maintenance of new polders. Continued capacity building and strengthening of WMOs will enable them to oversee sustainable Polder Management (NWPo).

### **The intervention allows for adopting technological innovations after implementation**

**Score: 2**

#### **Assessment**

There will only be very little room for technological improvement. This could be related to the strengthening of the dam, tidal river management, or the development/improvement of the soil fertility to increase crop production. Land use within the polder, however, can be used in innovative ways to increase productivity.

### **Recommendation**

Innovation for new polders could be found in tidal river management, a technology that is being used in certain regions of the Bangladesh Delta. These projects will provide new information on how this can be used to increase the sustainability of these polders. Other technological innovations could be found in decreasing the challenges related to water logging. If innovative solutions are developed that require less energy, that can function on solar or wind power, and that do not need intensive maintenance, the functioning of the polder from this perspective could improve.

## The intervention is synchronized with developments in other sectors

**Score: 2**

### Assessment

This is an integrated project to develop new land that will be used in a multifunctional manner. However, the available information mainly focuses on the technical aspects of char development and does not provide much evidence for synchronization of the project with developments in other sectors (infrastructure, energy production, market development, etc.). This is very important, as polder development will be a stepping stone to further economic, social, and ecological development. If there is no coordination between these developments and the development of the water system, the available resources will be soon depleted and not shared in an equitable manner.

### Recommendation

In-depth studies and evaluations of the functioning and O&M of other polders could provide valuable information on how these polders develop over time, and on which economic sectors profit or could have profited more from the development of these polders. This information has high added value in the development of new Char development projects, as this will increase the ability to plan in an integrated manner and to consider interdependencies and uncertainties that will affect the polder.

## I.12.6 CZ 1.6: Integrated Land Reclamation Project of Hatiya-Dhamar Char-Nijhum Dwip The project can be adapted/scaled up when circumstances require

**Score: 2**

### Assessment

The surrounding area of the Nijhum Dwip and Hatiya Island is morphologically very active due to various natural forces and their interactions such as upland flow, tides, and waves. This area is vulnerable to high waves, salinity, and tidal flood/surge detrimental to life and property, agriculture, culture fisheries, and human development activities. Climate change can further increase the impact of these natural forces and must be considered. The development of Chars has been taking place for some decades already. Once a specific design is implemented, it is possible to adapt the design, but this has significant economic consequences. To increase the size of the polder, a new cross dam must be constructed. To heighten the ground level of the polder, tidal management is needed, which has significant socio-economic consequences since the room will not be available for an extended period. The dikes surrounding the polder can also be heightened if this is required because of increasing flood risks caused by climate change, but this will not improve the sustainability of the polder. Damage will be even bigger in case of breaches, and the problem of water logging will also increase.

### Recommendation

Bangladesh has a long history of developing new polders, and many challenges exist in improving the sustainability of these polders. These challenges are related to the physical development of the polder, and, equally important, the organization of responsibilities to ensure that the polder is maintained. Local WMOs can be established, but the functioning of these WMOs has not been successful in all locations. Potential for involving NGOs and/or the private sector in O&M may be explored. Lessons learned are of great value to improve the long-term operation and maintenance of these polders. Continued capacity building and strengthening of WMOs will enable them to oversee sustainable Polder Management (NWPo)

### The intervention can be combined with additional measures to increase effectiveness

**Score: 3**

#### **Assessment**

The main objective of the project is to increase the availability of land that can be used for human settlement, agriculture, pasture for livestock, shrimp culture, forestry, etc. The structural measures proposed will achieve these objectives but are not flexible. Once carried out, these structural measures leave little room for additional measures, other than to increase dimensions of the original interventions or transitions in land use. Both will have significant economic consequences. There are several interventions possible in the management of polders, for example to establish and improve the functioning of WMOs. These types of interventions will be discussed in the Policy Matrix of the Investment Plan.

#### **Recommendation**

In the financial assessment, only agricultural and fisheries benefits were included. Furthermore, only structural measures were included (embankments, canals, water control structures, etc.). Additional measures are possible to increase the effectiveness of these measures in relation to a broader scope of objectives. These objectives could include other land uses (timber, livestock, etc.) and the development of the tourism sector. There is a dire need for practices that will increase the sustainable use of the existing polders. This knowledge can be used to decide on new polders and how to manage them. Therefore, it is important to collect available information on evaluations and, where needed, carry out additional M&E activities. With this knowledge, there will be more information available for sound decision making on design, construction, operation, and maintenance of new polders.

### The intervention allows for adopting technological innovations after implementation

**Score: 2**

#### **Assessment**

There will only be very little room for technological improvement when considering the planned interventions. The application of innovative technologies to strengthen the dam. Reducing flood risk is possible, but if this is to be done in a later stage, it will have significant financial consequences. If the broader perspective and potential benefits are considered, technological development can be adopted to increase benefits. Technological innovation to optimize the land use is possible. If dams are built such that the land on the dam can be used for different purposes (e.g. roads, housing, etc.), the intervention will add to the economic, social, and ecological development of the polder.

#### **Recommendation**

Innovation for new polders could be found in tidal river management, a technology that is being used in certain regions of the Bangladesh Delta. These projects will provide new information on how this can be used to increase the sustainability of these polders. Other technological innovations could be found in decreasing the challenges related to water logging. If innovative solutions are developed that require less energy, that can function on solar or wind power, and that do not need intensive maintenance, the functioning of the polder from this perspective could improve.



## The intervention is synchronized with developments in other sectors

**Score: 1**

### Assessment

This intervention is on a location where natural sedimentation processes take place, but at considerable distance from the mainland. The project information discusses possibilities for a self-sustenance in times of disasters. The project should therefore not only discuss the technical or structural interventions, but should contain or at least should be part of an integrated development plan for the polder area to ensure that activities taking place on this newly created land are sustainable. At this moment, it is not clear if the structural intervention is part of a comprehensive development plan. Cooperation between different authorities is extremely important to ensure that all the required infrastructure is developed, and this will be an extremely complex process.

### Recommendation

The project information includes many possibilities to integrate different developments, but concentrates only on the structural measures. If other developments (infrastructure, energy production, market development, etc.) do not take place, sustainable operation and maintenance of this char will become extremely difficult. In-depth studies and evaluations of the functioning and O&M of other polders will lead to crucial information on how these polders develop in time. Applying this experience to the development of the Hatiya-Dhamar Char-Nijhum Dwip is of high added value for sustainable development of this project.

## I.12.7 CZ 1.7: Urirchar-Noakhali Cross Dam Project

### The project can be adapted/scaled up when circumstances require

**Score: 2**

### Assessment

This cross dam will be constructed in an area of moderate tidal motion. Currently, at low tide, the Bamni channel between Noakhali and Urir Char can be crossed by foot. The cross dam will enhance the autonomous processes of accretion in the area between Urir Char and the mainland from Noakhali. The Urir Char–Noakhali Cross Dam (UCNCD) closes off the tidal channel between Urir Char and Noakhali, resulting in enhanced accretion of land at both sides of the dam. This accretion will develop immediately after the closure of the channel. In addition, the cross dam will provide a road connection between Urir Char and the Noakhali mainland. The total length of the cross dam is about 10km. The construction of a cross dam is adaptable, but to a limited extent. Additional costs are much higher than when included at the beginning.

### Recommendation

Adaptation needs depend on the actual dimensions, the level to which this design has considered the lifespan of such a dam, and the possible effects of climate change over that specific period (sea level rise, storm surges, precipitation patterns, etc.). Climate change models should be used to simulate effects and ensure that the dam has the proper design buffer to cope with increasing water levels and storm surges. Using the FS that has been prepared in 1989 as a baseline could provide information that helps define projections of future scenarios.



### The intervention can be combined with additional measures to increase effectiveness

**Score: 3**

#### Assessment

Additional technical interventions are available for land accretion, but these are complex and need intensive operation and management. For this, hard structures must be constructed that can regulate the in- and out-flow of water to increase the level of the land.

#### Recommendation

As indicated in the polder development projects above, there are possibilities to combine the implementation of this structural measure with other interventions. However, these will be aimed at increasing the development level of the polder and not so much at reducing the flood risk level. Spatial planning and improved resiliency can add to the reduction of the flood risk. This should be considered in the economic, social, and ecological development of the polder.

