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**Investment Plan for the Bangladesh Delta Plan
2100. Volume 1: The Plan**

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**Investment Plan for the
Bangladesh Delta Plan 2100
Volume 1: The Plan**

**Government of the People's Republic of Bangladesh
Bangladesh Planning Commission
General Economics Division**

**Technical report submitted by the World Bank to the
Government of Bangladesh**

**Final Report
July 2017**

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The Investment Plan for the Bangladesh Delta Plan is developed by the General Economics Division of the Planning Commission with the support of a consortium of consultants from Castalia Ltd., Arcadis, and SMEC, under technical assistance from the World Bank Group.

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Executive Summary

The Bangladesh Delta Plan (BDP) 2100 is a long-term, integrated, and holistic vision of water and land management throughout Bangladesh. It supports the country's long-term development in the face of the opportunities and risks that emerge from the interface between water, climate change, and human activity.¹ Investment planning to implement this long-term vision will be done through shorter-term strategies, prepared in accordance with the principles of adaptive delta management (ADM). This adaptive approach to delta planning selects investment projects that link short to medium-term development targets and investment programs with the long-term goal of sustained development based on climate-sensitive management.

The current Investment Plan is the first such selection of projects to put the Delta Plan into action. It sets out the physical and institutional investments the Government will make to put the Delta Plan into effect. The current Investment Plan consists of a total of 80 projects: 65 are physical projects, and 15 are institutional and knowledge development projects. Its total capital investment cost is BDT2,978 billion (\$38 billion).² All projects can be started within the next eight years, though given the scale and programmatic nature of some investments, construction in some cases will extend over decades.

Development of the Investment Plan followed a rigorous, consultative, and inclusive process, using the principles of ADM. As part of the BDP 2100 formulation process, the General Economics Division (GED) of the Planning Commission asked over 20 agencies involved in work in the Delta to submit their priority investment projects. This generated 133 candidate projects with total capital costs of BDT3,753 billion (\$47 billion).

The candidate projects were screened, grouped, then sequenced following an ADM methodology. Bangladesh is the first country in the world to develop a comprehensive investment plan for an entire delta using ADM. The purpose of ADM is to ensure that the right investments are made at the right time. It aims to avoid both 'too little, too late' and 'too much, too early' by identifying tipping points when a change in approach is needed. Therefore, flexible approaches based around smaller interventions phased over time are often preferred to large one-off projects that cannot be changed once committed to. Projects aim to address climate conditions that can be realistically anticipated. Interactions between projects, land use, and water management are considered. Working in harmony with natural hydrological systems is generally preferred to large-scale attempts to alter such systems. Resources are used efficiently following cost-benefit analysis, and protection from water disasters is prioritized. Broad participation, investment in knowledge, and innovation are key. The ADM approach is detailed in section 2.

Candidate projects were included in the Investment Plan if their expected benefits exceed expected costs; if they contribute to at least one of the six Delta Plan goals; and if they are compatible with the ADM approach. Of the 133 candidate projects, 80 met these criteria.

These 80 projects were then grouped into the seven 'hotspots' defined in the Delta Plan. These hotspots were developed from consideration of the Delta's distinct hydrological regions, and

¹ Bangladesh Planning Commission, Government of the People's Republic of Bangladesh (January 2017), BDP 2100 DRAFT p. xliv.

² This includes the costs of conducting feasibility studies.

the type and magnitude of the natural hazards in each. There are six geographic hotspots: 1) coastal zone, 2) rivers and estuaries region, 3) urban areas, 4) Barind and drought-prone region, 5) Chittagong Hill Tracts, and 6) Haor and wetland region. A seventh cross-cutting hotspot addresses common issues that cut across the six geographical hotspots. Where appropriate, similar projects in hotspots were further grouped together into sub-programs, such as improved urban water supply and sanitation, irrigation in the Barind, and Haor flood management. These sub-programs promote scale, coordination, and learning economies in implementing these projects.

Within each hotspot program, projects were prioritized and sequenced along adaptive pathways. Adaptive pathways help sequence projects by identifying archetypical projects to address a theme. They identify how economic and climate change scenarios affect when a change in approach is needed from one type of project to another. These points in time when a change in approach is needed are called ‘tipping points’.

Eighteen adaptive pathways were developed, covering three themes for each of the six geographic hotspots. These three central themes were: 1) preventing ‘too much water’, 2) ensuring ‘enough’ water, and 3) ensuring ‘adequate quality’ water.

Many interventions are possible to address each theme. These interventions can be placed into three project clusters. Some interventions simply build and expand on what is already being done (*Cluster 0+* projects). Others require a change from the current approach (*Cluster 1* projects). At the extreme, some may require changing the behavior of the water system (*Cluster 2* projects). Each project was sequenced along the relevant adaptive pathway based on the hotspot the project relates to, the theme it addresses, and its cluster.

The total capital expenditure on projects in the Investment Plan is estimated to be BDT2,922 billion (\$37 billion). Adding in the feasibility studies (where currently lacking) and operating and maintenance costs,³ total expenditure on the plan is expected to be BDT4,091 (\$52 billion). Annual expenditure on the plan will average BDT178 billion (\$2 billion) over the first 10 years, peaking at BDT254 billion (\$3 billion) in 2025. The Investment Plan portfolio of projects is presented in Figure 3.2. The investment expenditure profile is detailed in section 4.

This ambitious Investment Plan is feasible within the fiscal parameters set out in the Delta Plan. It will be financed using a mix of public, climate, and private finance (as described in section 4). It is expected that 99% of total expenditures on the plan will be publicly financed. Public capital expenditure is expected to average BDT120 billion (\$1 billion) per year over the first five years of the plan, peaking at BDT242 billion (\$3 billion) in 2025.

Of the total public finance, the Government aims to raise BDT370 billion (\$5 billion), or 12% of total expenditure, from climate finance sources. As the least-developed country with the most people seriously at risk from climate change, Bangladesh needs and deserves a substantial contribution from global climate finance providers. The Investment Plan’s Climate Change Adaptation Program (CCAP) is a holistic program for boosting climate resilience in the Delta. It includes policies and institutions for coordinating climate resilience, as well as 46 infrastructure projects. The programmatic nature of the CCAP will facilitate the process of obtaining climate finance.

³ Operating and maintenance costs for infrastructure projects are considered up to 2040.

The Investment Plan also targets private finance through seven pioneer public-private partnership (PPP) projects. Although Bangladesh has a strong foundation in PPPs, private finance in delta projects like the ones in the Investment Plan has been relatively rare. The seven pioneer projects will help pave the way to scale up private finance in large-scale irrigation, inland water transport, dredging and land reclamation, water supply and sewerage services, and embankments with roads. Annual private inflows peak in 2021 at BDT6 billion (\$72 million, or 0.02% of GDP). This is a modest amount to start with, but will gradually increase after pioneer PPP projects show success, and after a comprehensive policy reform agenda is implemented. This reform agenda includes introducing user charges, developing viability gap funding mechanisms, having credit-worthy offtakers, and building capacity within ministries and other agencies to implement bankable contracts.

To ensure the successful implementation and sustainability of the Investment Plan, policy and institutional reforms are planned so that an increasingly integrated and adaptive approach can be taken to planning and implementing investments in the Delta. These reforms start with how investments will be coordinated, and projects delivered. Bangladesh's successful five-year planning cycle will be retained, but greater flexibility and inter-agency coordination in implementation of the plan will be introduced as ADM is incorporated. ADM approaches will be progressively embedded into the planning paradigms of all agencies. New policies will be implemented to maximize the development impact of projects and to stimulate the flow of ever-larger volumes of private and climate finance. A steering committee and implementing agency will be appointed for each hotspot program and sub-program to provide the institutional framework to coordinate implementation. The policy and institutional reforms to support the Investment Plan are detailed in section 5.

The current Investment Plan is based on the existing situation and challenges in Bangladesh. As the Plan is implemented, circumstances may evolve that require adjustments in the design, selection, prioritization, and phasing of projects. Tracking these evolving circumstances requires careful monitoring and evaluation, not just of the implementation of the Plan, but of environmental, economic, and social developments across the Delta. Section 6 describes the monitoring and evaluation framework for the Investment Plan. Monitoring and evaluation capacity building will be coordinated with knowledge gathering and data management. By using this information base to evaluate and periodically adapt the Investment Plan, the Investment Plan will be a learning-based, living document that remains relevant to evolving conditions.

1 Introduction

The Bangladesh Delta Plan (BDP) 2100 is a long-term, integrated, and holistic vision of water and land management throughout Bangladesh. It aims to support the country's long-term development in the face of the opportunities and risks that emerge from the interface between water, climate change, and human activity.⁴ Bangladesh has made great strides in development under the Sixth Five Year Plan (FY2010–FY2015), and aspires to build on this momentum to reach upper middle-income country status and eliminate extreme poverty. At the same time, Bangladesh is the fifth most vulnerable country in the world to natural hazards such as flooding and cyclones. The frequency and intensity of these natural hazards will increase with climate change.

Unless Bangladesh addresses these vulnerabilities, the adverse effects will slow or even undo the progress it has achieved. Without appropriate interventions, Bangladesh's 160 million people could lose between 1% to 2.5% of GDP per year due to these vulnerabilities.⁵ Therefore, the BDP 2100's long-term holistic vision urgently needs to be implemented, including through investing in the projects set out in this Plan, and adopting the adaptive delta management (ADM) principles, used in the development of this Plan, to adapt the Plan in light of experience and new information.

Investment planning to implement this long-term vision will be done through shorter-term strategies, prepared in accordance with the principles of ADM and updated on a five-year cycle. This adaptive approach to delta planning includes selection of investment projects that provide the link between the short to medium-term development targets and investment programs, with the long-term goals of sustained development based on climate-sensitive management.⁶

The current Investment Plan is the first such selection of projects to put the Delta Plan into action. It sets out the physical and institutional investments the Government will take to put the Delta Plan into effect. Box 1.1 shows the relationship between the Investment Plan and the Delta Plan. The current Investment Plan consists of 65 physical projects and 15 institutional and knowledge development projects. Its total capital investment cost is BDT2,978 billion (\$38 billion). All the projects can start within the next eight years, though, given the scale and programmatic nature of some investments, construction will in some cases extend over decades. These 80 projects—with their costs and implementation timelines—are presented in section 3.

Selection of the projects in the Plan followed a rigorous, consultative, and inclusive process, using the principles of ADM. This makes Bangladesh the first country in the world to develop a comprehensive investment plan for an entire delta using ADM. The process used is described in section 2.

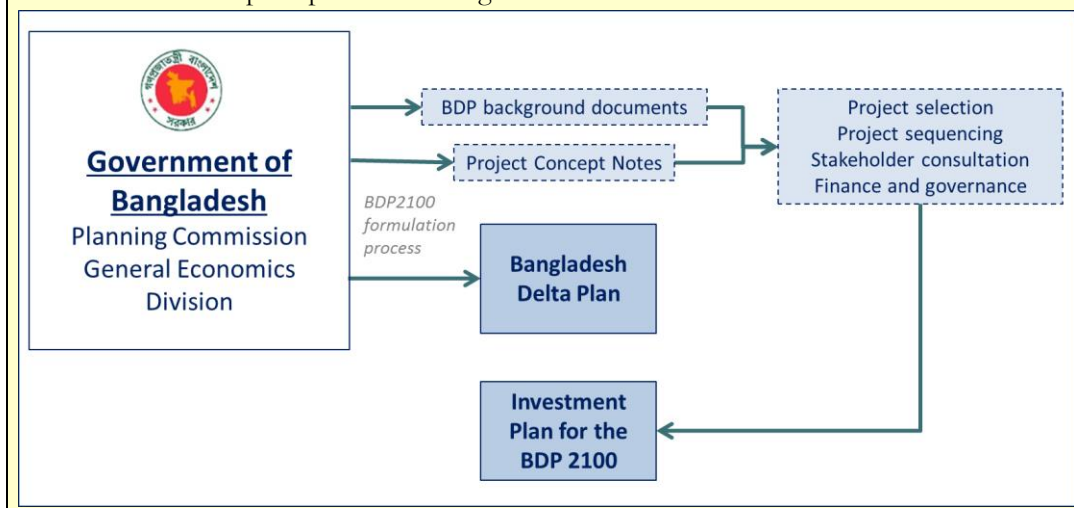
⁴ Bangladesh Planning Commission, Government of the People's Republic of Bangladesh (January 2017), BDP 2100 DRAFT p. xlv.

⁵ BDP 2100 DRAFT p. xxiii.

⁶ BDP 2100 DRAFT p. xlv.

Box 1.1: The Investment Plan as an Annex to the Delta Plan

The background documents and project concept notes developed as part of the BDP 2100 formulation process were the inputs for the Investment Plan. To develop the Investment Plan, projects were selected and sequenced according to an ADM methodology. Stakeholders were consulted throughout the process to incorporate their views. A financing and governance plan was then developed to implement the Investment Plan. As an annex to the Delta Plan, the Investment Plan helps implement its long-term vision.



This ambitious Investment Plan is feasible within the fiscal parameters set out in Chapter 11 of the Delta Plan. Public capital expenditure is expected to average BDT120 billion (\$2 billion) per year over the first five years of the plan, peaking at BDT242 billion (\$3 billion) in 2025.

The Delta Plan notes the need to attract increasing amounts of private capital into investments in the Delta. This Investment Plan targets BDT34 billion (\$427 million) in private finance over the first 10 years of the plan in pioneer projects designed to show the feasibility of private finance, laying the ground for increased private investment. This will also require increasing cost recovery, strengthened institutions, and growing investor confidence.

Public expenditure accounts for 99% of the Investment Plan, while 1% is expected to be privately financed. This private finance is for seven pioneer public-private partnership (PPP) projects. Successful implementation of these pioneer projects will then pave the way to implement similar PPP projects and scale up private finance over time. Given the importance of the plan to making Bangladesh resilient to climate change, climate finance in the order of BDT370 billion (\$5 billion), or 12% of total capital expenditure, is also targeted.

An Investment Plan based on ADM depends on flexibility in the prioritization and sequencing of projects. The current Investment Plan is based on the existing situation and challenges in Bangladesh. As the Plan is implemented, circumstances may evolve that require adjustments in the design, selection, prioritization, and phasing of projects. In this way, the Investment Plan is a learning-based, living document that will be evaluated and adapted periodically to stay relevant to evolving conditions.