### The intervention allows for adopting technological innovations after implementation

**Score: 2**

#### Assessment

There will be only very little room for technological improvement without considerable financial consequences. This will only become an option if technical innovations can reduce costs that would otherwise result from adapting the construction to extreme climate changes, or increases transport between Noakhali and Urirchar. These technological innovations relate to strengthening the dam and increasing the height of the dam to maintain the required flood risk level when climate events become more extreme.

#### Recommendation

Innovation for new polders could be found in tidal management to increase the level of the land and reduce problems related to water logging. This technology is being used in certain regions of the Bangladesh Delta. These projects will provide new information on how this can be used to increase the sustainability of these polders. Other technological innovations may be found in decreasing the challenges related to water logging. If innovative solutions are developed that require less energy, that can function on solar or wind power, and that do not need intensive maintenance, the functioning of the polder from this perspective could improve.

### The intervention is synchronized with developments in other sectors

**Score: 2**

#### Assessment

The project information considers different developments that will take place on Urirchar and the need for land accretion to address existing land hunger. The dam will provide room for a connecting road. However, the intervention planned is a structural unidimensional measure. Even though some other sectors are mentioned in the information, no concrete plans are mentioned to implement structural or non-structural measures to support the development of other sectors.

### **Recommendation**

The project can be strengthened with a thorough analysis of the developments that will take place during the next decades, and how the construction of a cross dam will influence these developments. If developments from other sectors (such as navigation, agriculture, fisheries, etc.) are assessed, opportunities might arise to combine works and ensure that interventions will accelerate these developments.

### **I.12.8 CZ 1.8/CZ 1.21: West Gopalganj Integrated Water Management Project** **The project can be adapted/scaled up when circumstances require**

**Score: 4**

#### **Assessment**

The project concerns improving drainage and irrigation capacity, flood control measures, and an integrated water management plan. The whole area of 62,000ha has been divided into six polders. For each of these polders, a dedicated mix of structural and non-structural measures is proposed. Each of these polders could be considered as one individual project (combined into a program), but it is presented as one project. In principle, this intervention includes a series of measures that can be very well adapted to changing circumstances if needed. This can be done for the type of interventions to be carried out, as well as for the design of the individual interventions. However, this should also be allowed by the programming and planning procedures in place.

### **Recommendation**

A comprehensive M&E initiative is required to ensure that during and after implementation, the effectiveness of the interventions and the effect of changing circumstances are taken into consideration. Planning procedures should allow for changes in the implementation of the project and adaptation to changing circumstances. This should be included in the development of the project.

### **The intervention can be combined with additional measures to increase effectiveness**

**Score: 5**

#### **Assessment**

These investments do not include the risk of destruction of capital. The project will improve safety against floods and reduce vulnerability to climate change related disasters. It will also improve water security and the efficiency of water use. To increase the level of achievement of these objectives, many different types of measures (efficiency of water use in agriculture, water treatment for domestic consumption, waste water treatment, local flood risk management and drainage interventions, etc.) can be added and will further improve livelihood and quality of life in the region. Therefore, this project is fully flexible in relation to the implementation of additional measures.

### **Recommendation**

A comprehensive M&E initiative is required to ensure that during and after implementation, the effectiveness of the interventions and the effect of changing circumstances are taken into consideration. The outcome of the M&E process will lead to recommendations on additional interventions. Continued attention is needed to introduce and strengthen WMOs. Improved capacity would provide the WMOs with the knowledge and skills to sustainably manage the polders.

### The intervention allows for adopting technological innovations after implementation

**Score: 4**

#### Assessment

Since this project consists of a modular implementation, it provides the required flexibility to adopt, in time, innovative technologies.

#### Recommendation

The M&E initiative should have a strong focus on implementation of innovative technologies to further the achievement of the goals. This requires a different approach from when only proven technologies are applied. Procedures should also enable the adoption of innovative technologies.

### The intervention is synchronized with developments in other sectors

**Score: 3**

#### Assessment

Potential benefits in agriculture, fisheries, and transportation are mentioned. However not much emphasis is given to these sectors in the project design.

#### Recommendation

It is discussed how the structural water-centric interventions can serve these sectors, but a more comprehensive analysis is needed to assess how developments in other sectors could be combined with the water-centric interventions to increase the impact of the interventions. Combination between socio-economic developments, spatial planning, and water-centric projects in an integrated approach could lead to a more robust and flexible set of measures that answer better to the development goals in this specific region.

### I.12.9 CZ 1.11/CZ 1.38: Improved Drainage in the Bhabadha Area/TRM of 7 Beels in Coastal Zone

#### The project can be adapted/scaled up when circumstances require

**Score: 4**

#### Assessment

This project is also a combination of measures. It includes the construction of embankments along the river, construction of a drainage regulator at the outfall of the khals, the excavation of drainage khals, and Tidal River Management (TRM) for sediment management and restoration of Hamkura River. Most these measures can be adapted and redesigned if changing circumstances require it, even during the implementation phase. However, this requires that procedures are flexible enough to allow for these adaptations.

#### Recommendation

A comprehensive M&E initiative is required and should be built into the project to ensure that during and after implementation, the effectiveness of the interventions is evaluated regularly and the effect of changing circumstances are considered in assessing achievement of objectives. Climate change related sea level rise needs to be addressed in the design.

### The intervention can be combined with additional measures to increase effectiveness

**Score: 5**

#### **Assessment**

These investments do not include the risk of destruction of capital. The project will improve safety against floods, reduce drainage congestion, prevent salt water intrusion, and reduce risk of climate change related disasters. It will also improve water security and the efficiency of water use, and it will improve land and water management. These interventions will improve livelihood in the region. To increase the level of achievement of these objectives, many different types of measures (increasing the volume and discharge capacity of the water bodies, constructing additional dikes, constructing a secondary dike, compartmenting the region, etc.) may be implemented. Therefore, this project is fully flexible in relation to the implementation of additional measures.

#### **Recommendation**

A comprehensive M&E initiative is required to ensure that during and after implementation, the effectiveness of the interventions and the effect of changing circumstances are taken into consideration. The outcome of the M&E process will lead to recommendations on additional interventions. Continued attention is needed to introduce and strengthen WMOs. Improved capacity would provide the WMOs with the knowledge and skills to manage sustainably the polders.

### The intervention allows for adopting technological innovations after implementation

**Score: 4**

#### **Assessment**

Most the measures are flexible and can adopt innovative technologies to adapt to changing circumstances. Many innovative technologies may already be adopted if the proper structure is in place to ensure proper operation and maintenance. Institutional capacity and training is part of the priorities, as will be indicated in the Policy Matrix of the Investment Plan.

#### **Recommendation**

The M&E initiative should have a strong focus on implementation of innovative technologies to further the achievement of the goals. This requires a different approach from when only proven technologies are applied. Procedures should also enable the adoption of innovative technologies.

### The intervention is synchronized with developments in other sectors

**Score: 2**

#### **Assessment**

Only minor reference is made to the different socio-economic sectors that are affected by the water logging and the solutions that are being proposed, even though there are many win-win combinations to be identified if interventions from individual sectors are combined.

## **Recommendation**

The project information indicates some interrelationships with other sectors, but does not indicate what integration is possible between them. It is discussed how the structural water-centric interventions can serve these sectors, but a more comprehensive analysis is needed to assess how developments in other sectors could be combined with the water-centric interventions to increase the impact of the interventions (e.g. the development of less water consuming rice varieties). Combination between socio-economic developments, spatial planning, and water-centric projects in an integrated approach could lead to a more robust and flexible set of measures. If this integrated approach is adopted, the project would score higher on this criterion, as there are many opportunities to synchronize developments and find a more efficient use of available resources.

### **I.12.10 CZ 1.26: Development of Water Management Infrastructure in Bhola Island The project can be adapted/scaled up when circumstances require**

**Score: 2**

#### **Assessment**

This project encompasses the construction of an embankment and an early warning system in relation to erosion of the embankment and its stability to ensure that when there is an increased risk of a dike breach, people are warned well in advance. The design of the embankment considers extreme climate events, but it is not clear if the design has been tested for different climate change scenarios. No indication is given which climate change scenario and safety level is used for the proposed design. This is important because once the dike is built, it can be adapted to changing circumstances only with significant financial consequences. Therefore, this project is scored as having only limited flexible. The consequences will also depend on how the room on the dam will be used, and which instruments are available to ensure that there is compliance with the prescribed land use and zoning.