To implement this plan in an adaptive way, new policy and institutional approaches will be needed. As section 5 sets out, these changes start with how investments will be coordinated and projects delivered. Bangladesh’s successful five-year planning cycle will be retained, but

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greater flexibility and inter-agency coordination in implementation of the plan will be introduced as ADM is incorporated. ADM approaches will be progressively embedded into the planning paradigms of all agencies, improving future investment plans. New policies will be implemented to maximize the development impact of projects and to stimulate the flow of ever-larger volumes of private and climate finance into Delta investments. The plan will be kept on track by monitoring progress against targets, while future plans will be improved by systematic learning from past experience, as section 6 describes.

2 Development of the Investment Plan Using Adaptive Delta Management

Adaptive delta management (ADM) requires plans that are flexible, adapt in response to emerging information, and pursue no-regrets investments first.⁷ The goal of the Investment Plan is to:

‘Ensure long term water and food security, economic growth and environmental sustainability while effectively coping with natural disasters, climate change and other delta issues through robust, adaptive and integrated strategies, and equitable water governance.’⁸

ADM principles suggest that costly and irreversible projects should not be committed to until it is clear they are needed—the concept of tipping points that trigger such investments is used. Flexible approaches based around smaller interventions phased over time will often be preferable to large one-off projects that cannot be changed once committed to. Projects that would not stand up under climate conditions that can realistically be anticipated should be avoided. Interactions between projects, land use, and water management all need to be considered. Working in harmony with natural hydrological systems will generally be preferable to large-scale attempts to alter such systems. Resources must be used efficiently following cost-benefit analysis, and priority given to providing citizens with security from water disasters. Broad participation, investment in knowledge, and innovation—all need to be brought to bear on delta investment planning. These ADM principles were developed in the Netherlands—like Bangladesh, a country located largely in the delta of major rivers—and adapted by the Government of Bangladesh for development of this Delta Investment Plan.

By incorporating the principles of ADM into the planning process, this Investment Plan considers not only the impact of individual projects, but also the relationships among projects and their combined impact. It groups projects into holistic programs that integrate infrastructure projects with the knowledge gathering, capacity building, and policy reforms initiatives needed to make them successful. In this way, it helps implement the holistic water resources management approach, and facilitates cross-sectoral coordination beyond the water sector. The ADM approach allows the Investment Plan to be adapted to changing circumstances, and as additional information becomes available. In this way, the whole of the Investment Plan provides many more benefits than the sum of the individual projects.

Projects in the plan were proposed by the more than 20 agencies involved in investments in the Delta.⁹ As part of the Delta Plan formulation process, GED asked the ministries that are involved in work in the Delta to submit their priority investment projects. Priority projects and plans were solicited from ministries across a broad range of sectors, which were developed into project concept notes. GED screened these projects and compiled projects for further consideration and incorporation into the Investment Plan. This generated 133 candidate projects with total capital cost of BDT3,753 billion (\$47 billion).

⁷ BDP2100 p. xlvi.

⁸ BDP2100 p. xliv.

⁹ For a complete list of agencies, see Appendix C (pp. 155–157).

These candidate projects were screened, grouped, and then sequenced using ADM principles in a manner designed to achieve the goals of the Delta Plan.

Screening

Projects were only included in the Delta Investment Plan if they are socially beneficial, contribute to the Delta Plan goals, and are compatible with the ADM approach. The Delta Plan identifies six goals:

- Goal 1: Ensure safety from floods and climate change-related disaster
- Goal 2: Enhance water security and efficiency of water usages
- 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 5: Develop effective institutions and equitable governance for in-country and trans-boundary water resources management
- Goal 6: Achieve optimal and integrated use of land and water resources.¹⁰

Projects were first reviewed to ensure that they contribute to one or more of these goals. Then they were assessed to ensure that they are socially beneficial, in the sense that benefits exceed costs. A cost-benefit analysis was done where the information available allowed it.¹¹ Where there was not enough information to conduct a cost-benefit analysis, projects were included if similar projects have proven socially beneficial in the past, with a requirement for a feasibility study and cost-benefit analysis to be carried out before the project is actually implemented. For these project concepts without detailed information available, a multi-criteria analysis was done. The methodology of this analysis is summarized in Box 2.1.

All projects were assessed for their compatibility with ADM principles. These included: whether the infrastructure can be adapted to changing physical conditions foreseen in the short, medium, and long term; whether the project can be easily combined with other relevant measures; whether it is beneficial across all likely future scenarios (“no regrets”); and whether it delivers new technology or knowledge needed to reach Delta goals. Projects were not selected for the Investment Plan unless they met some or all of these criteria.

Projects that are relatively inflexible, or otherwise did not score well on ADM criteria, were included in the plan if they were the only option to meet vital Delta goals. Where appropriate, such projects were sequenced later in the plan, allowing time to assess if the project is truly needed, or if other more flexible projects could be developed that would achieve Delta goals in a more adaptive way.

Eighty out of the 133 candidate projects were screened in for inclusion in the Investment Plan. The other candidate projects, as currently designed, do not meet the screening criteria. Table B.26 in Appendix B (pp. 137–149) lists all the candidate projects and notes whether they are included in the Investment Plan. For projects not in the Investment Plan, the table explains which of the criteria the project still needs to meet.

¹⁰ BDP 2100 DRAFT p. xxiv.

¹¹ BDP2100 Investment Plan Volume 3: Appendix I. This appendix covers only projects with sufficient information available to conduct a costs and benefits analysis.

Grouping

The 80 projects that were screened in were then grouped into the seven ‘hotspots’ defined in the Delta Plan. These hotspots were developed from consideration of the Delta’s distinct hydrological regions and the type and magnitude of the natural hazards in each.¹² The six geographic hotspots are as follows:

- **Coastal Zone**, comprising areas belonging to 18 coastal districts with an area of 33,610 square kilometers
- **Rivers and Estuaries Region**, comprising areas belonging to 28 districts along rivers and estuaries with an area of 35,216 square kilometers
- **Urban Areas**, consisting of 6 districts with an area of 12,644 square kilometers
- **Barind and Drought-Prone Region**, comprising 18 districts with an area of 22,806 square kilometers
- **Chittagong Hill Tracts**, consisting of 3 districts and an area of 13,295 square kilometers¹³
- **Haor and Wetland Region**, comprising 7 districts with an area of 16,532 square kilometers.

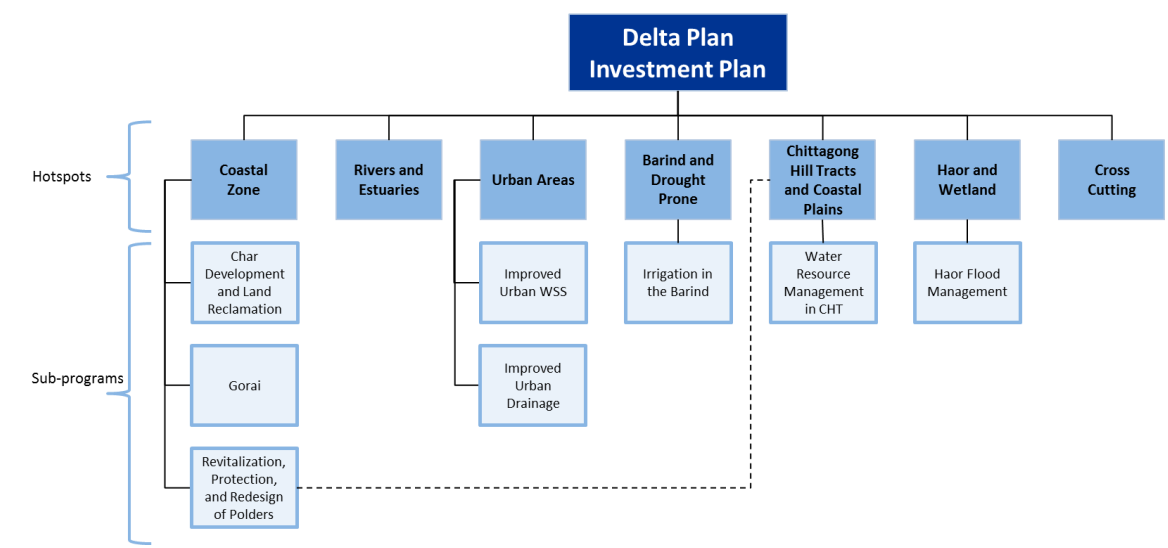
A seventh cross-cutting hotspot addresses common issues that cut across the six geographical hotspots.

Where appropriate, similar projects in a hotspot are grouped together into sub-programs, as illustrated in Figure 2.1. As an example, all the projects related to Char Development and Land Reclamation in the Coastal Zone will form a single sub-program. This sub-program will promote scale and learning economies in implementing these projects. Similarly, projects specific to urban water supply and sanitation can be grouped together in an Urban Water Supply and Sanitation program within the Urban Areas hotspot. This grouping will allow institutional reform measures and technical inputs to be shared across the many similar projects to be implemented in urban water supply. The sub-program for the Gorai aims to facilitate coordination in planning and implementation of projects in that area.

¹² BDP 2100 DRAFT p. 7.

¹³ The Chittagong Hill Tracts hotspot, as defined in the Delta Plan, includes the Coastal Plains.

Figure 2.1: Overview of the Investment Plan Hotspots and Sub-Programs



While most programs fall under a single hotspot, there are special cases that span multiple hotspots. One such is the Revitalization, Protection, and Redesign of Polders Program. Polders are important in many coastal areas, and should be developed through a single program. Because the Chittagong region Coastal Plains are included in the Chittagong Hill Tracts hotspot, the Polders program will operate in both hotspots. The improved Urban WSS and Improved Urban Drainage Programs also include projects from the cross-cutting hotspot. This is sensible, because WSS and drainage issues are important throughout Bangladesh.

The sub-programs are intended to facilitate management of the Investment Plan by allowing better coordination, sharing of lessons learned, and economies of scale. Each program will have a management structure that facilitates inter-agency and inter-sectoral coordination, as explained in section 5.6. The detailed program management structure is presented in Appendix E (pp. 183–189).

Prioritization and sequencing

Within each hotspot program, projects were prioritized and sequenced along adaptive pathways. Adaptive pathways help to sequence projects so that investments are neither ‘too much, too soon’, nor ‘too little, too late’, but instead deliver ‘enough, in time’. Within each hotspot, projects address three central themes:

1. Preventing ‘too much water’—for example, stopping floods and water-logging
2. Ensuring ‘enough’ water—for example, enabling water security for irrigation flows, and adequate in-channel flows for inland water navigation
3. Ensuring ‘adequate quality’ water—for example, preventing pollution of water bodies, and ensuring that municipal water is safe to drink.

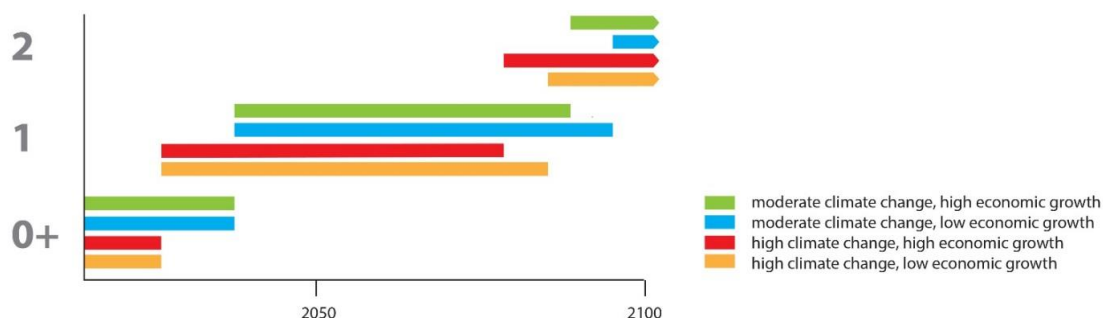
Many interventions are possible to address each theme. Some simply build and expand on what is already being done. Others require a change from the current approach. At the extreme, some may require changing the behavior of the water system. These three types of projects can be placed into clusters:

- **Improvement of current system (*Cluster 0+*)**—These projects are often the low-hanging fruit or no-regrets improvements, making what already exists work better. Examples include rehabilitating existing embankments or drainage systems. Generally, it makes sense to do these projects first, before doing more intrusive or high-risk projects. All projects that involve knowledge or institutional capacity building are *Cluster 0+* projects.
- **Change in current approach (*Cluster 1*)**—These projects change current approaches, but do not change the configuration of the entire water system. They are often high-cost and irreversible. Examples include building new embankments to provide flood protection to new areas, and land reclamation using cross dams.
- **Change the water system’s behavior (*Cluster 2*)**—These projects involve systemic changes that are often high-risk, require high levels of implementation capacity, and have major economic, social, or environmental consequences. Examples include construction of storm surge barriers, or abandoning tracts of cultivated or inhabited land.

To address a theme, such as preventing ‘too much water’, it often makes sense to start with *Cluster 0+* projects that are already proven to work. If these *Cluster 0+* projects will no longer be sufficient given changing circumstances, a tipping point is reached and a change in the current approach is needed. Therefore, *Cluster 1* projects should be implemented. In extreme scenarios when a tipping point is reached such that *Cluster 1* projects are no longer sufficient, *Cluster 2* projects can be implemented. For example, Bangladesh is experienced in implementing char development and settlement projects (CDSP) to protect inhabitants of newly formed chars. Project CZ1.3 is a *Cluster 0+* CDSP project for chars in the Noakhali District. With more extreme weather patterns and more frequent flooding reaching a tipping point, a change in approach may be needed, such as constructing the Urirchar-Noakhali cross dam (CZ1.7), which is a *Cluster 1* project. Over time as another tipping point is reached, more extreme *Cluster 2* projects may be needed, such as constructing mega barrages.

Adaptive pathways help sequence projects in this way by identifying archetypical projects for each theme, and identifying when a tipping point is reached, necessitating a change from *Cluster 0+* to *Cluster 1* to *Cluster 2* projects. For each of the six geographic hotspots, there is an adaptive pathway for each of the three themes. This results in a total of 18 adaptive pathways. Figure 2.2 shows a prototypical adaptive pathway. Appendix B.2 (pp. 85–114) presents the 18 adaptive pathways and describes the archetypical projects in detail.