#### **Recommendation**

In detailing the design, it is important that climate change models are used in an optimal manner to simulate effects on discharges and take these effects in to consideration. Furthermore, decisions must be taken up front in relation to the flood risk level that should be achieved with these interventions, considering eventual changes in land use within the polder and required flood risk levels. A modular design of the embankments could make it more feasible to adapt the measure. This could be considered as one of the criteria to address in the tender procedure. Furthermore, monitoring and maintenance of the works must be included in the project design, as well as the development of applications needed to control land use on the dam. Capacity building of WMOs is needed, and M&E is also required. With a thorough M&E initiative, the effect of the interventions could be monitored and evaluated in the light of changes in land use and the value of what needs to be protected.

## The intervention can be combined with additional measures to increase effectiveness

**Score: 4**

### Assessment

It is possible to combine this intervention with additional interventions if required. A possibility could be the creation of a second defense line behind the embankment. With this, the flood risk can be reduced for the area behind the second defense line. These options have not been considered in the existing project design. Other additional measures can be found in changing land use, spatial planning (location of strategic installations), and preparation (resiliency) for a dike breach. This concept of multiple safety levels can be implemented over time, decreasing the effect of flooding/erosion and with that the risk. A transition to more room for the river is not realistic in this case. Hence, the only situation that will lead to capital destruction is a transition to the concept of living with floods without the protection of a dike. This transition is also not realistic.

### Recommendations

During the development of the area within the polder, the concept of multiple safety layers should be considered as a guiding principle for spatial planning. Since Bhola is an island in a very active delta region, mathematical modelling should be included to ensure that all interventions are designed taking into account future scenarios. The modelling could also provide a basis for an early warning system.

## The intervention allows for adopting technological innovations after implementation

**Score: 4**

### Assessment

This depends on the precise design of the intervention to assess whether technological development can be implemented easily. The existing strengthening of embankments are flexible and can be adapted using innovative technologies. Technology to monitor the stability of the embankment and the ability to assess the collected information is developing rapidly. These technological innovations can be adopted easily. Concepts like ‘smart dikes’ could improve the maintenance of the embankment, and the information that will be gathered can also be used for early warning systems related to potential breaches. This type of technological innovation will also need room on the dike. Hence, the flexibility of implementing innovative technologies will depend also on the land use allowed on and around the dike, and the way these rules are enforced.

### Recommendation

The possibility of adopting technological innovation depends on the availability of financial means and on the availability of space on and around the embankments. If the space is occupied, it will become more difficult. Operation and maintenance should also consider this in developing policies on what is allowed and how to ensure compliance.

## The intervention is synchronized with developments in other sectors

**Score: 1**

### Assessment

The embankment will protect the land uses on the island, but no direct synchronization of the measure with other sectors such as improved infrastructure, increased agricultural production, fisheries, and livestock, etc. is included in the project proposal.

### Recommendation

It is important to ensure that the construction of an embankment is synchronized with other developments that will take place in the region. Protection of developments will increase property value and, depending on the envisioned development, different measures could be implemented. The room on the embankment itself can be used in a multifunctional manner. It should be assessed which other uses are allowed without jeopardizing the primary objectives. Using the embankment for a road and the construction of an electricity transmission installation is a good example of multifunctional use. If opportunities for synchronization are studied and included in the project, the score on this criterion will be significantly higher.

## I.12.11 UA 1.1: Protection of Rivers System around Dhaka City with Their Ecological Restoration

### The project can be adapted/scaled up when circumstances require

**Score: 2**

### Assessment

The project encompasses structural measures to increase the discharge of water through four main rivers in the Dhaka City area. Once the structural interventions have been implemented, changing circumstances could change the required discharge to achieve the same goal, and goals could also change. These goals include minimum discharge, flood risks, and finding the proper multifunctional space on and bordering the rivers. Canals that are excavated and designed as earth canals can be adapted, but the discharge of water control structures is limited to their design capacity. If additional capacity is needed, it might be necessary to replace the control structures, possibly leading to capital destruction.

### Recommendation

The feasibility study dates from 2004. This means that an update of the FS is necessary. The new FS should consider different development scenarios for Dhaka and use these scenarios to select a preferred alternative that is robust and uses construction technology and materials that increase flexibility when changing circumstances require it.

## The intervention can be combined with additional measures to increase effectiveness

**Score: 4**

### Assessment

Additional measures are possible. In relation to the proposed intervention, consequences in relation to costs and required room will most probably lead to the conclusion that it is more feasible



to reconstruct the existing infrastructure to adapt to the changed circumstances. Hence, the risk of capital destruction is present. Additionally, the should be available to implement additional measures. This should be kept in mind in spatial planning. In relation to the objective of water quality improvement, many additional measures can be adopted to decrease the pressure from solid waste and the quality of the water that reaches the river system (surface runoff, domestic and industrial waste water, etc.).

### **Recommendation**

Additional measures are necessary to ensure that the water in the rivers will have the required quality. These measures include the disposal of solid waste, wastewater treatment, and the control of water that is generated by the land use along these rivers (domestic, industrial, agricultural, etc.) As long as measures are possible to improve the quality of the water that reaches the river up to the required limits, it might not be necessary to take additional measures to (further) increase the discharge through the rivers. Hence, strong interagency and intersectoral coordination, as well as coordination with other projects in Dhaka, is crucial because there are many interlinked organizations, authorities, and projects.

### **The intervention allows for adopting technological innovations after implementation**

**Score: 1**

#### **Assessment**

In relation to the interventions that are planned in this project, no flexibility exists in relation to adopting new technologies. If this project is coordinated in an integrated manner with urban development and waste (solid and water) management, many additional interventions with their innovative applications will be possible and will sharply increase the score on this criterion.

### **Recommendation**

Adopting new technologies will not be possible for increasing the discharge through the canals unless new technologies for pumping water in to the system is being used. However, innovative technology can be adopted to increase the quality of the water that reaches the rivers from domestic, agricultural, and industrial use. Furthermore, additional measures are possible in relation to enforcement of laws and regulation related to water quality and waste management.

### **The intervention is synchronized with developments in other sectors**

**Score: 2**

#### **Assessment**

From the available information, it is not clear whether synchronization is ensured in the design of the actual proposal. Multiple uses of the water are indicated, and the interrelationships with other projects in the city are mentioned. For certain sections, navigation will be ensured, and the construction of an embankment with a new road is synchronized with the 'Dhaka Integrated Flood Control Embankment cum Eastern Bypass Road Multipurpose Project'. A more integrated approach could significantly increase the score on this criterion.

### **Recommendation**

A detailed study of the different sections of the canals is needed to identify all opportunities for synchronization of the design with other developments that are taking place or that will take place. Here exists the opportunity to integrate water management in urban and spatial planning and to find opportunities to co-finance interventions between the different sectors. There are many opportunities to synchronize and ensure efficient use of resources if this study is carried out and authorities are able to coordinate the implementation of interventions.

### **I.12.12 UA 1.2: Dhaka Integrated Flood Control Embankment cum Eastern Bypass Road Multipurpose Project**

**The project can be adapted/scaled up when circumstances require**

**Score: 2**

#### **Assessment**

The proposed Dhaka Integrated Flood Control Embankment cum Eastern Bypass Road Multipurpose Project will provide flood protection for the eastern part of 124 square km. of Dhaka City. This will mitigate damage and loss of life and capital due to flooding by the Balu River and due to internal flood water generated by precipitation and surface runoff. The project will also include the construction of a road on the embankment to improve the infrastructure. The project includes several structural measures to improve drainage and retention of water. The project is divided into three components. Each compartment is treated as a discrete flood protected area with its boundary sub-embankments to reduce flood risk to 1:100. Embankments between the compartments will be used to improve transportation. It is not indicated which time horizon has been used for the flood risk reduction in relation to climate change. Most of the interventions are hard structural interventions. This means that they are not adaptable to changing circumstances. The fact that the project covers several compartments provides the opportunity for a phased implementation. Over time, designs of the compartments could be adapted, but this is not described as an option in the project documentation.