Figure 2.2: Sample Adaptive Pathway



The adaptive pathway shows how a change in approach is needed from *Cluster 0+* to *Cluster 1* and *Cluster 2* projects over time. When this tipping point occurs depends on a range of possible future developments (scenarios).¹⁴ For example, larger flood defenses may be needed sooner if there is a high rate of climate change versus a moderate rate. High versus low economic growth may affect land use, and thus the type of interventions needed to protect that land.

There are times when projects in multiple clusters are done concurrently, most obviously when projects in a single hotspot are nevertheless in separate hydrological systems. As an example, Dhaka and Chittagong are both in the urban areas hotspot, but it is not necessary to delay the Dhaka Integrated Flood Control Embankment cum Eastern Bypass Road Multipurpose Project (a *Cluster 1* project) for the completion of a *Cluster 0+* project for Improvement of Drainage Congestion and Flood Control for Chittagong City Corporation Area.

Similarly, projects that are in the same hydrological systems, but serving different goals or areas and lacking any technical connection, may proceed at the same time, even if they are in different clusters. As an example, it is not necessarily beneficial for the *Cluster 1* project for Protection of Rivers System around Dhaka City to be delayed until project Drainage Improvement of Dhaka-Narayangonj-Demra Project (Phase 2) is completed.

Using the ADM approach makes the Investment Plan adaptive in two ways. First, the timing of projects adapts. It is not possible to predict the future situation (scenario), so the approach adopted is to remain alert to developments and adapt the plan accordingly when projects are needed. Second, the selection and sequencing of projects adapts as the Plan is implemented. Lessons are learned and knowledge is gathered, which will result in new projects being added, and others being implemented in a different order.

¹⁴ BDP 2100 DRAFT pp. 182–207.

Box 2.1: Project Screening, Grouping, and Sequencing through Multi-Criteria Analysis

Projects assessed for inclusion in the Investment Plan were at various stages of development. Some were detailed project plans with completed feasibility studies, while others were only early project concepts. Because these early project concepts do not have as much information available, they required an additional assessment, prioritization, and sequencing procedure. This was done through participatory Multi-Criteria Analysis (MCA).

In the MCA, various criteria were used to evaluate each project concept. Projects were scored on each criterion, on a scale of 1 to 5. These criteria include: compliance with ADM principles, impact on institutional capacity, impact on sensitive ecosystems, reduction of flood and disaster risks, impact on disaster preparedness, impact on water security, impact on water pollution control, incorporation of integral spatial planning, impact on sediment management, capital costs, O&M costs, economic efficiency, amount of stakeholder support, technical complexity, ability to attract private finance, ability to attract climate finance, and expected number of people affected. Each of these criteria is described in detail in Appendix B.4 (pp. 115–120).

The relative importance of each of these criteria was determined by participants from a broad range of government agencies, academic institutions, research institutions, and the private sector. Stakeholders provided input through in-person interviews, an email questionnaire, and a questionnaire distributed during the draft Investment Plan workshop in Dhaka in April 2017. Based on the relative weights determined by participants, the scores for each individual criterion were averaged together into a total MCA score for each project.

The MCA consisted of three stages:

- **Screening:** Projects that meet Delta Plan goals, have economic benefits that are expected to be higher than economic costs, and comply with the principles of ADM were screened in. Projects that do not meet these criteria yet are not included in the current IP.
- **Categorization:** Projects that were screened in were then categorized as low-to-medium risk infrastructural projects, knowledge/institutional/planning projects, medium-to-high risk infrastructure project projects, or projects with uncertain feasibility. Knowledge/institutional/planning projects and low-to-medium risk infrastructure projects were prioritized. Feasibility studies are recommended for medium-to-high risk infrastructure projects and projects with uncertain feasibility, to confirm whether these projects should be implemented.
- **Grouping and sequencing:** Projects were then grouped and sequenced following the ADM methodology described in this section.

Appendix B.4 (pp. 115–135) provides more detail on the MCA methodology and results.

Sequencing of projects must also consider the total fiscal envelope available for the Investment Plan. In the event that the total costs in a given year are larger than the fiscal envelope for the year, the lowest-ranked projects will be postponed until total costs fit within the fiscal envelope for each year. These are projects that do not contribute to as many Delta goals, are not as ADM compatible, or create less net social benefit, for example.

3 Investment Plan Projects and Sequencing

The first Delta Investment Plan that accompanies Bangladesh’s first Delta Plan is set out in Figure 3.2. It consists of 80 projects. Sixty-five of these projects involve creation of physical infrastructure, while 15 are for building knowledge and capacity needed for progressively improving adaptive delta management (ADM) and investment planning in the future. The projects are grouped by hotspot (each of which is discussed below), joined in sub-programs where appropriate, and phased along adaptive pathways. The phasing is such that 25 projects are expected to commence in 2018. Other projects are programmed to come in later, after additional studies are completed, or after projects earlier on the same adaptive pathway have been implemented.

Of the 80 projects, 73 are expected to commence within the first five-year period of the plan. However, given the scale and programmatic nature of some of the projects, construction will in some cases extend over decades. The last project, the Village Piped Water Supply System Project (Phase I & II), is expected to be completed in 2051.

The key for interpreting the investment plan graphic is given in Figure 3.1. A project detail sheet for each project in the plan is provided in Appendix A (pp. 1–81). Additional details on the project are held by GED and the respective implementing agencies. Box 3.1 notes how some of these additional details are incorporated in the Investment Plan graphic.

Figure 3.1: Interpreting the Investment Plan Graphic

| Hotspot Color Code | | Icon Code | | |
|--------------------------|--|---------------------------------|---|--|
| Coastal Zone | | \$ Capex < \$50 mil | \$\$ \$50 mil < Capex < \$1,300 mil | \$\$\$ Capex > \$1,300 mil |
| Rivers and Estuaries | | | | |
| Urban Areas | | Preventing too much water theme | Supplying sufficient quantity of water theme | Supplying sufficient quantity of water theme |
| Barind and Drought Prone | | 0+ Cluster 0+ | 1 Cluster 1 | 2 Cluster 2 |
| Chittagong Hill Tracts | | | | |
| Haor and Wetlands | | CCAP Program | Potential for Public-Private Partnership | Knowledge/Capacity Building Project |
| Cross Cutting | | | | |
| Project Phasing Code | | | | |
| Feasibility Study | | | | |
| Construction Period | | | | |
| Operating Period | | | | |

Figure 3.2 shows the Investment Plan Portfolio of Projects. The figure’s first two columns provide the project code and its name. The next column presents a short project description followed by the project’s capital investment costs in BDT million and \$ million.^{15, 16} The

¹⁵ Capital costs for all projects are taken from the Project Concept Notes developed through the BDP 2100 formulation process.

¹⁶ Average 2015 BDT to USD exchange rate (<https://www.oanda.com/currency/average>)

projects are grouped by hotspot program. Within each hotspot, projects are ordered by theme and then by cluster, according to the adaptive pathways presented in Appendix B.2 (pp. 85–114). *Cluster 0+* projects that address the theme ‘preventing too much water’ are first, followed by *Cluster 1* and *Cluster 2* projects that address the same theme. Projects that address the theme ‘ensure sufficient quantity of water’ are shown next, in order from *Cluster 0+* to *Cluster 1* and *Cluster 2*. Third, projects that address the theme ‘ensure sufficient quality of water’ are shown, again in order by cluster. Projects that are grouped into sub-programs are connected by arrow brackets, with the name of the sub-program.

Box 3.1: PCN Information Used in Investment Plan Graphic

The project concept notes (PCNs) developed during the BDP 2100 formulation process indicate which projects have up-to-date feasibility studies, or still require them. For projects in the Investment Plan that require a feasibility study, the duration of the study is estimated based on the size and complexity of the project, and includes detailed project design, project preparation, financing approval, and procurement. Most projects are estimated to need two years for these activities. There are 15 mega infrastructure projects (defined as projects with capital costs over BDT40 billion (\$504 million)), which have three years scheduled.

Estimates of the overall project timeline are also based on the PCNs. The PCNs provide the implementation/construction length and operating period of most projects. For the few projects where this information is not available, duration is estimated based on the length of similar projects.

Figure 3.2: Investment Plan Portfolio of Projects

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| Investment Plan Portfolio of Projects | | | Total Capital Costs | |
|---------------------------------------|---|---|---------------------|------------|
| Project Code | Name | Description | BDT (mil) | US\$ (mil) |
| HOTSPOT: Coastal Zone | | | | |
| CZ 1.8/1.21 | West Gopalganj Integrated Water Management Project | Protect the West Gopalganj area against flash floods and increase agricultural production through improved drainage and irrigation capacity, implementing flood control measures, and developing an integrated water management plan in the West Gopalganj area | 2,735 | 34 |
| CZ 1.11 | Improved Drainage in the Bhabadha Area | Reduce drainage congestion and floods through several river management interventions; rehabilitate the Bhabadha regulator to increase drainage capacity; involve the local community in the project; construct an embankment along the river. | 1,557 | 20 |
| CZ 1.26 | Development of Water Management Infrastructure in Bhola Island | Protect the Location 4 area from flooding, storm surges, salinity, erosion and loss of land due to sea level rise; develop an Erosion Early Warning System for the Bhola district. | 14,651 | 185 |
| CZ 1.3 | Char Development and Settlement Project- V | 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. | 1,138 | 14 |
| CZ1.48 | Program for Implementation of Rationalized Water Related Interventions in Gumti - Muhuri Basin | Rationalize water resources management by improving infrastructure through modernization of existing water infrastructures with institutionalized participatory schemes cycle management process and ADM principles. | 13,988 | 176 |
| CZ1.41 | Program for Implementation of Rationalized Water Related Interventions in Gorai-Passur Basin | Manage the water resources in an integrated, holistic way; rationalize water resources management by modernizing existing water infrastructures with institutionalized participatory schemes cycle management process and ADM principles. | 14,570 | 184 |
| CZ1.44 | Rationalization of Polders in Baleswar - Tentulia Basin | Reducing loss of assets, crops and livestock from cyclone and storm surges; reducing salt water intrusion in the polders; ensuring fresh water flow in the rivers and canals; reducing agricultural production loss by protecting the lands from erosion. | 158,502 | 1,997 |
| CZ1.40 | Rationalization of Polders in Gorai-Passur Basin | Reduce the loss of assets, crops and livestock; reduce vulnerability loss; reduce salt water intrusion; increase agricultural production; improve drainage congestion situation; improve institutional setting. | 106,604 | 1,343 |
| CZ1.45 | Program for Implementation of Rationalized Water Related Interventions in Baleswar-Tentulia Basin | Manage the water resources in an integrated, holistic way; rationalize water resources management by modernizing existing water infrastructures with institutionalized participatory schemes cycle management process and ADM principles. | 8,800 | 111 |
| CZ1.47 | Rationalization of Polders in Gumti - Muhuri Basin | Reduce the loss of assets, crops and livestock; reducing salt water intrusion into the polders; reduce salt water intrusion; increase agricultural production. | 64,328 | 811 |
| CZ1.30 | Rehabilitation of Water Management Infrastructure in Bhola District | Protect the citizens of Bhola against flooding, salinity and loss of land due to sea level rising; increase river flows and erosion; increase strength of seasonal typhoons. | 23,419 | 295 |
| CZ12.6 | Integrated Coastal Zone Land use Planning in Bangladesh using GIS and RS Technology | Guide the development of different land use in the Coastal Zone in line with the BDP2100, SDG and ICZMP; ensure planned development with special focus on the urban area; promote 'Action area' focused development for specific areas such as ecologically sensitive areas, islands, ports, etc. | 899 | 11 |
| CZ1.39 | Morphological Dynamics of Meghna Estuary for Sustainable Char Development | Better understand the overall hydraulic and morpho dynamic processes in the estuary; increased sustainability of char development; define remedial measures for the erosion at Char Nangulia and Caring Char | 72 | 1 |
| CZ1.52 | Land beyond Land, Efforts to Reclaim lands at near Coast; Preparatory Surveys and Studies | Reclamation of lands at near coast to support activities for economic use and growth; generate new surveys, studies, modelling required to develop detailed engineering design of land reclamation considering risk from rising sea level and possible earthquake. | 927 | 12 |
| CZ1.53 | Structural interventions for managing sea level rise: preparatory surveys & studies | Enhance Bangladesh security against sea level rise by building elevated (multi-purpose) sea dykes and river barriers. | 1,024 | 13 |
| CZ4.1 | Development of Climate Smart Integrated Coastal Resources Database (CSICRD) | Provide up to date information of the coastal zone; provide information related to climate change impacts and vulnerability; aid the decision makers in project planning, implementation and management. | 122 | 2 |
| CZ 1.4 | Study on Integrated Management of Drainage Congestion for Greater Noakhali | Collect information on drainage congestion in the Greater Noakhali area; determine optimal solutions for problems identified; build structural interventions; identify silted up canals and canals that need dredging to enhance navigability. | 16 | 0.20 |
| CZ 1.5 | Study on Tidal River Management | Determine environmental and social impacts of the Tidal River Management (TRD) programme; devise the TRM programme; determine institutional capacity gaps; and recommend actions to bridge gaps. | 1,250 | 16 |
| CZ1.7 | Urirchar-Noakhali Cross Dam Project | Reclaim land through the construction of a cross dam between Urir Char and Char Maksumul Hakim; provide a road connection between Urir char and the Noakhali mainland. | 4,353 | 55 |
| CZ 1.6 | Integrated Land Reclamation Project of Hatiya-Dhamar Char-Nijhum Dwip | Reclaim land through construction of a 1,250-meter cross-dam between Hatiya and Nijhum Dwip; resettle people rendered landless by river-erosion. | 550 | 7 |
| CZ12.8 | Southern Agricultural Improvement Project (SAIP) | Increase agricultural productivity through better management and utilization of land and water resources, and promotion of climate smart technology in the southern region of Bangladesh. | 39,184 | 494 |
| CZ17.1 | Exploration of the Production Potential of Coastal Saline Soils of Bangladesh | Research characterization, identification, and severity of saline soil and water in Bangladesh; Screening of salt tolerant rice and non-rice crop cultivars in salt-affected area; Identifying suitable salt tolerant limit of rice and wheat crop cultivars. | 98 | 1 |
| CZ 1.1 | Construction of Ganges Barrage and Ancillary Works | Increase the irrigation facilities, restore the ecological balance, and increase the livelihood opportunities of the Ganges DEPENDENT Area (GDA); manage use of water to be available under the Ganges water sharing Treaty of 1996. | 408,713 | 5,150 |
| HOTSPOT: Rivers and Estuaries | | | | |
| MR 1.2 | Pre-Feasibility Study on Integrated River System Management and Protection of Accreted Land | Build knowledge on hydrological and socio-economic processes, and on the Integrated River Management (IRM) of the river systems of Bangladesh; gather insight on policy options, institutional arrangements, and institutional funding potential. | 3,854 | 49 |
| MR 1.5 | Study for harnessing the waters of the Brahmaputra River | Provide insights on the hydro-morphological dynamics of the Brahmaputra River; provide insights for relevant policy instruments. | 435 | 5 |
| MR 1.1 | River Bank Improvement Program | Improve the socio-economic development in greater Dhaka; provide safety against floods for vital infrastructure of Dhaka and adjacent areas by strengthening and creating a reliable flood embankment with roadway. | 140,694 | 1,773 |
| MR 1.46 | Integrated Jamuna-Padma Rivers Stabilization and Land Reclamation Project | Stabilize the Jamuna-Padma river corridor; reclaim land; reduce flood risk; restore distributaries; restore navigation; increase land-based productivity; protect the environment. | 289,800 | 3,651 |
| MR 3.1 | Sustainable Restoration of Connectivity of Major Navigation Routes | Improve the navigability of 24 river routes by dredging; open up around 2500km of waterways for smooth and year-round plying of waterways; increase the water flow of the respective rivers. | 22,948 | 289 |
| MR 1.6 | Development of Chandona-Barasia River Basin System | Increase sweet water flow by dredging/excavation of the off-take canals; provide irrigation facilities to a gross area of 29,155ha, net 22,050ha for increasing agricultural production; have a sweet water reservoir into the Chandana-Barasia River for domestic purposes. | 461 | 6 |
| MR12.1 | Enhancement of Agricultural Productivity towards Food Security in Char Lands | Ensure food security, improve nutritional status and reduce the poverty of marginal and small farmers and their families living in the Char lands through boosting agricultural production and improving income generating | 15,039 | 189 |

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| Investment Plan Portfolio of Projects | | | | | | | | | | | | | | | | | | | | | | | | |
|---------------------------------------|------|------|--------|--------|------|------|--------|------|------|------|------|------|------|------|------|------|------|------|-------|-------|------|------|------|---|
| Project Code | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 | 2037 | 2038 | 2039 | 2040 | |
| HOTSPOT: Coastal Zone | | | | | | | | | | | | | | | | | | | | | | | | |
| CZ 1.8/CZ1.21 | \$ | | | | | | | | | | | | | | | | | | CC AP | 0+ | 🔹 | | | |
| CZ 1.11 | \$ | | | | | | | | | | | | | | | | | | CC AP | 0+ | 🔹 | | | |
| CZ 1.26 | \$\$ | | | | | | | | | | | | | | | | | | CC AP | 0+ | 🔹 | | | |
| CZ 1.3 | \$ | | | | | | | | | | | | | | | | | | CC AP | 0+ | 🔹 | | | |
| CZ1.48 | | | \$\$ | | | | | | | | | | | | | | | | CC AP | 0+ | 🔹 | | | |
| CZ1.41 | | | \$\$ | | | | | | | | | | | | | | | | CC AP | 0+ | 🔹 | | | |
| CZ1.44 | | | \$\$\$ | | | | | | | | | | | | | | | | CC AP | 0+ | 🔹 | | | |
| CZ1.40 | | | \$\$\$ | | | | | | | | | | | | | | | | CC AP | 0+ | 🔹 | | | |
| CZ1.45 | | | \$\$ | | | | | | | | | | | | | | | | CC AP | 0+ | 🔹 | | | |
| CZ1.47 | | | \$\$ | | | | | | | | | | | | | | | | CC AP | 0+ | 🔹 | | | |
| CZ1.30 | | | \$\$ | | | | | | | | | | | | | | | | CC AP | 0+ | 🔹 | | | |
| CZ12.6 | \$ | | | | | | | | | | | | | | | | | | 📖 | 0+ | 🔹 | 🔹 | 🔹 | |
| CZ1.39 | \$ | | | | | | | | | | | | | | | | | | 📖 | 0+ | 🔹 | | | |
| CZ1.52 | \$ | | | | | | | | | | | | | | | | | | 📖 | 0+ | 🔹 | | | |
| CZ1.53 | \$ | | | | | | | | | | | | | | | | | | 📖 | 0+ | 🔹 | | | |
| CZ4.1 | \$ | | | | | | | | | | | | | | | | | | 📖 | CC AP | 0+ | 🔹 | 🔹 | 🔹 |
| CZ 1.4 | \$ | | | | | | | | | | | | | | | | | | 📖 | CC AP | 0+ | 🔹 | | |
| CZ 1.5 | \$ | | | | | | | | | | | | | | | | | | 📖 | CC AP | 0+ | 🔹 | | |
| CZ 1.7 | | | | | | \$\$ | | | | | | | | | | | | | CC AP | 1 | 🔹 | | | |
| CZ 1.6 | | | | | | \$ | | | | | | | | | | | | | CC AP | 1 | 🔹 | | | |
| CZ12.8 | | | \$\$ | | | | | | | | | | | | | | | | | | 0+ | 🔹 | 🔹 | |
| CZ17.1 | \$ | | | | | | | | | | | | | | | | | | 📖 | 0+ | 🔹 | | | |
| CZ 1.1 | | | | | | | \$\$\$ | | | | | | | | | | | | CC AP | 2 | 🔹 | | | |
| HOTSPOT: Rivers and Estuaries | | | | | | | | | | | | | | | | | | | | | | | | |
| MR 1.2 | \$ | | | | | | | | | | | | | | | | | | 📖 | CC AP | 0+ | 🔹 | | |
| MR 1.5 | \$ | | | | | | | | | | | | | | | | | | 📖 | CC AP | 0+ | 🔹 | | |
| MR 1.1 | | | \$\$\$ | | | | | | | | | | | | | | | | CC AP | 0+ | 🔹 | | | |
| MR 1.46 | | | | \$\$\$ | | | | | | | | | | | | | | | CC AP | 1 | 🔹 | | | |
| MR 3.1 | | | \$\$ | | | | | | | | | | | | | | | | CC AP | 0+ | 🔹 | | | |
| MR 1.6 | | | \$ | | | | | | | | | | | | | | | | CC AP | 0+ | 🔹 | | | |
| MR12.1 | | | \$\$ | | | | | | | | | | | | | | | | CC AP | 0+ | 🔹 | | | |

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| Investment Plan Portfolio of Projects | | | Total Capital Costs | |
|--|--|--|---------------------|-------|
| Project Code | Name | Description | US\$ (mil) | |
| | | | BDT (mil) | (mil) |
| HOTSPOT: Urban Areas | | | | |
| UA 1.3 | Drainage Improvement of Dhaka-Narayanganj-Demra Project (Phase 2) | Improve the drainage management of the DND project area; provide flood mitigation through flood wall heightening; restore normal livelihood of dwellers of the DND area through socio-economic enhancement and environmental endorsement. | 5,711 | 72 |
| UA 10.1 | Improvement of Drainage Congestion and Flood Control for Chittagong City Corporation Area | Heightened roads as critical infrastructure enabling evacuation in case of emergencies; drainage system improvements for the many locations in the city and slums. | 30,805 | 388 |
| UA 11.1 | Improvement of Drainage Congestion, Canal Dredging and Flood Control for Barisal CC area | Improvement of drains, raising/heightening of key roads, canal re-excavation, improvement in solid waste collection, resilient housing, sound water supply measures were considered appropriate measures in the Vulnerability Analysis. | 4,522 | 57 |
| UA 3.1 | Improvement of drainage network, flood control and solid waste management for Khulna City | Improve the drainage congestion in Khulna city protection of the natural canal, construction of new drain and restoration of existing drains need to be done. | 73,226 | 923 |
| UA 9.3 | Project for improvement of storm water drainage facilities in the city corporation area | Rehabilitate or re-excavate to increase the carrying capacity of the existing khals/drains; ensure easy and quick disposal of storm and domestic waste water to permanent disposal channel so as to keep the city infrastructure undisturbed and health problems. | 11,545 | 145 |
| UA 1.2 | Dhaka Integrated Flood Control Embankment cum Eastern Bypass Road Multipurpose Project | Provide flood protection for the eastern part of 124km2 of Dhaka City; mitigate damage and loss of life and wealth due to flooding by the Balu River and from internal flood water. | 58,060 | 732 |
| UA 9.1 (20.1) | Greater Dhaka Integrated Water and Sewage Improvement Project | Improve safe water coverage; improve quality of drinking water; capacity building of city corporation staff engaged in water supply and sanitation activities to manage and protect the water supply system. | 378,000 | 4,763 |
| UA 9.1 | Water Supply project for the city corporation areas in Bangladesh (Phase I & II) | Facilitate the cities with safe drinking water through pipe line, to improve health and living standard of the people; reduce discharge of water borne diseases through production and supply of safe drinking water; develop sustainable O & M system for water supply service staff of city corporations; improve environmental condition. | 31,255 | 394 |
| UA 23.2 | Financial performance improvement of a Water Utility in a medium size city | Improve the funding sources for water utilities in Bangladesh and reduce the dependency on Development Partner funding in this sector; improve the financial sustainability and service level of a selected utility in Bangladesh as a showcase for other utilities. | 383 | 5 |
| UA 23.1 | Khulna Water Supply Project Phase II | Improve the existing water supply system through surface water supply to ensure safe, potable and adequate water supply for Khulna City area; provide adequate water service for the growing population including low income people; ensure uninterrupted water supply in the city area. | 26,662 | 336 |
| UA 9.2 | Improvement of sanitation system in city corporation areas of Bangladesh | Improve the sanitation system community and public latrine is required in the city corporation areas; sewerage treatment plant and sufficient sewer line is needed to carry and treatment of household sewerage. | 23,400 | 295 |
| UA 1.1 | Protection of Rivers System around Dhaka City with Their Ecological Restoration | Ensure zero discharge of effluent into the rivers, canals, water bodies and paddy fields; clean hazardous and toxic deposits from bed of the rivers; environmental disposal of dredged materials; promote green growth; improve water quality of rivers; stop disposal of solid and liquid wastes into rivers; create a watchdog against polluters; determine bio-indicators | 14,788 | 186 |
| HOTSPOT: Barind and Drought Prone | | | | |
| DP1.21 | Rationalized Water Related Interventions in Hurasagar basin | Rationalize water resources management by improving infrastructure through modernization of existing water infrastructures with institutionalized participatory schemes cycle management process and ADM principles. | 15,934 | 201 |
| DP 1.3 | Revitalization and Restoration of Hurasagar and Atrai rivers | Mitigate erosion and increase flood safety; facilitate agriculture and fisheries; ecological restoration. | 89,522 | 1,128 |
| DP 1.1 | North Rajshahi Irrigation Project | Provide irrigation to a net area of about 74,800ha in North Rajshahi; increase crop yield by reducing crop damage; switch from local to High Yield Variety rice; construct a pump house, pumping stations, and a network of irrigation canals. | 19,910 | 251 |
| DP 1.2 | Revitalization and Restoration of Beel Halmi | Allow controlled water flow in the polders during the wet season to support agriculture, fisheries, etc.; use surface and groundwater jointly during the dry season for agricultural activities. | 4,762 | 60 |
| DP 1.4/1.5 | Kurigram Irrigation Project | Flood protection along the rivers; increased employment of women; construction of an irrigation scheme to supply water to the area. | 26,992 | 340 |
| DP25.1 | WMOs and Participatory Management Model, North Rajshahi Irrigation with Ganges Barrage | Establishment of the Water Management Organizations following participatory water management; development of an agreed cost recovery mechanism for O&M; facilitate in the O&M of the scheme and ensure sustainability. | 101 | 1 |
| DP25.2 | Development WMOs for Cost Recovery for O&M for the Mahananda Irrigation Scheme | Establishment of the Water Management Organizations following participatory water management; development of an agreed cost recovery mechanism for O&M; facilitate in the O&M of the scheme and ensure sustainability. | 61 | 1 |
| DP25.3 | WMOs and Participatory Management Model, for O&M for the Kurigram Irrigation Schemes (I & II) | Establishment of the Water Management Organizations following participatory water management; development of an agreed cost recovery mechanism for O&M; facilitate in the O&M of the scheme and ensure sustainability. | 102 | 1 |
| DP 15.3 | Barind Area Fisheries Development Project | Enhance aquaculture and capture fisheries in the Barind area; protect fish bio-diversity; improve fish habitat; improve the socio-economic conditions of the vulnerable fishers' communities and fish farmers; adopt climate smart technologies to address climate change related issues | 3,580 | 45 |
| HOTSPOT: Chittagong Hill Tracts | | | | |
| CH1.11 | Program for Implementation of Rationalized Water Related Interventions in Chittagong Coastal Plain Basin | Rationalize water resources management by improving infrastructure through modernization of existing water infrastructures with institutionalized participatory schemes cycle management process and ADM principles. | 811 | 10 |
| CH1.10 | Rationalization of Polders in Chittagong Coastal Plain | Design and implement multifunctional small scale reservoirs, along with fitting operation, maintenance and management arrangements. | 42,376 | 534 |
| CH26.2 | Development Catchment and Sub-catchment Management Plans | Development of catchment and sub-catchment management plans; evaluate the role and location of multifunctional small scale reservoirs, and hills-plain interaction as well as the need for regional cooperation. | 16 | 0.21 |
| CH 9.2 | Water Supply and Environmental Sanitation in Pourashavas Under CHTs | Ensure safe drinking water through expansion, rehabilitation and installation of a piped water system; ensure a proper sanitation system for sustainable environment; ensure proper drainage facilities and improve the solid waste management system; improve hygienic behavior through awareness campaigns | 5,433 | 68 |
| CH12.4 | Enhancement of Livelihood in the Chittagong Hill Tracts Through Good Agricultural Practice | Establishment of new Horticulture Centers/Improvement of existing Horticulture Centers/ nurseries for Quality Planting Material (QPM); Yield/Productivity increase at farmers level by 8-20%; Increase of farm income by 8-10%. | 9,519 | 120 |
| CH26.1 | Kaptai Lake rehabilitation Study and Pilot Project | Develop the Kaptai Lake rehabilitation plan; optimize lake level management and water allocation for hydropower, downstream water management (including increased dry season flow against salt intrusion). | 10 | 0.13 |
| CH1.1 | Prospects for Promoting Soil Conservation and Watershed Protection in Chittagong Hill Tracts | Identify watershed areas for reservation for agriculture and fisheries in CHT; develop an integrated soil conservation and watershed management system for the CHT. | 8 | 0.09 |
| CH26.5 | Flow control and water storage structures for water availability in the dry season | Design and implement multifunctional small scale reservoirs, along with fitting operation, maintenance and management arrangements. | 625 | 8 |