### **Recommendation**

Because the available information does not provide information on which climate scenario has been used to define the preferred option, and no provisions have been made for a phased implementation, the project scores very low on this criterion. If these aspects are taken in to consideration in further design studies to detail the project and procedures allow for intermediate adaptations, the score of this intervention on this criterion will be higher.

**The intervention can be combined with additional measures to increase effectiveness**

**Score: 2**

#### **Assessment**

These interventions add to achieving the required flood risk level and are designed to do this for a certain development path. If the development path changes, there are many interventions possible to increase the discharge capacity of the urban area. This should be done in a coordinated manner. The more intensively the land is used, the more difficult it will become to find the room for additional drainage canals and pumping stations to ensure that water is being discharged with

a sufficient capacity to maintain the required flood risk level. Additional interventions to maintain the required flood risk level from the river are more complex. These include development of instruments to protect natural wet lands. These work as retention ponds. If no protection is in place, these will likely be converted into real estate. The only possibility would be to increase the height and width of the dike, but this will become very expensive because of the space required and the fact that there are plans to use the dike to construct roads. If there is no space available because of immovable property (mosques, temples, cultural heritage, etc.), only solutions like flood walls are feasible. Therefore, the intervention has only limited flexibility in relation to combination with additional interventions.

### **Recommendation**

In relation to spatial planning of the urban area, it is important that this is being done in a coordinated manner. Spatial planning should include zonation with restricted development to ensure that there is sufficient room to take additional measures to increase the discharge of local rain water.

### **The intervention allows for adopting technological innovations after implementation**

**Score: 3**

#### **Assessment**

Technical innovation will be possible to strengthen the stability of the dike and to increase the discharge capacity from the urban area towards the river. For pumping stations, this will only be possible when pumps are being replaced, but there are many developments with energy neutral intermittent pumping stations that need less maintenance.

### **Recommendation**

To ensure that the potential is fully used, an effective M&E structure is needed.

### **The intervention is synchronized with developments in other sectors**

**Score: 2**

#### **Assessment**

The integrated multipurpose scheme is supposed to be consistent with the long-term strategy for Greater Dhaka East, staging the implementation of flood protection and drainage improvement over the next decades in response to development pressure, climate change, and various natural calamities. Each compartment is treated as a discrete flood protected area with its boundary sub-embankments being above the 100 years' flood level, and acting as internal link roads. In the project proposal, other sectors are mentioned. It is indicated how this project will facilitate the development in these sectors, but there is no indication of strong coordination with other policy domains or authorities responsible for the implementation of these sectoral policies. This coordination is crucial to ensure that the most effective and efficient solutions are identified and implemented, and that the development potential within the protected compartments is structured and optimized in a socially acceptable manner.

### **Recommendation**

Stronger coordination between responsible authorities is needed. Many win-win opportunities can be identified when this coordination takes place between the authorities that are responsible for water management. Intersectoral coordination will lead to more effective and efficient use of resources. Solid waste management, spatial planning, housing, and industrial activities are all directly and indirectly connected to the water system (quality and quantity). Local retention of water can decrease peak flows and reduce water demand. Local interventions to reduce the use of contaminants might be cheaper than construction and operation and maintenance of water treatment plants. Land use will affect the potential for implementation of additional interventions to increase the discharge capacity.

### **I.12.13 UA 1.3: Drainage Improvement of Dhaka-Narayangonj-Demra Project (Phase 2)** **The project can be adapted/scaled up when circumstances require**

**Score: 2**

#### **Assessment**

Phase 1 of the Dhaka-Narayangonj-Demra (DND) project was carried out between 1962 and 1968 as a flood control drainage and irrigation (FCDI) project primarily to protect Dhaka and Narayanganj towns from floods and to protect croplands. The whole project area is bounded by road cum embankments and floodwalls. The interventions proposed are mostly structural measures that could be adapted if needed because of changing circumstances, but the consequences will be considerable in relation to costs and the room required for the interventions. This is valid for the measures to increase the drainage as well as the flood wall to reduce the risk of flooding from the river. For both types of measures, as well as for the planned bridge, it is necessary that the actual design is evaluated in the light of new insight on economic and demographic developments and climate change, because these will be the main drivers that will determine what is needed.

### **Recommendation**

It is recommended that a new FS evaluate the actual preferred set of measures and identifies designs that are more adaptable. That can be achieved in the types of interventions, in the types of materials used, and in the spatial planning around the interventions to ensure that there is sufficient room to adapt interventions.

### **The intervention can be combined with additional measures to increase effectiveness**

**Score: 3**

#### **Assessment**

Taking in to account the challenges and the type of measures that are proposed, it can be indicated that, from a technical point of view, there are always possibilities to carry out additional measures to drain the area if changes require doing so. However, such additional measures in an intensively used area such as the DND will have significant social and economic consequences. For the proposed floodwall, even with additional measures it will be very difficult to maintain the required safety level, other than by increasing the height of the wall.

### **Recommendation**

In the design of the project, different development scenarios should be considered. Taking in to account that the FS was done in 2004, it is important to use the actual state of knowledge to reevaluate the planned interventions in type and in design to ensure that the preferred set of interventions is robust and flexible. This also means that spatial planning should be considered to ensure that additional measures may be added when needed in the future. Economic and social consequences need to be limited or sufficiently mitigated.

### **The intervention allows for adopting technological innovations after implementation**

**Score: 2**

#### **Assessment**

Once the proposed interventions are implemented, there is only little room for technical innovation without capital destruction. Technical innovation in pumps and energy supply is possible. Pumps become more efficient, and energy is generated in a sustainable manner with renewable resources. Destruction of capital would be reduced if there is an option to delay replacement of pumps until they are fully depreciated.

### **Recommendation**

A new FS is needed to evaluate whether the solutions chosen and the way they are designed leave sufficient space to adopt technological innovations over time. With proper spatial planning, additional measures will be possible, and technological innovations can be used.

### **The intervention is synchronized with developments in other sectors**

**Score: 2**

#### **Assessment**

The project information provides ample information on the relationships with other sectors. However, it does not indicate how the proposed interventions are really synchronized with developments in the relevant policy sectors (urban development, industrial development, mobility, etc.).

### **Recommendation**

It is crucial that the new FS fully adopts an integrated approach and seeks opportunities to implement interventions in coordination with other authorities and in combination with interventions in other sectors. This will most probably lead to numerous win-win opportunities, since the land use in the area to be protected is so intensive. With an integrated approach, the score on this criterion will increase significantly.

#### **I.12.14 UA 9.1: Greater Dhaka Integrated Water and Sewage Improvement Project** **The project can be adapted/scaled up when circumstances require**

**Score: 4**

##### **Assessment**

Considering there is still a lot to be done in the planning and design of this project, there are many opportunities to ensure that the project proposal will be robust and flexible. A modular approach will make it possible to be prepared for unexpected changes in the developments that affect the water supply and treatment of wastewater. However, once measures have been implemented, it will have significant consequences to increase capacity.

##### **Recommendation**

A thorough cost/benefit analysis of the different development pathways is needed to find the most preferred development path. Since this project has not yet been developed beyond a FS, assessment and recommendations are similar. For a thorough FS, objectives of the project should be well defined.

#### **The intervention can be combined with additional measures to increase effectiveness**

**Score: 4**

##### **Assessment**

If the project proposal described above provides sufficient room for adaptation of the project, the need to combine this with additional measures will be limited. The ideas described are mainly focused on using surface water for consumption and to build a sanitation system that is able to transport and treat wastewater. Additional measures could be found in interventions that would decrease the water demand (efficient water use, reduction of unaccounted for water, water pricing, recycling waste water, etc.) and reduce the pressure on end of pipe solutions when considering wastewater treatment plants. The latter could be achieved by promoting urban and housing developments with separate sewer systems.

##### **Recommendation**

When detailing this project, thorough analysis is needed to ensure that implementation leaves sufficient room for additional measures. This increases the flexibility of this project.

#### **The intervention allows for adopting technological innovations after implementation**

**Score: 4**

##### **Assessment**

Given the stage of the development of this proposal, there is still enough flexibility to ensure that technological innovation is adopted as efficiently and effectively as possible. This does not mean that the project will consist mainly of state of the art technology, as conventional technology could be the most appropriate given the actual situation in Bangladesh in relation to the possibilities for operation, maintenance, monitoring, and evaluation. However, in planning, the adoption of technological innovation can be considered as one of the criteria for selecting and designing a solution.

### **Recommendation**

When detailing this project, a structure needs to be included that allows for continuous evaluation of the effectiveness of the interventions carried out and the opportunities to increase the effectiveness and improve efficiency through the adoption of innovative technologies.

### **The intervention is synchronized with developments in other sectors**

**Score: 4**

#### **Assessment**

These interventions that are indicated to improve water supply and sanitation in the city of Dhaka will need strong coordination with other authorities and stakeholders from large volume users in industry down to the household level. At all levels, the demand and discharge of wastewater can be influenced. For building water treatment plants, it is necessary to find the available space and to optimize the location in relation to actual land occupation and future land use. For this, it is crucial to consider demographic, economic, and social developments in the decision making, the planning, and the implementation of the interventions. Construction of new transportation systems as well as maintenance of existing systems should be coordinated, for example with the authorities that are responsible for the mobility infrastructure. In this way, resources will be used more efficiently, and disturbance of existing urban areas can be reduced. In combining sectoral developments in an area with such high intensity in land use, many win-win opportunities can be identified.

### **Recommendation**

Because future developments are uncertain to some extent, it will be necessary to adapt and synchronize on a continuous basis. This can only be done when there is a structure that monitors developments, and if planning procedures are flexible enough to adapt to changing circumstances.

### **I.12.15 UA 10.1: Improvement of Drainage Congestion and Flood Control for Chattogram City Corporation Area**

#### **The project can be adapted/scaled up when circumstances require**

**Score: 3**

#### **Assessment**

The project comprises a series of structural measures and there is no evidence that, aside from solving the actual problems, possible future changes have been considered. Once the measures have been implemented, it will have significant economic and social consequences to adapt these interventions. However, the project encompasses a phased approach with three different time horizons. That means that there will be opportunities to adapt the interventions before they are implemented. From the available information, it is not clear up to what extent future uncertainties have been taken in to consideration in the phased implementation of the project.



### **Recommendation**

To assure that the adaptation potential can be used to its full extent, it is necessary that planning protocol/procedures allow for sufficient flexibility. Also, to decide on adaptation, a proficient monitoring and evaluation structure is needed.

### **The intervention can be combined with additional measures to increase effectiveness**

**Score: 3**

#### **Assessment**

If the project proposal provides sufficient room for adaptation of the project, the need to combine this with additional measures will be limited. The ideas described are mainly focused on expanding the sewage system to transport and treat wastewater and solid waste management. Additional measures may be found in interventions that reduce the pressure on end of pipe solutions. In relation to the sewage system, this could be achieved by promoting urban and housing developments with separate sewer systems. In relation to solid waste, a social awareness program could assist in reducing the load of solid waste and improving the separation of waste. This can be combined with other projects being developed by Chattogram City Corporation for drainage, solid waste management, and fecal sludge management.

### **Recommendation**

Aside from the structural measures, this project should also consider social and economic measures that could assist in achieving the goals. There is a strong need to coordinate between activities and projects carried out by other stakeholders.

### **The intervention allows for adopting technological innovations after implementation**

**Score: 2**

#### **Assessment**

The phased approach will provide ample opportunities to adopt technological innovations, for example in fecal sludge treatment. However, the conditions to identify and introduce technological innovations are not addressed in the available documentation.

### **Recommendation**

To ensure that the adaptation potential can be used to its full extent, it is necessary that planning protocol/procedures allow for sufficient flexibility. Also, to decide on adaptation, a proficient monitoring and evaluation structure is needed. If these aspects are taken in to consideration, the score of this intervention on this criterion will be higher. As a coastal city, climate change impact will be quite significant and therefore should be addressed accordingly.

### **The intervention is synchronized with developments in other sectors**

**Score: 2**

#### **Assessment**

There is a strong indication that there is synchronization with solid waste management, but there are many other opportunities to synchronize this project with developments in other sectors such as the new water supply projects being implemented by Chattogram Water Supply and Sewerage Authority. However, to do so, a more comprehensive analysis is needed of the developments that will take place in the region and how this will be interlinked with the implementation of the measures and the required capacity.

### **Recommendation**

An analysis of local and regional plans will probably lead to opportunities for win-win situations in the construction, operation, and maintenance of this project. The latter is especially important to ensure that the system will maintain its function in the long term. If these aspects are added, the score of this intervention on this criterion will be higher.

### **I.12.16 HR 2.2/3.1: Village Protection against Wave Action in Haor Area and Improved Water Management in Haor Basins**

#### **The project can be adapted/scaled up when circumstances require**

**Score: 4**

#### **Assessment**

The Haor Master Plan anticipates different development scenarios. It ensures adequate, sufficient measures by connecting short-term decisions to long-term delta needs (like flood protection, drainage, and habitat management). Given the different initiatives, it provides sufficient flexibility to address uncertainties and to invest in real needs. The Haor Master Plan not only addresses flood risks and erosion, but also pays attention to socioeconomic activities as well as ecosystem management.

This specific project is a component of the Haor Master Plan and encompasses a series of structural measures such as construction of vent regulators, repair/re-sectioning of embankments, and the re-excavation of rivers, khals, canals, and drainage channels. These interventions all need maintenance. Embankments and the waterways especially can be adapted to changing circumstances. The vent regulators are hard structures and cannot be adapted. This should be considered in the design, with over-dimensioning to cope with eventual effects of climate change.

### **Recommendation**

In this project, learning by doing is a very important aspect to adapt sufficiently to changing circumstances. For this, interventions need to be evaluated. Results of these evaluations should lead to recommendations on required changes in the planning of the project and the design of the interventions. This means that planning procedures should allow for the flexibility to adapt planning and design during implementation.

### **The intervention can be combined with additional measures to increase effectiveness**

**Score: 4**

#### **Assessment**

Many different measures can be implemented to achieve the objectives of this project. The interventions included in the project proposal do not block the implementation of additional measures to increase the effectiveness. Spatial planning should also leave enough room for the construction of additional measures. However, to determine if additional measures should be taken and which additional measures would fit best, a strong monitoring and evaluation structure should be in place. If this receives insufficient attention during and after project implementation, it will not be possible to find the optimal combination of measures to maintain the required security levels.

### **Recommendation**

Most important is to establish the monitoring and evaluation structure to know when and to decide which additional measures should be implemented to cope with changing circumstances. Furthermore, the measure should be combined with nonstructural measures such as early warning systems to allow populations under threat sufficient time to take necessary measures to reduce the damage when a flood event occurs.

### **The intervention allows for adopting technological innovations after implementation**

**Score: 4**

#### **Assessment**

Given the type of measures included in the plan and the phasing of the implementation, it will be possible to include technological development in re-excavating water bodies and increasing the stability of the embankments. Furthermore, development is to be expected in the ability to prognosticate extreme weather events and to improve the early warning systems. With longer lead periods, more time becomes available to take the necessary steps to reduce damage.

### **Recommendation**

It is important that continuous study of implementable technologies takes place to ensure that whenever new technologies become available, it is possible to decide whether they have an added value for achieving the goals indicated in the project proposal.

### **The intervention is synchronized with developments in other sectors**

**Score: 3**

#### **Assessment**

It is extremely important that the different components of the project are addressed in an integrated manner, taking in to consideration all the initiatives in the region, including initiatives directed at infrastructure, mobility, economic development, agriculture, aquaculture, education, health, and others.

The available project documentation mentions many intersectoral aspects, but it is not clear whether there is sufficient integration and interaction with the different authorities responsible for the implementation of the related sector policies.

The Haor Master Plan, for example, would provide a strong foundation for a truly integrated approach in the region. However, how this will guide the implementation still needs to be developed.

### **Recommendation**

Impact of projects on a broad range of objectives included in the Seventh Five-Year Plan will be stronger if these initiatives are planned in a more integrated manner. Relatively small scale interventions can be carried out and, in the proper planning of these interventions, there will be stronger flexibility to adapt to changing circumstances. These changing circumstances are not only climate change related. These interventions will directly influence potential for regional development and, as such, should consider the path these developments are taking.