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| Investment Plan Portfolio of Projects | | | | | | | | | | | | | | | | | | | | | | | |
|--|------|------|------|--------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|-------|------|------|------|------|
| Project Code | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 | 2037 | 2038 | 2039 | 2040 |
| HOTSPOT: Urban Areas | | | | | | | | | | | | | | | | | | | | | | | |
| UA 1.3 | | | \$\$ | | | | | | | | | | | | | | | | CC AP | 0+ | 1 | | |
| UA 10.1 | | | \$\$ | | | | | | | | | | | | | | | | CC AP | 0+ | 1 | | |
| UA 11.1 | | | \$\$ | | | | | | | | | | | | | | | | CC AP | 0+ | 1 | | |
| UA 3.1 | | | | \$\$ | | | | | | | | | | | | | | | CC AP | 0+ | 1 | | |
| UA 9.3 | | | \$\$ | | | | | | | | | | | | | | | | CC AP | 0+ | 1 | | |
| UA 1.2 | | | | \$\$ | | | | | | | | | | | | | | | CC AP | 1 | | | |
| UA 9.1 (20.1) | | | | \$\$\$ | | | | | | | | | | | | | | | CC AP | 0+ | | 2 | |
| UA 9.1 | | | \$\$ | | | | | | | | | | | | | | | | CC AP | 0+ | | 1 | |
| UA 23.2 | | | \$ | | | | | | | | | | | | | | | | CC AP | 0+ | | 1 | |
| UA 23.1 | | | \$\$ | | | | | | | | | | | | | | | | CC AP | 1 | | | 1 |
| UA 9.2 | | | \$\$ | | | | | | | | | | | | | | | | CC AP | 0+ | | | 1 |
| UA 1.1 | | | \$\$ | | | | | | | | | | | | | | | | CC AP | 1 | | | 1 |
| HOTSPOT: Barind and Drought Prone | | | | | | | | | | | | | | | | | | | | | | | |
| DP1.21 | | | \$\$ | | | | | | | | | | | | | | | | CC AP | 0+ | | 2 | |
| DP 1.3 | | | | \$\$ | | | | | | | | | | | | | | | CC AP | 1 | | | 2 |
| DP 1.1 | \$\$ | | | | | | | | | | | | | | | | | | CC AP | 0+ | | 1 | |
| DP 1.2 | \$\$ | | | | | | | | | | | | | | | | | | CC AP | 0+ | | 1 | |
| DP 1.4/1.5 | \$\$ | | | | | | | | | | | | | | | | | | CC AP | 0+ | | 1 | |
| DP25.1 | \$ | | | | | | | | | | | | | | | | | | CC AP | 0+ | | 1 | |
| DP25.2 | \$ | | | | | | | | | | | | | | | | | | CC AP | 0+ | | 1 | |
| DP25.3 | \$ | | | | | | | | | | | | | | | | | | CC AP | 0+ | | 1 | |
| DP 15.3 | | | \$ | | | | | | | | | | | | | | | | CC AP | 0+ | | | 1 |
| HOTSPOT: Chittagong Hill Tracts | | | | | | | | | | | | | | | | | | | | | | | |
| CH1.11 | | | \$ | | | | | | | | | | | | | | | | CC AP | 0+ | | 2 | |
| CH1.10 | | | | \$\$ | | | | | | | | | | | | | | | CC AP | 0+ | | 1 | |
| CH26.2 | \$ | | | | | | | | | | | | | | | | | | CC AP | 0+ | | 3 | |
| CH 9.2 | \$\$ | | | | | | | | | | | | | | | | | | CC AP | 0+ | | 2 | |
| CH12.4 | | | \$\$ | | | | | | | | | | | | | | | | CC AP | 0+ | | 1 | |
| CH26.1 | \$ | | | | | | | | | | | | | | | | | | CC AP | 0+ | | 2 | |
| CH1.1 | | | | | \$ | | | | | | | | | | | | | | CC AP | 0+ | | 2 | |
| CH26.5 | | | | | | | \$ | | | | | | | | | | | | CC AP | 1 | | | 1 |

Final Report

| Investment Plan Portfolio of Projects | | | Total Capital Costs | |
|---------------------------------------|--|--|---------------------|------------|
| Project Code | Name | Description | BDT (mil) | US\$ (mil) |
| HOTSPOT: Haor and Wetland | | | | |
| HR 2.1/2.2 | Village Protection against Wave Action in Haor Area and Improved Water Management in Haor Basins | Protect immovable property; protect the social facilities; ensure sustainable livelihood; develop green belt. | 7,286 | 92 |
| HR 1.1 | Program for Implementation of Rationalized Water Related Interventions in Upper Meghna Basin | Rationalize water resources management by improving infrastructure through modernization of existing water infrastructures with institutionalized participatory schemes cycle management process and ADM principles. | 5,780 | 73 |
| HR 2.4 | Elevated Village Platforms for the Haor Areas | Protect the villages in haors from erosion due to wave action during wet season; protect social facilities including schools, markets etc. against wave action; protect the immovable property of the villagers living in the haor and ensure sustainable livelihood of haor. | 3,942 | 50 |
| HR 14.1 | Ecosystem habitat preservation program for plants, wildlife, fisheries, and migratory birds | Conduct a baseline study to assess the biodiversity of these haor; preserve biodiversity providing a suitable environment for plants, forest size, and animal species; monitor plants, the animal population, and their habitat through regular research programs. | 386 | 5 |
| HR 15.4/5 | Sustainable Haor Wetland/Rivers and Fish Habitat Management | Protect and restore haor and river ecosystems, fish breeding grounds and habitats; develop a local database on the ecosystem of different critical fishes; develop institutional capacity in planning, design, implementation, O&M, and monitoring. | 9,700 | 122 |
| HR 14.3 | Management of Commercially Important Wetland Ecosystem | Initiation and promotion for management of commercially important wetlands biodiversity; control and monitoring of sustainable harvesting of commercially important natural resources; sustainable management of wetland biodiversity through local users. | 417 | 5 |
| HOTSPOT: Cross Cutting | | | | |
| CC18.5 | Improvement of Urban Drainage in District and Upazila level municipalities of Bangladesh | Improve urban drainage and water harvesting systems and urban ecological zones in nearly 200 urban centers. | 157,650 | 1,986 |
| CC12.37 | Integrated Agricultural Development in moderately Cyclone affected area | Promote production and marketing technologies in crop sector, finance a comprehensive package beyond the supply of improved seeds and fertilizers; provide technical assistance and training to increase long term productivity of popular and new crops/varieties. | 16,398 | 207 |
| CC1.4 | Development/Improvement of Multi-purpose Disaster Shelters and its Management Information System (MDS&MIS) | Ensure that safety of people from these hazards; ensure the proper management of these shelters; provide up to date information to the project authorities and implementing agencies for the smooth operation and maintenance of these shelters. | 307,624 | 3,876 |
| CC1.3 | Dynamic Climate Smart Knowledge Portal and Hydro-geological Database for MoWR and BWDB | Ensure efficient management of projects of BWDB; provide knowledge support to the MOWR; share the information with the stakeholders. | 191 | 2 |
| CC1.41 | Program for Implementation of Rationalized Water Related Interventions in Dhaleswari Basin | Reduce vulnerability and enhance livelihood opportunities; improve navigation facilities; reduce bank erosion, improve the drainage system; respond to emergency situations; build flood-proof houses in the Charlands and Low lying areas; maintain an environmental water flow; conserve the fish habitat for sustainable reproduction. | 1,838 | 23 |
| CC1.43 | Revitalization of Khals all Over the Country | Increase the conveyance capacity of the Khals; improve the navigation facility; reduce siltation; improve the drainage system; produce an environmentally safe water flow; conserve a sustainable fish habitat. | 4,577 | 58 |
| CC9.18 | Project for improvement of storm water drainage facilities in pourashava (Phase I) | Improve the environment of the city; ensure easy and quick disposal of storm and domestic waste water to permanent disposal channel so as to keep the city infrastructure; reduce of different diseases and health problem occur due to stagnant water. | 23,485 | 296 |
| CC9.10 | Piped Water Supply project in 100 Pourashavas | Facilitate the cities with safe water supply through pipe line; improve health and living standard of the people; reduce water borne diseases among people through supply of safe water. | 25,031 | 315 |
| CC9.11 | Water Supply project in the Urban areas of Bangladesh (secondary towns) | Facilitate the cities with safe water supply through pipe line, to improve health and living standard of the people; reduce water borne disease among people through supply of safe water; develop suitable O & M systems in the Pourashav. | 46,688 | 588 |
| CC9.17 | Project for improvement of water supply and sanitation facilities in char area | Improve the health and living standard of the char area population of Bangladesh by providing access to safe water supply and sanitation system. | 9,720 | 122 |
| CC9.13 | Village Piped water supply system project (Phase I & II) | Ensure safe water supply through piped network at arsenic iron and salinity prone villages involving union parisad; build capacity of union parisad in operation and maintenance of the piped water supply system. | 53,376 | 673 |
| CC1.45 | Expansion and Modernization of Network & Tools for Groundwater Monitoring Including National Coordination Mechanism | Expand the monitoring network to assess and monitor the groundwater quantity and quality; modernize and strengthen data collection, storage and analytical methods and instruments; institutional capacity building; support water budget and water allocation plans for the sustainable development, management and governance of water resources | 4,033 | 51 |
| CC1.46 | Managed Aquifer Recharge for Artificial Storage (MARAS) of Water to Improve Groundwater Table and Quality Conditions in Vulnerable Areas | Install and monitor sustainable and appropriate recharge technologies to reduce the groundwater declining trend, and to reduce the groundwater salinity in the coastal belt for small scale water supply. | 1,334 | 17 |
| CC9.12 | Improvement of sanitation system in urban areas of Bangladesh | Establishment of sustainable excreta disposal system; improve community health and environment of the city; reduction of water borne and excreta related diseases among citizens. | 22,173 | 279 |
| CC 16.19 | Climate Resilient Livestock Production | Generate knowledge and good practices for sustainable livestock and clean air production; diversify and upgrade new energy and biological products; strengthen regional and global partnership; establish a Livestock Production and Environment Research Centre/Climate Resilient Livestock Production Research Centre. | 1,190 | 15 |

Final Report

| Investment Plan Portfolio of Projects | | | | | | | | | | | | | | | | | | | | | | | |
|---------------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Project Code | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 | 2037 | 2038 | 2039 | 2040 |
| HOTSPOT: Haor and Wetland | | | | | | | | | | | | | | | | | | | | | | | |
| HR 2.1/2.2 | | | \$ | \$ | | | | | | | | | | | | | | | | | | | |
| HR 1.1 | | | \$ | \$ | | | | | | | | | | | | | | | | | | | |
| HR 2.4 | | | \$ | | | | | | | | | | | | | | | | | | | | |
| HR 14.1 | | | \$ | | | | | | | | | | | | | | | | | | | | |
| HR 15.4/5 | | | \$ | \$ | | | | | | | | | | | | | | | | | | | |
| HR 14.3 | | | | | | | \$ | | | | | | | | | | | | | | | | |
| HOTSPOT: Cross Cutting | | | | | | | | | | | | | | | | | | | | | | | |
| CC18.5 | | | \$ | \$ | \$ | | | | | | | | | | | | | | | | | | |
| CC12.37 | | | \$ | \$ | | | | | | | | | | | | | | | | | | | |
| CC1.4 | | | \$ | \$ | \$ | | | | | | | | | | | | | | | | | | |
| CC1.3 | \$ | | | | | | | | | | | | | | | | | | | | | | |
| CC 1.41 | | | \$ | | | | | | | | | | | | | | | | | | | | |
| CC 1.43 | | | \$ | \$ | | | | | | | | | | | | | | | | | | | |
| CC9.18 | | | \$ | \$ | | | | | | | | | | | | | | | | | | | |
| CC9.10 | | | \$ | \$ | | | | | | | | | | | | | | | | | | | |
| CC9.11 | | | \$ | \$ | | | | | | | | | | | | | | | | | | | |
| CC9.17 | | | \$ | \$ | | | | | | | | | | | | | | | | | | | |
| CC9.13 | | | \$ | \$ | | | | | | | | | | | | | | | | | | | |
| CC 1.45 | | | \$ | \$ | | | | | | | | | | | | | | | | | | | |
| CC1.46 | | | \$ | | | | | | | | | | | | | | | | | | | | |
| CC9.12 | | | \$ | \$ | | | | | | | | | | | | | | | | | | | |
| CC 16.19 | \$ | | | | | | | | | | | | | | | | | | | | | | |

3.1 Coastal Zone Hotspot

The 23 projects for the coastal zone have a total expected investment of BDT884 billion (\$11 billion). They are predominantly focused on the theme of ‘preventing too much water’ (BDT427 billion, equivalent to \$5 billion), and include flood protection infrastructure, land reclamation projects, and development of chars and polders.

Eight knowledge-related projects in this hotspot are slated for immediate development. These will provide the knowledge needed for more adaptive management of the hard infrastructure projects that follow. The knowledge-oriented projects include the development of GIS and remote sensing technologies for Integrated Coastal Zone land use planning (CZ12.6); preparatory studies of ways to reclaim land beyond the coast (CZ1.52); a study on the morphological dynamics of the Meghna Estuary (CZ1.39); a study on integrated management of drainage congestion for the Greater Nohkhali (southeast region) (CZ1.4); studies aiming to develop a suitable institutional arrangement for proper management of polders, and environmental and social impacts of TRM (CZ1.5); studies of the possibilities for multi-purpose sea-dykes and barriers (CZ1.53); and development of a Climate Smart Integrated Coastal Resource Database (CZ4.1). Studies of crops suitable for use in saline areas will also be commissioned (CZ17.1).

Twelve physical *Cluster 0+* projects are slated for immediate commencement, as indicated in the coastal zone adaptive pathways. Two of the Coastal Zone projects are *Cluster 1* projects, meaning that they involve a step change in approach. The first of these is the Urichar-Noakhali cross dam project (CZ1.7). This is programmed to start in 2022, after the relevant knowledge products (CZ1.39 and CZ1.52) have been completed. By this time, the *Cluster 0+* project of char development in Noakhali district will also be complete (CZ1.3). The second *Cluster 1* project involves land reclamation by constructing a cross dam between Hatiya and Nijhum Dwip (CZ1.6).

The only *Cluster 2* project in the Coastal Zone Hotspot Investment Plan is the Ganges Barrage (CZ1.1). This is a strategic project with a cost in excess of BDT408 billion (\$5 billion). Its effects are hard to predict and largely irreversible, and the project requires international agreements that have not yet been negotiated. This is why the Ganges Barrage is categorized as a *Cluster 2* project and sequenced later. Although a feasibility study and detailed engineering design have already been done, a review and further study are needed. This is because the geographic location and design of the barrage are not yet agreed, the institutional capacity of implementing agencies needs to be reviewed, and the project requires negotiations with India.

Lower-impact projects with similar effects are programmed in first, notably the Southern Agricultural Improvement Project (CZ12.8), with a capital cost of BDT39 billion (\$494 million). Exploration of the agricultural potential of saline soils (CZ17.1) is also programmed in earlier, as this study may suggest lower-cost ways of boosting agricultural output. A comprehensive feasibility study for the Ganges Barrage is programmed for 2022, after results from these previous studies and other projects are expected to be available. Construction on the barrage would start in 2025 if the feasibility studies show that it is feasible, socially beneficial, and that there are no lower-cost or more flexible options that would achieve the same benefits.

3.2 Rivers and Estuaries Hotspot

The Rivers and Estuaries Investment Plan includes seven projects focused on improving management of rivers. Two are knowledge projects, and five are infrastructure projects. Almost all are *Cluster 0+* projects, programmed to start immediately. Together, these projects have a total investment of BDT483 billion (\$6 billion).

The most significant of these is a BDT290 billion (\$4 billion) project, the Integrated Jamuna-Padma Rivers Stabilization and Land Reclamation Project (MR1.46). The aim of the project is to stabilize the banks of the Jamuna-Padma to control river-bank erosion, increase land reclamation, reduce flood risk by construction of embankments, restore navigation and maintain safe navigation channels, increase land-based productivity through intensified agriculture, and designate environmental protection zones along the river. Two projects, MR1.2 and MR1.5, develop relevant knowledge and planning instruments for this project. Therefore, the MR1.46 project is sequenced to start after these two are completed.

The other major project is the BDT140 billion (\$2 billion) River Bank Improvement Project (MR1.1), aimed at strengthening and extending embankments on rivers around Dhaka. This project's focus is flood protection, though it will also improve drainage and transportation. This project is planned in three phases. The first phase is at an advanced level of readiness, with a feasibility study prepared in 2015 and Executive Committee of the National Economic Council approval pending. The second two phases still need further study, however. The complex and multi-faceted nature of this project means that three years have been allowed to complete feasibility studies and finalize designs, considering inter-relationships with other Investment Plan projects. Provided the project still proves to be feasible and socially beneficial, construction is expected to commence in 2021.

The other three infrastructure projects aim to ensure that there is enough water when and where it is needed, whether for navigation, irrigation, or municipal supply. The Sustainable Restoration of Connectivity of Major Navigation Routes (MR3.1) will use dredging and other techniques to restore and maintain navigable channels in 24 rivers totaling 2,500km of waterway, at a cost of about BDT23 billion (\$289 million).

In addition, the Chandona-Barasia River Basin System will be developed (MR1.6) to provide irrigation and a sweet water reservoir for domestic purposes, while in char lands, irrigation and other measures to boost agricultural productivity will be implemented (MR12.1). These projects to improve water availability all need improved feasibility studies, which are expected to take around two years to complete, meaning their construction is programmed to start in 2020.

Two knowledge-related projects are included in the Rivers and Estuaries Investment Plan. The first develops a master plan for harnessing river resources, reducing flood risks, improving irrigation and drainage system management, providing river training and bank protection, reclaiming land, and enhancing ecosystems and environments, in line with national goals and achievements (MR1.2). The second adds to knowledge on how to harness the Brahmaputra River (MR1.5). Both knowledge-related projects can be implemented immediately.

3.3 Urban Areas Hotspot

In the urban areas of the Delta, 12 projects are planned, with a total cost of BDT672 billion (\$9 billion). Six of these projects focus on flood protection; four are primarily concerned with water supply; and two with sanitation and protection of ecosystems.

Among the flood projection schemes, two aim to protect parts of the Dhaka metropolitan area. The first is of these is a *Cluster 0+* project to improve drainage and raise floodwall heights in the Dhaka-Narayangonj-Demra area (UA1.3).

The second project with a similar objective is the Dhaka Integrated Flood Control Embankment cum Eastern Bypass Road Multipurpose Project (UA1.2). This is a *Cluster 1* project that changes existing ways of doing things and is largely irreversible. Without careful planning, it may risk unintended consequences, such as destruction of wetlands that currently provide important ecological services. Three years are programmed for investigation of the project, including the search for lower-impact ways to achieve the same objectives. Alternatives for sustainable integrated urban wetland development will be investigated during this extended feasibility study. In 2021 construction of the project will commence, whether in its current form, or following whatever improved approach may emerge from the study.

There are also flood control projects for Chittagong (UA10.1), Barisal (UA11.1), Khulna (UA3.1), as well as the Barisal, Sylhet, Rangpur, Comilla, and Mymensingh city corporation areas (UA9.3).

By far the largest project in the Urban Areas hotspot is the BDT378 billion (\$5 billion) Greater Dhaka Integrated Water and Sewerage Improvement Project (UA9.1/20.1). This will provide high-quality water and sanitation services to all inhabitants of the Greater Dhaka metropolitan area. The project is programmed to begin construction in 2021, and to extend over decades as sewer networks are progressively extended throughout the city. The project also relates to UA9.2, which improves sanitation systems in city corporation areas of Bangladesh. Both also contribute to the protection of the rivers system around Dhaka City (UA1.1).

There are three other projects to construct water supply infrastructure in urban areas. A new surface water treatment plant with intake structure, transmission, and distribution network system will be constructed for Khulna (UA23.1). A second project (UA9.1) will provide water supply infrastructure in the Barisal, Sylhet, Rangpur, Comilla, and Mymensingh city corporation areas. These hard infrastructure projects will be complemented by a project to research and implement measures to improve the financial performance of a water utility in a medium-size city (UA23.2).

3.4 Barind and Drought-Prone Hotspot

In the Barind and Drought-Prone Areas, ensuring adequate quantities of water is the priority. All nine projects in the Investment Plan include measures to do so. Three of the projects aim to create participatory management and improved cost recovery for irrigation schemes in various areas (DP25.1, DP25.2, and DP25.3). These are low-cost *Cluster 0+* projects that can advance immediately.

Three more *Cluster 0+* projects involve restoring or developing substantial irrigation schemes with associated improvements in agricultural practices. These will benefit North Rajshahi (DP1.1, costing BDT20 billion, or \$251 million); Beel Halti (DP1.2, costing BDT5 billion or \$60 million); and Kurigam (DP1.4/1.5, costing BDT27 billion or \$340 million). All of these projects are programmed to start construction in 2018.

Another *Cluster 0+* project is rationalization of water-related interventions in the Hurasagar Basin (DP1.21). This significant project has an estimated capital cost of BDT16 billion (\$201 million). The final *Cluster 0+* project is a Fisheries Development Project (DP15.3). This project

has an estimated capital cost of BDT4 billion (\$45 million), and aims to increase sustainable management of aquaculture and fisheries resources.

The only *Cluster 1* project in this hotspot is the BDT90 billion (\$1 billion) scheme to revitalize the Hurasagar and Atrai Rivers (DP1.3). The scale and irreversibility of this project means that it is programmed to start only after work has commenced on the *Cluster 0+* project: Rationalization of water-related interventions in the Hurasagar Basin (DP1.21). The likely value of the scheme under various climate and economic development scenarios will be assessed. If these studies confirm a tipping point is reached and the project is needed, construction will begin in 2021.

3.5 Chittagong Hill Tracts Hotspot

Eight projects are planned for the Chittagong Hill Tracts, with an estimated total investment cost of BDT60 billion (\$754 million). All but one of these projects is classed as *Cluster 0+* projects to be implemented immediately. The *Cluster 0+* projects are programmed to proceed as soon as any necessary studies to confirm feasibility have been completed.

Project CH26.5 (Flow control and water storage structures for water availability in the dry season) is a *Cluster 1* project, for which catchment and sub-catchment management plans are a prerequisite. For this reason, the project is planned after *Cluster 0+* project CH26.2 'Development Catchment and Sub-Catchment Management Plans'.

Cluster 0+ project CH1.1 'Prospects for Promoting Soil Conservation and Watershed Protection in Chittagong Hill Tracts' is planned after the completion of project CH26.2 for the same reason.

3.6 Haor and Wetland Hotspot

The Investment Plan contains six projects for the Haor and Wetland Hotspot. Total investment costs are estimated at BDT28 billion (\$353 million).

Given wetland conditions, three of the projects aim to protect inhabitants against the problem of too much water in the wrong places at the wrong times. Two are *Cluster 0+* projects. One of these aims to provide infrastructure to protect villages against wave action and to improve water management in Haor Basins (HR2.1/2.2). The other aims to rationalize water-related interventions in the Upper Meghna Basin, providing a wide baseline study, a strategy for water management in the region, and flash flood control and ecosystem services (HR1.1).

The other project that protects against too much water involves creating elevated village platforms (HR2.4). This project will help communities adapt to flooding that could be caused by issues that play on a regional scale. Given that the need for these platforms would depend on the *Cluster 0+* projects in this theme, this project is scheduled to start later.

The project to improve management of commercially important wetland ecosystems (HR14.3) is also a *Cluster 1* project, with many aspects that will be informed by the strategies formulated in project HR1.1. For this reason, the project to improve wetland ecosystems is planned to start after project HR1.1.

Two other *Cluster 0+* projects aim to improve water quality and protect ecosystems. HR15.5, Sustainable Haor Wetland/Rivers and Fish Habitat Management, has total capital costs of BDT10 billion (\$121 million). HR14.1, Ecosystem Habitat Preservation Program for Plants, Wildlife, Fisheries and Migratory Birds, has total capital costs of BDT386 million (\$5 million).

This project includes a baseline survey on biodiversity and ecosystem resources, and aims at habitat restoration and protection.

3.7 Cross-Cutting Area

The last section of the Investment Plan contains 15 projects, each of which cut across multiple hotspots. The total capital expenditure¹⁷ across these projects is estimated at BDT689 billion (\$9 billion). Among the 15 projects, 14 are classed as *Cluster 0+*. It is desirable to proceed quickly with these projects.

Five out of ten projects include the construction of water supply or sanitation infrastructure systems. Three *Cluster 0+* projects provide water supply infrastructure to urban areas: water supply in 100 Pourashavas (CC9.10 costing BDT25 billion, equal to \$315 million); water supply in secondary towns (CC9.11 costing BDT47 billion, equal to \$588 million); and water supply in villages (CC9.13 costing BDT53 billion, equal to \$673 million).

Improvement of sanitation systems in 100 Pourashavas will be achieved through project CC9.12, costing BDT22 billion (\$279 million). Finally, project CC9.17 comprises the improvement of water supply and sanitation facilities in rural char areas, costing BDT10 billion (\$122 million).

Two more *Cluster 0+* projects (CC9.18 and CC18.5) involve the improvement of urban drainage facilities in 100 Pourashavas and 200 District and Upazila-level municipalities.

Projects CC12.37 (Integrated Agricultural Development in Moderately Cyclone-Affected Area) and CC1.4 (Development/Improvement of Multi-Purpose Disaster Shelters and Its Management Information System (MDS&MIS)) aim to minimize damage and loss of life in the cyclone-affected areas in the coastal zone.

Project CC1.3 aims to strengthen the institutional capacity of the MoWR and BWDB by developing a 'Dynamic Climate Smart Knowledge Portal and Hydro-Geological Database'. The project costs are BDT191 million (\$2 million). Another project related to capacity building is CC1.45, Expansion and Modernization of Network and Tools for Groundwater Monitoring Including Establishment of a National Coordination Mechanism. Total capital costs of this project are BDT4 billion (\$51 million).

Three other *Cluster 0+* projects are included: CC1.41, CC1.43, and CC16.19. The first is a Program for Implementation of Rationalized Water-Related Interventions in Dhaleswari Basin, which involves improving navigation facilities and the drainage system, and reducing flood risks. This project has a total capital cost of BDT2 billion (\$23 million). The second project, CC1.43, aims to boost agricultural production, and improve monsoon drainage, navigation, and fish culture. This project has total capital costs of BDT5 billion (\$58 million). The third project is focused on resilient livestock production (CC16.19).¹⁸ This project has a total capital cost of BDT1 billion (\$15 million).

The project for managed aquifer recharge for artificial storage (MARAS, CC1.46) aims to improve the groundwater table in areas vulnerable to saline intrusion in the groundwater table. This project is a change in approach for Bangladesh, and involves potentially irreversible

¹⁷ Including the cost of the feasibility studies.

¹⁸ This project as currently designed does not meet the ADM criteria of the MCA, as described in Box 2.1. However, an exception has been made to include it in the Investment Plan, because of its focus on climate change resiliency.

effects, making it a *Cluster 1* project. Given the current lack of any other options for addressing the pressing needs of these vulnerable communities, however, this project is slated to proceed in 2020, provided that studies indicate a tipping point has already been reached, and the project is therefore needed.

3.8 Summary Statistics

Of the 80 projects in the Investment Plan, 65 are infrastructure projects, and 15 are knowledge or institutional capacity-building projects. The focus on infrastructure projects reflects the fact that of the 133 projects considered for the Investment Plan, 110 were infrastructure projects, and 23 were knowledge or institutional capacity-building projects.

Table 3.1 and Figure 3.3 show the total investment costs by hotspot program, separated by capital expenditure and feasibility study costs. The hotspots with the most planned investments in the current Investment Plan are the coastal zone, cross-cutting hotspot, urban areas, and rivers and estuaries.