Considering the interconnectivity, it is crucial that up and downstream effects of interventions are assessed. Interventions such as construction of new dikes and deepening drainage canals will change the water system and will therefore change flood risks and erosion processes in other areas. These effects should be considered when planning interventions.

#### **I.12.17 DP 1.1: North Rajshahi Irrigation Project**

##### **The project can be adapted/scaled up when circumstances require**

**Score: 2**

##### **Assessment**

These types of large scale irrigation projects have very little flexibility to adapt to changing circumstances. Since the production of crops depends on many different aspects, extreme caution is needed in dimensioning the interventions. Most of the included interventions are structural and very difficult to adapt. For this project, the availability of water also depends on the construction of the Ganges Barrage, which is still uncertain. Furthermore, international agreements on river discharges and climate change will strongly affect the availability of water.

##### **Recommendation**

The studies for the design date back to 2006. The effect of changing circumstances is very strong. Therefore, it is extremely important to carry out an actualization of the feasibility study that factors in these uncertainties to find the most robust/flexible design for this irrigation scheme. Nonstructural measures should also be included. It is crucial that the WMOs are strengthened to ensure that they have the capacity to be in charge of operation and maintenance.

##### **The intervention can be combined with additional measures to increase effectiveness**

**Score: 4**

##### **Assessment**

Additional measures are possible, but will have significant additional financial consequences. These measures can be found in technical interventions to maintain or increase the water availability. With declining groundwater levels and uncertainties related to international agreements and the construction of the Ganges Barrage, additional measures should also be sought on the demand side. More efficient use of the available water through more efficient irrigation techniques or changing to crops with a lower water demand are options that should be considered.

##### **Recommendation**

Monitoring and evaluation is needed to know what the output and outcome of this project is. Based on that information, it can be assessed whether it is feasible from a social and economic point of view to carry out additional measures. This also depends on the overall objectives for agricultural production and how a certain level of food security should be achieved.

### The intervention allows for adopting technological innovations after implementation

**Score: 3**

#### Assessment

Adopting technological innovation is possible in relation to ground water irrigation, but this would cause a further depletion of the aquifers and is not sustainable in the long run. Technological innovations can also be introduced for irrigation techniques and crop rotations. These technological innovations are more promising in the long run.

#### Recommendation

Adopting new agricultural practices takes a long time. Farmers are used to their practices, which have been developed over generations, and they are normally not eager to change to other techniques or crops. Therefore, it is important to invest strongly in research on new technologies and to initiate intensive programs to educate and train farmers whenever new technologies become available. The Ministry of Agriculture already has several research centers and organizes training programs. New initiatives should be developed and combined with existing endeavors to optimize agricultural production.

### The intervention is synchronized with developments in other sectors

**Score: 2**

#### Assessment

Large scale irrigation schemes have far reaching effects on socioeconomic developments in the region. However, the project proposal is mainly focused on the structural measures to bring the water from the river to the fields, measures to maintain a required flood risk level, and measures to reduce water logging. There is some reference to ecological restoration and the proposal includes roads, bridges, a trail ways and a telephone line, but there is no integrated development plan that optimizes the way the irrigation project can facilitate these developments and vice versa.

#### Recommendation

An integrated regional development plan that incorporates the effects of a large-scale irrigation scheme on sectoral developments would optimize the outcome of such an initiative. This should include the development of infrastructure, the development of markets, training and education facilities, and use of the structural interventions by other users for fish cultivation, domestic water supply/consumption, or recreation, etc. Such an integrated plan would significantly improve the score of the project on this criterion.

### I.12.18 DP 1.2: Revitalization and Restoration of Beel Halti

#### The project can be adapted/scaled up when circumstances require

**Score: 2**

#### Assessment

Most of the interventions mentioned in the project documentation are hard structural measures. That means that the possibility to adapt these measures to changing circumstances is very limited. Some measure can be adapted, like the embankments and the canals/rivers, if there is space to do so. However, the discharge capacity will be limited to the design capacity of the hard structural works like the regulators and the inlets/outlets.

### **Recommendation**

In the design, given the inflexibility of these interventions, it is crucial that uncertainties are analyzed in detail to ensure that the measures have sufficient capacity to cope with changing circumstances. This, however, will increase the risk of over investment.

### **The intervention can be combined with additional measures to increase effectiveness**

**Score: 3**

#### **Assessment**

There are many additional measures that can be taken to increase the drainage capacity and to reduce the flood risk from the river. These measures lead to significant social and economic consequences and should be avoided if possible. This can be done by considering potential changes in the original design. On the other hand, alternatives are not really viable other than creating more retention areas within the polders. In view of the already existing land hunger, this will be very difficult to implement.

### **Recommendation**

In the original plan, it should be considered which additional measures could be implemented. The boundary conditions for these interventions should be included in the design. This means that extra space should be allocated for expansion of the drainage system and the embankment. This does not mean that this area cannot be used at all, but the land use should be such that capital destruction is limited when the room is needed to implement the additional measures.

### **The intervention allows for adopting technological innovations after implementation**

**Score: 2**

#### **Assessment**

The project allows for adopting technological innovation, but the measures that are part of the original proposal do not offer a huge potential. Innovative technologies could be used in case additional measures are required.

### **Recommendation**

It is necessary that studies provide the information needed to assess whether innovative technologies could help achieve the objectives in the long run.

### **The intervention is synchronized with developments in other sectors**

**Score: 2**

#### **Assessment**

In the project documentation, there are some references to cooperation with other authorities and interrelationships with other economic sectors. However, how cooperation will be implemented is not specified. Therefore, it remains unclear up to what level coordinated implementation will take place, and up to which level win-win opportunities have been identified in interaction with these authorities.

### **Recommendation**

The feasibility study was carried out in 2006/2007. Therefore, an update is required. In updating the FS, opportunities should be identified to cooperate with the involved actors, and action plans should describe how this cooperation will materialize. The updated plan will need to provide insight on how the polders will profit from this cooperation and synchronize with developments in other sectors.

### **I.12.19 DP 1.3: Revitalization and Restoration of Hurasagar and Atrai rivers**

#### **The project can be adapted/scaled up when circumstances require**

**Score: 4**

#### **Assessment**

This project encompasses dredging of two rivers to increase the discharge capacity and navigability. River bank protection works will mitigate erosion and increase flood safety. The interventions will also facilitate agriculture and fisheries, but no direct actions are included to improve development in these sectors. It is also expected that maintenance works and dredging will lead to ecological restoration. Most of these activities are fully adaptable. For the river bank protection works, different scenarios should be included when deciding on the design, because financial consequences to adapt these works could be significant.

### **Recommendation**

To adapt when needed, monitoring and evaluation should be organized in a structural manner. Dredging programs should be evaluated continuously to ensure that timing and intensity of dredging is performed in an optimal manner.

#### **The intervention can be combined with additional measures to increase effectiveness**

**Score: 3**

#### **Assessment**

Depending on the objectives, additional measures are possible. However, consequences for increasing the discharge capacity will be significant. Measures to mitigate erosion, to facilitate agriculture and fisheries, or to restore the ecosystems are numerous. However, they are of a completely different order with respect to the objectives to be achieved compared to the type of interventions proposed in this project.

### **Recommendation**

An integrated approach would lead to a more effective achievement of objectives. The way the project is described now could lead to the conclusion that the main objectives are to improve the discharge capacity and the navigability, and that the other objectives are more indirect. With a more integrated approach, effectiveness of this intervention may increase, and additional measures will be possible to help achieve the objectives.



### The intervention allows for adopting technological innovations after implementation

**Score: 4**

#### Assessment

Innovative technologies can be introduced to increase the stability of the embankments and in dredging activities.

#### Recommendation

The monitoring and evaluation structure specified above should also consider innovative technologies to be introduced.

### The intervention is synchronized with developments in other sectors

**Score: 3**

#### Assessment

The interventions support achieving a broad scope of objectives, directly and indirectly. A more integrated approach could lead to new insights on how interventions can be combined.

#### Recommendation

Given the characteristics of the interventions proposed, this can also be a standalone project and could be suitable for private sector involvement. Securing navigability of the rivers could be the basis for a business case needed to enter in to a PPP contract.

### I.12.20 DP 1.4/1.5: Kurigram Irrigation Project (South and North Unit)

#### The project can be adapted/scaled up when circumstances require

**Score: 2**

#### Assessment

These types of large scale irrigation projects have very little flexibility to adapt to changing circumstances. This project includes many hard-structural works, including the Dharla Barrage, that are not adaptable. In addition, the production of crops depends on many different aspects. Therefore, extreme caution is needed in dimensioning the interventions.

#### Recommendation

The studies for the design date back to 2011/2012. The effect of changing circumstances is very strong. Therefore, it is extremely important to carry out an actualization of the feasibility study that factors in uncertainties to find the most robust/flexible design for this irrigation scheme. An alternative could be to subdivide the scheme into smaller units with their own systems to take water from the river and transport the water to the fields. This would allow for a more flexible approach, but would increase the overall cost. Nonstructural measures should also be included. It is crucial that the WMOs are strengthened to ensure that they have the capacity to be in charge of operations and maintenance.

### The intervention can be combined with additional measures to increase effectiveness

**Score: 4**

#### Assessment

Additional measures are possible, but will have significant additional financial implications. These measures can be found in technical interventions to maintain or increase the water availability. However, with declining groundwater levels and the uncertainties related to water availability in the river, measures should also be sought on the demand side. More efficient use of water through more efficient irrigation techniques or changing to crops with a lower water demand are possible options.

#### Recommendation

Monitoring and evaluation is needed to know what the output and outcome of this project is. Based on that information, it can be assessed whether it is feasible from a social and economic point of view to carry out additional measures. This also depends on the overall objectives for agricultural production and how a certain level of food security should be achieved.

### The intervention allows for adopting technological innovations after implementation

**Score: 3**

#### Assessment

Adopting innovative technologies is possible for ground water irrigation, but this would cause a further depletion of the aquifers and is not sustainable in the long run. Technological innovations can also be introduced for irrigation techniques and crop rotations. These technological innovations seem to be more promising in the long run.

#### Recommendation

Adopting new agricultural practices takes a long time. Farmers are used to their practices, which have been developed over generations, and they are normally not eager to change to other techniques or crops. Therefore, it is important to invest strongly in research on new technologies and to initiate intensive programs to educate and train farmers whenever new technologies become available. The Ministry of Agriculture already has several research centers and organizes training programs. New initiatives should be developed and combined with existing endeavors to optimize agricultural production.

### The intervention is synchronized with developments in other sectors

**Score: 2**

#### Assessment

Large scale irrigation schemes have far reaching effects on socioeconomic developments in the region. However, the project proposal mainly focuses on the structural measures to bring the water from the river to the fields, to maintain a required flood risk level, and to reduce water logging.

#### Recommendation

An integrated regional development plan that incorporates the effects of a large-scale irrigation scheme on sectoral developments would optimize the outcome of such an initiative. This should include the development of infrastructure, the development of markets, training and education facilities, and use of structural interventions for fish cultivation, consumption or recreation, etc. Such an integrated plan would significantly improve the score of the project on this criterion.

### I.12.21 CH 9.2: Water Supply and Environmental Sanitation in Pourashavas under Chattogram Hill Tracts

#### The project can be adapted/scaled up when circumstances require

**Score: 2**

##### **Assessment**

The project consists mainly of structural interventions to increase water supply, and to improve water treatment and drainage. These interventions, once implemented, are difficult to adapt. Some of the interventions can be adapted, but this will cause significant destruction of capital as it would require replacing installed equipment or infrastructure instead of adapting the measures. In the (draft) DPP, an implementation period of 4 years is mentioned. This will be too short a time frame to adapt the interventions during implementation. The DPP does not indicate which climate scenarios have been used to determine the preferred design of the interventions.

##### **Recommendation**

In detailing the project design, it is important to prepare a proper analysis of all the uncertainties that might affect an initiative at this scale. These uncertainties include social and economic developments, as well as climate change. These uncertainties will affect the required drainage capacity to be installed. Knowing the uncertainties will provide the necessary information to decide on the preferred set of measures and to reduce the risk of under- or over-investment.

#### The intervention can be combined with additional measures to increase effectiveness

**Score: 3**

##### **Assessment**

It will always be possible to increase capacity through additional measures. However, the construction of additional measures will have significant social and economic consequences.

##### **Recommendation**

From the start, spatial planning of the urban area should account for a development path that factors in additional measures whenever required by changing circumstances, because these additional measures will need space. If the required space is occupied by capital intensive investments, the cost of additional measures become significantly higher.

#### The intervention allows for adopting technological innovations after implementation

**Score: 2**

##### **Assessment**

Once the interventions have been implemented, there is not much potential for technological innovation. Innovation might be possible in the operation and maintenance.

##### **Recommendation**

Monitoring and evaluation is needed to assess the effectiveness and efficiency of the system. If results indicate that improvement is required, it would be useful to have a good overview of possible technological interventions.

## The intervention is synchronized with developments in other sectors

**Score: 2**

### **Assessment**

This type of intervention will have a huge economic and social effect on the pourashavas. These effects are mentioned in the project documentation, but should be fully integrated in the project decision making, planning, construction, and operations and maintenance.

### **Recommendation**

This project has potential to score significantly higher, because there are many interlinkages between urban development and the interventions included in this project. An additional assessment and an integrated approach is recommended.

## **I.13 DPP Manual Feasibility Study**

Listed below are some of GED's most critical requirements from a feasibility study that is submitted along with any Development Project Proforma/Proposal:

- Financial and economic analysis (Volume II of the Manual provides guidelines on how to calculate financial and economic net present value)
- Lessons learnt from similar projects
- Detailed cost estimates and phasing of these costs
- Comparison of major cost items with similar projects
- Specifications and design of major project components
- Project Impact (including Environmental and Social impact) and management responses to this impact
- Linkages with national plans, SDGs, ministry policies and priorities
- Stakeholder consultations including private sector, local government and NGOs
- Resettlement issues (magnitude and costs) and plans
- Risk analysis and mitigation measure

The main reforms need to be done immediately are (a) establishment of a ‘Delta Wing’ in GED; (b) formation of Delta Governance Council (DGC); (c) establishment of Bangladesh Delta Fund; and (d) establishment of Local Water Bodies.

**Table 10.7: Water Supply Status in Other Cities under WASAs**

WASAs	Estimated Population in 2010 (million)	Daily Water Production (m <sup>3</sup> )	GW Source (No. of PW)	SW Source (No. of TP)	Pipe line (km)	House Connection (Number)	Supply Hours	Improved Coverage by Piped Water Supply (%)	Basic Coverage by Piped Water Supply and Water Points (%)
Chatto-gram	3.31	200,000	73	1	556	46,299	12	41	46
Khulna	1.26	35,000	56	-	227	15,300	12	45	85
Rajshahi	0.61	75,190	49	1	512	26,000	12	73	84
Sylhet	0.42	16,890	18	1	145	9,892	12	40	69
Barishal	0.30	10,721	18	-	165	9,852	12	40	45

GW- groundwater; PW- production well; TP- treatment plant;