Table 3.1: Investments by Hotspot Program

| Hotspot | Total Capital Expenditure | | Total Feasibility Study Costs | | Total Costs | |
|------------------------|---------------------------|---------------|-------------------------------|------------|------------------|---------------|
| | BDT (mil) | \$ (mil) | BDT (mil) | \$ (mil) | BDT (mil) | \$ (mil) |
| Coastal Zone | 867,501 | 10,931 | 16,860 | 212 | 884,361 | 11,143 |
| Rivers and Estuaries | 473,231 | 5,963 | 9,379 | 118 | 482,610 | 6,081 |
| Urban Areas | 658,357 | 8,295 | 13,167 | 166 | 671,524 | 8,461 |
| Chittagong Hill Tracts | 58,798 | 741 | 1,067 | 13 | 59,865 | 754 |
| Drought Prone | 160,965 | 2,028 | 2,181 | 27 | 163,145 | 2,056 |
| Haor and Wetlands | 27,511 | 347 | 471 | 6 | 27,982 | 353 |
| Cross-Cutting | 675,308 | 8,509 | 13,479 | 170 | 688,787 | 8,679 |
| Total | 2,921,671 | 36,814 | 56,604 | 713 | 2,978,274 | 37,526 |

Figure 3.3: Investments by Hotspot Program

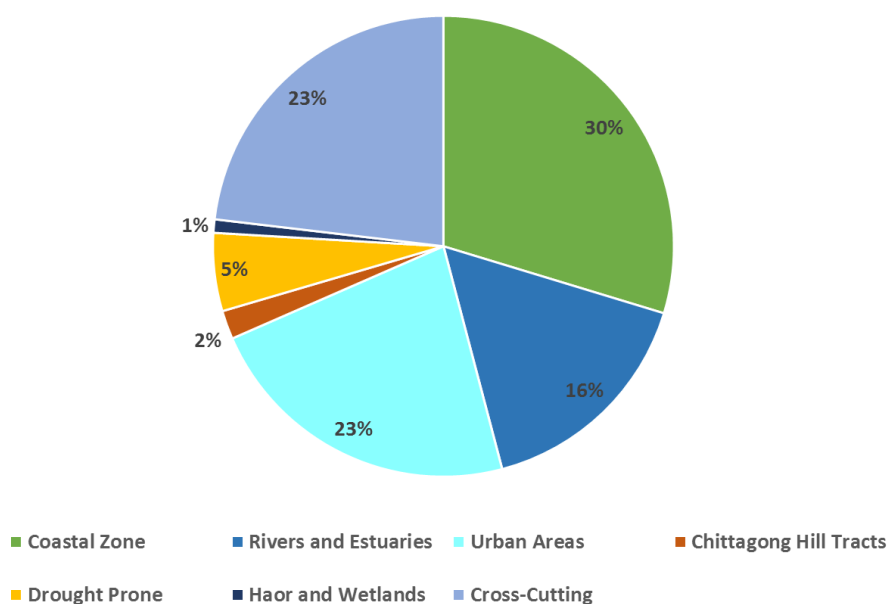


Table 3.2 shows the total investment by theme. Most investments are for the theme preventing too much water, followed by supplying sufficient quantity of water, and supplying sufficient quality of water. Some themes are more prominent in some hotspots than in others. Projects that fall under multiple themes are summed under each theme in the table.

Table 3.2: Investments by Theme

| Hotspot | Theme 'Preventing Too Much Water' | | Theme 'Supplying Sufficient Quantity of Water' | | Theme 'Supplying Sufficient Quality of Water' | |
|------------------------|-----------------------------------|----------|--|----------|---|----------|
| | BDT (mil) | \$ (mil) | BDT (mil) | \$ (mil) | BDT (mil) | \$ (mil) |
| Coastal Zone | 427,408 | 5,385 | 457,974 | 5,770 | 40,989 | 516 |
| Rivers and Estuaries | 443,393 | 5,587 | 39,217 | 494 | 0 | 0 |
| Urban Areas | 187,547 | 2,363 | 445,025 | 5,607 | 424,511 | 5,349 |
| Chittagong Hill Tracts | 44,067 | 555 | 16,641 | 210 | 5,467 | 69 |
| Drought Prone | 107,565 | 1,355 | 159,494 | 2,010 | 3,652 | 46 |
| Haor and Wetlands | 17,269 | 218 | 5,896 | 74 | 16,609 | 209 |
| Cross-Cutting | 493,371 | 6,216 | 190,400 | 2,399 | 40,264 | 507 |

| Hotspot | Theme ‘Preventing Too Much Water’ | | Theme ‘Supplying Sufficient Quantity of Water’ | | Theme ‘Supplying Sufficient Quality of Water’ | |
|--------------|-----------------------------------|---------------|--|---------------|---|--------------|
| | BDT (mil) | \$ (mil) | BDT (mil) | \$ (mil) | BDT (mil) | \$ (mil) |
| Total | 1,720,621 | 21,680 | 1,314,346 | 16,565 | 531,492 | 6,697 |

Table 3.3 shows the planned sources of financing for each theme.

Table 3.3: Sources of Financing by Theme

| | Theme ‘Preventing Too Much Water’ | | Theme ‘Supplying Sufficient Quantity of Water’ | | Theme ‘Supplying Sufficient Quality of Water’ | |
|--|-----------------------------------|---------------|--|---------------|---|--------------|
| | BDT (mil) | \$ (mil) | BDT (mil) | \$ (mil) | BDT (mil) | \$ (mil) |
| Public Capital Expenditure (without Climate Finance) | 1,427,968 | 17,992 | 1,203,414 | 15,163 | 523,872 | 6,601 |
| Climate Finance Capital Expenditure | 275,235 | 3,468 | 96,081 | 1,211 | 6,141 | 77 |
| Private Capital Expenditure | 17,418 | 219 | 15,151 | 191 | 1,479 | 19 |
| Total | 1,720,621 | 21,680 | 1,314,646 | 16,565 | 531,492 | 6,697 |

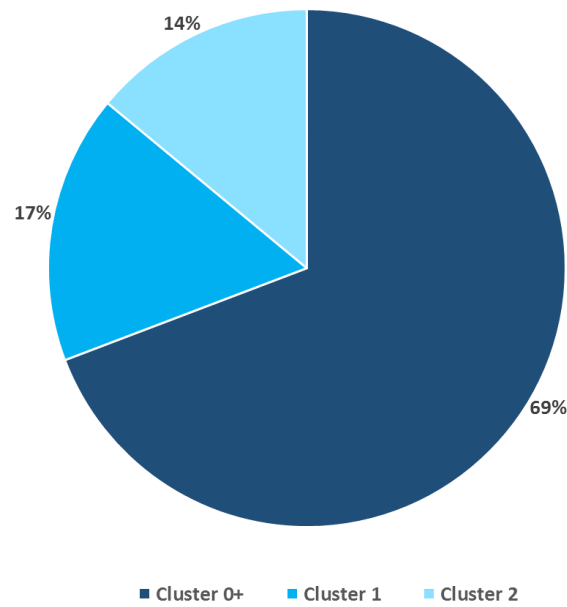
Table 3.4 and Figure 3.4 show the total investment by project cluster. Most projects in the Investment Plan are *Cluster 0+* projects, and therefore this cluster has by far the greatest amount of investment. Although there are more *Cluster 1* than *Cluster 2* projects, the total capital costs are similar because the *Cluster 2* project is a large mega-project.

Table 3.4: Investments by Cluster

| Hotspot | Cluster 0+ | | Cluster 1 | | Cluster 2 | |
|-------------------------|------------|----------|-----------|----------|-----------|----------|
| | BDT (mil) | \$ (mil) | BDT (mil) | \$ (mil) | BDT (mil) | \$ (mil) |
| Coastal Zone | 462,472 | 5,827 | 5,002 | 63 | 416,887 | 5,253 |
| Rivers and Estuaries | 187,014 | 2,356 | 295,596 | 3,725 | 0 | 0 |
| Urban Areas | 570,024 | 7,182 | 101,499 | 1,279 | 0 | 0 |
| Chittagong Hills Tracts | 59,227 | 746 | 638 | 8 | 0 | 0 |
| Drought Prone | 71,833 | 905 | 91,312 | 1,151 | 0 | 0 |

| Hotspot | Cluster 0+ | | Cluster 1 | | Cluster 2 | |
|-------------------|------------------|---------------|----------------|--------------|----------------|--------------|
| | BDT (mil) | \$ (mil) | BDT (mil) | \$ (mil) | BDT (mil) | \$ (mil) |
| Haor and Wetlands | 23,615 | 298 | 4,367 | 55 | 0 | 0 |
| Cross-Cutting | 687,426 | 8,662 | 1,361 | 17 | 0 | 0 |
| Total | 2,061,612 | 25,973 | 499,775 | 6,297 | 416,887 | 5,253 |

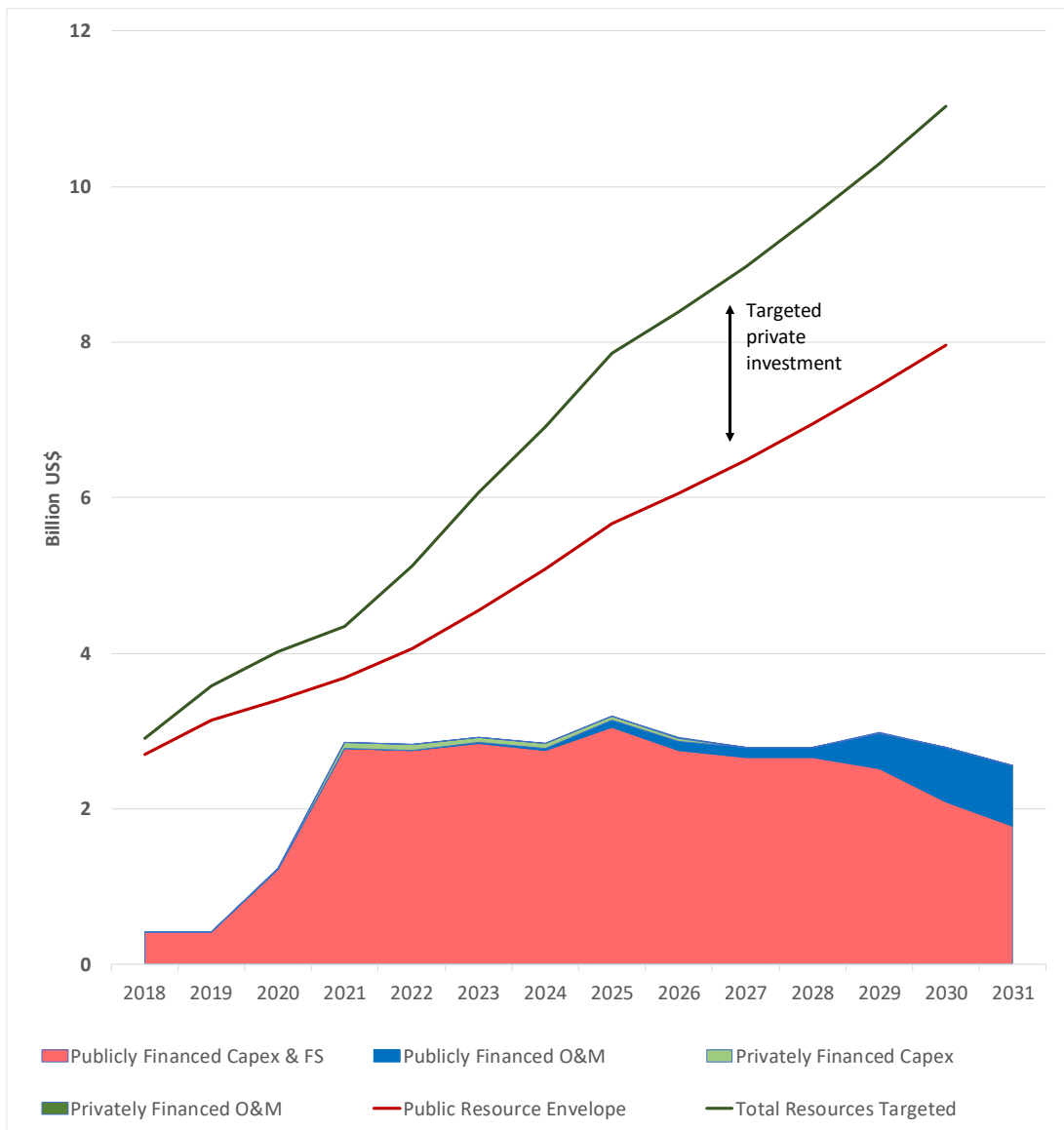
Figure 3.4: Investments by Cluster



4 Financing the Investment Plan

The total capital expenditure on projects in the Investment Plan is estimated to be BDT2,922 billion (\$37 billion). Adding in the feasibility studies and operating and maintenance costs,¹⁹ total expenditures on the plan are expected to be BDT4,091 (\$52 billion). Annual expenditure on the plan will average BDT178 billion (\$2 billion) over the first 10 years, peaking at BDT254 billion (\$3 billion) in 2025. The profile of expenditures is indicated by the stacked area graph in Figure 4.1. This section sets out the Plan for financing these expenditures.

Figure 4.1: Delta Plan Expenditures and Finance Targets



¹⁹ Operating and maintenance costs for infrastructure projects are considered up to 2040.

The Delta Plan targets public and private finance of the Investment Plan. These are shown by the lines in Figure 4.1. Public finance is expected to start at its current level of 0.8% of GDP; to grow to 1.3% of GDP by FY2025;²⁰ and to be sustained at that percentage thereafter.²¹ Given current GDP projections, this suggests that by 2020, BDT270 billion (\$3 billion) in public sector funds should be available, rising to BDT450 billion (\$6 billion) in 2025, and growing from there with GDP. This public-sector resource envelope is shown by the red line in Figure 4.1.²² The Delta Plan targets climate finance, and it is assumed that this will contribute to the total public financial resources available. The bulk of the increase in public resources will come from additional external borrowing. Simulations show that the debt service implications of this are easily manageable.²³

The Delta Plan also envisages private finance of Delta projects. It sets a target for scale-up of private finance to 0.5% of GDP by FY2025. The green line in Figure 4.1 shows total resources targeted from public and private sources. Total annual resources available are targeted to reach BDT623 billion (\$8 billion) by FY2025, and to grow with GDP thereafter.