Source: Water and Sewerage Authority (WASA), June 2009: Status Report

## List of Notable Publications by General Economics Division (GED) Bangladesh Planning Commission since 2009

1. Policy Study on Financing Growth and Poverty Reduction: Policy Challenges and Options in Bangladesh (May 2009)
2. Policy Study on Responding to the Millennium Development Challenge Through Private Sectors Involvement in Bangladesh (May 2009)
3. Policy Study on The Probable Impacts of Climate Change on Poverty and Economic Growth and the Options of Coping with Adverse Effect of Climate Change in Bangladesh (May 2009)
4. Steps Towards Change: National Strategy for Accelerated Poverty Reduction II (Revised) FY 2009-11 (December 2009)
5. Millennium Development Goals: Bangladesh Progress Report 2009 (2009)
6. Millennium Development Goals: Needs Assessment and Costing 2009-2015 Bangladesh (July 2009)
7. এমডিজি কর্মপরিকল্পনা (৫১টি উপজেলা) (জানুয়ারি-জুন ২০১০)
8. MDG Action Plan (51 Upazillas) (January 2011)
9. MDG Financing Strategy for Bangladesh (April 2011)
10. SAARC Development Goals: Bangladesh Progress Report 2011 (August 2011)
11. Background Papers of the Sixth Five Year Plan (Volume 1-4) (September 2011)
12. 6th Five Year Plan (FY 2011-FY 2015) (December 2011)
13. Millennium Development Goals: Bangladesh Progress Report-2011 (February 2012)
14. Perspective Plan of Bangladesh 2010-2021: Making Vision 2021 a Reality (April 2012)
15. Public Expenditure for Climate Change: Bangladesh Climate Public Expenditure and Institutional Review (October 2012)
16. Development of Results Framework for Private Sectors Development in Bangladesh (2012)
17. যষ্ঠ পঞ্চবার্ষিক পরিকল্পনা (২০১১-২০১৫) [মূল ইংরেজি থেকে বাংলায় অনূদিত] (অক্টোবর ২০১২)
18. Climate Fiscal Framework (October 2012)
19. Public Expenditure for Climate Change: Bangladesh CPEIR 2012
20. First Implementation Review of the Sixth Five year Plan -2012 (January 2013)
21. বাংলাদেশের প্রথম প্রেক্ষিত পরিকল্পনা (২০১০-২০২১) রূপকল্প ২০২১ বাস্তবে রূপায়ণ (ফেব্রুয়ারি ২০১৩)
22. National Sustainable Development Strategy (2010-2021) (May 2013)
23. জাতীয় টেকসই উন্নয়ন কৌশলপত্র (২০১০-২০২১) [মূল ইংরেজি থেকে বাংলায় অনূদিত] (মে ২০১৩)
24. Millennium Development Goals: Bangladesh Progress Report 2012 (June 2013)
25. Post 2015 Development Agenda: Bangladesh Proposal to UN (June 2013)
26. National Policy Dialogue on Population Dynamics, Demographic Dividend, Ageing Population & Capacity Building of GED [UNFPA Supported GED Project Output 1] (December 2013)
27. Capacity Building Strategy for Climate Mainstreaming: A Strategy for Public Sector Planning Professionals (2013)

28. Revealing Changes: An Impact Assessment of Training on Poverty-Environment Climate-Disaster Nexus (January 2014)
29. Towards Resilient Development: Scope for Mainstreaming Poverty, Environment, Climate Change and Disaster in Development Projects (January 2014)
30. An Indicator Framework for Inclusive and Resilient Development (January 2014)
31. Manual of Instructions for Preparation of Development Project Proposal/Proforma Part-1 & Part 2 (March 2014)
32. SAARC Development Goals: Bangladesh Progress Report-2013 (June 2014)
33. The Mid Term-Implementation Review of the Sixth Five Year Plan 2014 (July 2014)
34. Millennium Development Goals: Bangladesh Progress Report 2013 (August 2014)
35. Population Management Issues: Monograph-2 (March 2015)
36. GED Policy Papers and Manuals (Volume 1-4) (June 2015)
37. National Social Security Strategy (NSSS) of Bangladesh (July 2015)
38. MDGs to Sustainable Development Transforming our World: SDG Agenda for Global Action (2015-2030)- A Brief for Bangladesh Delegation UNGA 70th Session, 2015) (September 2015)
39. 7th Five Year Plan (2015/16-2019/20) (December 2015)
40. সপ্তম পঞ্চবার্ষিক পরিকল্পনা ২০১৫/১৬-২০১৯/২০ [মূল ইংরেজি থেকে বাংলায় অনূদিত] (অক্টোবর ২০১৬)
41. জাতীয় সামাজিক নিরাপত্তা কৌশলপত্র [মূল ইংরেজি থেকে বাংলায় অনূদিত] (অক্টোবর ২০১৬)
42. Population Management Issues: Monograph-3 (March 2016)
43. Bangladesh ICPD 1994-2014 Country Report (March 2016)
44. Policy Coherence: Mainstreaming SDGs into National Plan and Implementation (Prepared for Bangladesh Delegation to 71st UNGA session, 2016) (September 2016)
45. Millennium Development Goals: End- period Stocktaking and Final Evaluation Report (2000-2015) (September 2016)
46. A Handbook on Mapping of Ministries by Targets in the implementation of SDGs aligning with 7th Five Year Plan (2016-20) (September 2016)
47. Data Gap Analysis for Sustainable Development Goals (SDGs): Bangladesh Perspective (January 2017)
48. Environment and Climate Change Policy Gap Analysis in Haor Areas (February 2017)
49. Integration of Sustainable Development Goals into the 7th Five Year Plan (February 2017)
50. Banking ATLAS (February 2017)
51. টেকসই উন্নয়ন অভীষ্ট, লক্ষ্যমাত্রা ও সূচকসমূহ [মূল ইংরেজি থেকে বাংলায় অনূদিত] (এপ্রিল ২০১৭)
52. Exploring the Evidence: Background Research Papers for Preparing the National Social Security Strategy of Bangladesh (June 2017)
53. Bangladesh Voluntary National Review (VNR) 2017: Eradicating poverty and promoting prosperity in a changing world, (June 2017)
54. SDGs Financing Strategy: Bangladesh Perspective (June 2017)
55. A Training Handbook on Implementation of the 7th Five Year Plan (June 2017)



56. 7th Five Year Plan (FY 2015/16-FY 2019/20): Background Papers Volume 01: Macro Economic Management & Poverty Issues (June 2017)
57. 7th Five Year Plan (FY 2015/16-FY 2019/20): Background Papers Volume 02: Socio-Economic Issues (June 2017)
58. 7th Five Year Plan (FY 2015/16-FY 2019/20): Background Papers Volume 03: Infrastructure, Manufacturing & Service Sector (June 2017)
59. 7th Five Year Plan (FY 2015/16-FY 2019/20): Background Papers Volume 04: Agriculture, Water & Climate Change (June 2017)
60. 7th Five Year Plan (FY 2015/16-FY 2019/20): Background Papers Volume 05: Governance, Gender & Urban Development (June 2017)
61. Education Sector Strategy and Actions for Implementation of the 7th Five Year Plan (FY2016-20)
62. GED Policy Study: Effective Use of Human Resources for Inclusive Economic Growth and Income Distribution-An Application of National Transfer Accounts (February 2018)
63. Monitoring and Evaluation Framework of Sustainable Development Goals (SDGs): Bangladesh Perspective (March 2018)
64. National Action Plan of Ministries/Divisions by Targets for the Implementation of Sustainable Development Goals (June 2018)
65. Bangladesh Delta Plan 2100: Baseline Studies; Volume 1: Water Resources Management (June 2018)
66. Bangladesh Delta Plan 2100: Baseline Studies; Volume 2: Disaster and Environmental Management (June 2018)
67. Bangladesh Delta Plan 2100: Baseline Studies; Volume 3: Land use and Infrastructure Development (June 2018)
68. Bangladesh Delta Plan 2100: Baseline Studies; Volume 4: Agriculture, Food Security and Nutrition (June 2018)
69. Bangladesh Delta Plan 2100: Baseline Studies; Volume 5: Socio-economic Aspects of the Bangladesh Delta (June 2018)
70. Bangladesh Delta Plan 2100: Baseline Studies; Volume 6: Governance and Institutional Development (June 2018)
71. Journey with SDGs, Bangladesh is Marching Forward (Prepared for 73<sup>rd</sup> UNGA Session 2018) (September 2018)
72. এসডিজি অভিযাত্রা: এগিয়ে যাচ্ছে বাংলাদেশ (জাতিসংঘ সাধারণ পরিষদের ৭৩তম অধিবেশনের জন্য প্রণীত) (সেপ্টেম্বর ২০১৮)
73. বাংলাদেশ ব-দ্বীপ পরিকল্পনা ২১০০: একুশ শতকের বাংলাদেশ (সংক্ষিপ্ত বাংলা সংস্করণ) (অক্টোবর ২০১৮)
74. Bangladesh Delta Plan-2100; Bangladesh in the 21<sup>st</sup> century (Abridged Version) (October 2018)
75. Bangladesh Delta Plan 2100 (Bangladesh in the 21<sup>st</sup> Century); Volume 1: Strategy (October 2018)



# BANGLADESH DELTA PLAN 2100

(Bangladesh in the 21<sup>st</sup> Century)

October 2018

Volume 2  
Investment Plan



**General Economics Division**  
Bangladesh Planning Commission  
Ministry of Planning  
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