As can be seen from Figure 4.1, the expected total expenditure on the Investment Plan (shown by the stacked area graph) remains below the resources the Delta Plan aims to make available. Spending starts slowly in 2018 and 2019. This is because there are not many projects that are ready to be implemented immediately. Most projects require new or updated feasibility studies before they can be implemented. Institutional and policy reforms, capacity building, and knowledge studies must also be initiated in these first years. Then, in 2020, total investments quickly ramp up as feasibility studies are completed, reforms are implemented, and final decisions to proceed with projects are made.

It is expected that 99% of total expenditures on the plan will be publicly financed. This is shown by the red-shaded area (representing publicly financed capital expenditure) and blue-shaded area (representing publicly funded operations and maintenance costs). Public finance is discussed in section 4.1. Of the total public finance, the Government aims to raise BDT370 billion (\$5 billion) in climate finance for the Climate Change Adaptation Program, as detailed in section 4.2.

Private finance is also targeted. Annual private inflows peak in 2021 at BDT6 billion (\$72 million, or 0.02% of GDP). This is a modest amount to start with, but will gradually increase after pioneer PPP projects (described in section 4.3) show success, and after institutional reforms (described in sections 5.2 and 5.3) are implemented. The green-shaded area in Figure 4.1 shows the private finance expected to go into Investment Plan projects each year.

At the closest point (in 2021), resources required for the Investment Plan are still BDT67 billion (\$0.8 billion) below the public resources targeted. The fact that planned expenditure is below planned resource availability provides a buffer in case resource mobilization is less than expected. It should also allow additional projects to be added to the Investment Plan through the adaptive planning process described in section 2.

²⁰ The targeted fiscal allocation percentages for Delta investments are taken from Figure 11.3 of the BDP2100 DRAFT p. 510. The real GDP figures are taken from Table B5.3 of the BDP2100 DRAFT p. 665.

²¹ BDP 2100 DRAFT Chapter 11.

²² Although the figure only shows up to 2031, the resource envelope and Investment Plan expenditures continue beyond this date.

²³ BDP2100 DRAFT p. 512.

The general resilience of the financing plan to changes in resources availability is described in section 4.4. In the extreme risk case of no private or climate finance being mobilized, and public expenditures remaining at 0.8% of GDP as now, four projects would need to be delayed by up to four years.

4.1 Public Finance of the Investment Plan


Over the first five years of the plan, an average capital expenditure of BDT120 billion (\$2 billion) per annum will be publicly financed. Public finance will continue to be appropriated from the budget, with funding coming from government revenue and borrowing. The aim is to cover operating and maintenance costs through user charges, and (in case of any shortfall) recurrent government revenues from taxes and other sources.

The increase in government capital expenditure is expected to come largely from external financing secured in the form of grants and concessional loans. This is expected to have a very limited impact on the external debt-servicing burden for the country.²⁴

4.2 Accessing Climate Finance

‘Climate finance’ has been created by the global community to assist developing countries to both mitigate greenhouse gas emissions and adapt to climate change. Bangladesh is one of the most vulnerable countries to climate change worldwide. It ranks sixth in the Global Climate Risk Index of most affected countries over the period 1996–2015.²⁵ The number of people living in the Delta; its low elevation above sea levels; and the highly variable flows of the massive rivers running through it have long posed risks for Bangladeshis. Climate change is projected to exacerbate these risks, increase the occurrence of both floods and droughts, increase monsoon river flows, and increase salt-water intrusion.²⁶ Sea levels are projected to rise. Cyclones and storm surges are projected to increase in intensity, threatening millions of people in the Delta’s vulnerable coastal regions. Most importantly, while projections are for climate conditions to worsen, there is a wide uncertainty band around these projections, making the challenge of planning for resilience exponentially more difficult.

As the least-developed country with the most people seriously at risk from climate change, Bangladesh needs and deserves a substantial contribution from global climate finance providers.

As described in section 3, 52 of the projects in the Investment Plan have been grouped into the Climate Change Adaptation Program (CCAP). The CCAP is a holistic program for boosting climate resilience in the Delta. It includes policies and institutions for coordinating climate resilience, as well as 46 infrastructure projects. CCAP projects are marked in the Investment Plan with , and include projects in all hotspots that are expected to contribute significantly to climate resilience.

²⁴ BDP 2100 DRAFT p. 512.

²⁵ Bangladesh CRI score of 22.67. See: Germanwatch 2016. *Global Climate Risk Index 2017: Who suffers most from extreme weather events? Weather-related loss events in 2015 and 1996 to 2015*. Briefing paper written by: Sönke Kreft, David Eckstein and Inga Melchior.

²⁶ R.K. Pachauri and L.A. Meyer, "Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Geneva: IPCC 2014.

Table 4.1 summarizes the four guiding principles used to select projects for inclusion in the Investment Plan and the CCAP. Projects selected for the CCAP are listed in Appendix D (pp. 158-182), along with the ways in which they contribute to climate resilience.

Table 4.1: Guiding Principles for Selection of Pipeline Projects of the CCAP²⁷

| Guiding principle | Definition | Indicators/definition |
|--|---|--|
| Impact potential | Expected reduction in vulnerability by enhancing the adaptive capacity of a system and reduced exposure to climate risk | Expected decrease in vulnerability |
| Paradigm shift potential | Potential to catalyze impact beyond a one-off project or program investment | Potential for scaling up |
| | | Potential for knowledge developing |
| | | Contributing to institutional and regulatory framework |
| Sustainable development potential | Wider benefits and priorities, including environmental, social, and economic co-benefits | Expected co-benefits for the environment |
| | | Expected co-benefits for society and health |
| | | Expected co-benefits for economic development in the area |
| Potential to leverage other sources of finance | Potential to leverage and mobilize other financing sources (including private finance) | Attractiveness of the project to leverage other sources of finance |

The Government will apply for climate finance totaling BDT370 billion (\$5 billion) for the CCAP, an average of BDT21 billion (\$265 million) per year over the 2018–2022 period. This target was developed from the Multi-Criteria Analysis score assigned to each project in the CCAP. The 34 projects that promote climate resilience, while also serving other needs to a greater extent, are assumed to be 20% funded with climate finance on average. The MCA scores and criteria are described in section 2 and Appendix B.4 (pp. 115–135).

In total, climate finance is expected to contribute 12% toward the total capital expenditures on the Investment Plan. Given the extreme risks posed by climate change throughout the Delta, the Government considers this to be a conservative and realistic target. These conservative targets were set because although there is a strong case for climate finance, time, effort, and coordination are needed to access it. Although Bangladesh has experience with climate finance through the Bangladesh Climate Change Trust Fund and the Bangladesh Climate Resilience Fund, significant new sources such as the Green Climate Fund (GCF) have recently become available. As Bangladesh becomes more experienced in applying for and accessing these climate funds, the Government will aim to increase the sums contributed by these sources.

²⁷ Based on the investment criteria of the Green Climate Fund, and adapted by Arcadis/Castalia.

The CCAP facilitates the process of obtaining climate finance. By presenting an entire program rather than individual projects, the Government will save time and resources, and will make approval possible relatively upstream in the project cycle. The rules governing the GCF and similar funds delegate project preparation to the accredited financial intermediaries, and therefore applies those intermediaries' project preparation procedures and processes. Thus, applying to these funds should not significantly change the project preparation and approval timeline. In addition, the CCAP will help Bangladesh access other financing modalities such as Program for Results (PforR) and retroactive financing. These modalities can allow the Government to proceed with projects using its own finance, and then be reimbursed from climate finance, provided certain conditions are met.

Climate finance may be in the form of grants and concessional loans. Grant funding is expected to be available for investment planning, project preparation, and some projects that do not generate enough revenue to cover capital costs. Projects with rates of return below normal market thresholds, or with high risk premiums, may receive highly concessional loans. Projects with rates of return near normal market thresholds but with some additional risk or high opportunity costs may receive loans on near-commercial terms. Some concessional funds will be used to leverage private finance in PPP projects.

The Delta Commission will coordinate among the many agencies that will implement the CCAP. The Delta Fund, mobilized by the Commission, will be the repository for international climate finance assistance. As described in section 5, the Commission will coordinate the Delta plans and projects of the other lead agencies in the Delta, including the Bangladesh Water Development Board; the Water Resources Planning Organization; the Water Supply & Sewerage Authorities; and the Joint Rivers Commission. It will act in concert with and facilitate communication and coordination among all the Government agencies and programs involved in the CCAP, such as the Ministry of Environment and Forests, the Department of Environment, the Department of Agricultural Extension, and the Bangladesh Water Multi-Stakeholder Partnership. The Delta Commission will also facilitate coordination with the National Implementing Entities of the GCF. The Delta Commission will ensure that the principles of adaptive delta management are comprehensively applied in investment planning, land and water management, and policy development in the Delta. This is the only way to achieve climate resilience for the Delta within available resources.

4.3 Resource Mobilization through Private Finance

The Government recognizes the benefits of innovation, efficiency, and resource mobilization that the private sector can bring to Delta investments. The strategy is to seek private investment in projects with the potential to generate revenue, and so provide a return on investment.

Bangladesh has already had success with public-private partnerships (PPPs) and private finance. A PPP Law was enacted in September 2015, and a PPP Authority was established in September 2010. Since 2000, 58 projects with private finance have reached financial close in the electricity, ICT, airports, natural gas, ports, and roads sectors, attracting a total of over \$11.6 billion (an average of \$684 million in total investment annually).²⁸ More than 40 PPP projects are currently under development.

²⁸ <https://ppi.worldbank.org/snapshots/country/bangladesh>











Not all sectors are equally attractive for private financing, however. For example, it may be easier to attract private finance in the transport, water supply and sanitation, and energy sectors. This is because there is a tradition of user charges, and significant domestic and international experience in structuring such transactions. Water and electricity utilities have established tariffs, and there are several toll roads and bridges in Bangladesh. Services may be withheld in case of non-payment. Irrigation, on the other hand, may be a more challenging sector for private finance of large surface water projects. Hurdles to overcome include users not expecting to pay cost-recovery tariffs for surface water irrigation schemes, poor-quality service from many existing schemes, and a lack of payment enforcement mechanisms.

Thus, although Bangladesh has a strong foundation in PPPs, private finance in delta projects like the ones in the Investment Plan have been relatively rare. Current bottlenecks include the lack of cost-recovery mechanisms, the lack of international standard PPP contracts for these sectors, and the lack of credit-worthy offtakers. Removing these bottlenecks will require implementing a comprehensive reform agenda, as explained later in this section, and demonstrating success through pioneer PPP projects. Once these bottlenecks are removed, there is an enormous opportunity to scale up private finance in delta projects.


Seven projects in the Plan have been identified as pioneer projects suitable for private financing. The projects targeted for private finance are listed in Table 4.2. They were selected after considering the following criteria:

- Likelihood of a revenue stream that can generate returns on investment
- Successful use of private finance in similar projects in other countries
- Likely market interest in these opportunities in Bangladesh, if they are appropriately structured and marketed
- Likelihood that there will be many more similar projects seeking finance as the Delta Plan is implemented.


Table 4.2: Projects Targeted for Private Finance


| Code | Project Name | Description of PPP Potential | Total Capex | | % of Private Finance Estimated | PPP Project Groups |
|--|--|---|-------------|----------|--------------------------------|---|
| | | | BDT bil | US\$ mil | | |
| Urban Areas | | | | | | |
| UA 1.1 | Protection of Rivers System around Dhaka City with Their Ecological Restoration | Capital and maintenance dredging with land development projects; managing scheduled passenger ferry facilities; collection and disposal of solid waste; sewage treatment plants; riverside beautification projects; and recreational facilities | 14.8 | 185 | 10% |    |
| UA 1.2 | Dhaka Integrated Flood Control Embankment cum Eastern Bypass Road Multipurpose Project | 24km embankment with tolled bypass road on top | 58.1 | 725 | 30% |  |
| UA 9.1 | Water Supply Project for the City Corporation Areas in Bangladesh (Phase I & II) | 8 water treatment plants with capacity of 3,000 m ³ /hr | 31.3 | 390 | 10% |  |
| UA 23.1 | Khulna Water Supply Project Phase II | 110,000m ³ /day surface water treatment plant; 55km transmission pipelines; 5 distribution reservoirs of 10,000–20,000m ³ ; 8 overhead tanks of 300–500m ³ ; and distribution network (400km network, 25,000 service pipe connections) | 26.7 | 333 | 10% |  |
| Barind Tracts and Drought Prone Areas | | | | | | |
| DP 1.1 | North Rajshahi Irrigation Project | Large-scale irrigation project for 74,800ha | 19.9 | 249 | 10% |  |
| DP 1.4/1.5 | Kurigram Irrigation Project | Potential to construct tolled roads with improving 144km of flood control embankments; large-scale irrigation project for 42,800ha and 25,392ha areas | 27.0 | 337 | 10% |   |
| Cross-Cutting | | | | | | |
| CC 9.11 | Water Supply Project in the Urban Areas of Bangladesh (Secondary Towns) | Water production tube wells and transmission systems | 46.7 | 583 | 10% |  |

 Embankment with road

 Large-scale irrigation

 Inland Water Transport

 Dredging and/or land reclamation

 Water supply and sewerage services

For these pioneer projects, it is estimated that between 10% and 30% of the capital costs for each project can be privately financed. This amounts to a total of BDT34 billion (\$429 million) in privately financed capital expenditures. Private finance in the plan does not exceed 0.02% of GDP per year. This is far below the 0.5% targeted in the Delta Plan. However, as experience is gained with these types of PPPs and necessary reforms are made, the program can be quickly scaled up, with many similar projects being implemented as PPPs, and attracting increasing percentages of private finance in each project.

Projects to attract private finance will generally use the Design-Build-Finance-Operate-Maintain (DBFOM) model. In this model, a private company is responsible for financing, building, and operating a facility to provide services to users. The DBFOM model will be used because, among the most widely used PPP models, this is the only one that mobilizes private financing for greenfield facilities—a key Delta Plan goal. The DBFOM structure also provides incentives to ensure proper operations and maintenance, another Delta Plan objective.

To implement these pioneer PPP projects, attract private finance, and scale up the total amount of private finance over time, a comprehensive policy reform agenda will be implemented. Success depends on introducing user charges (engraining the beneficiary pays principle), developing viability gap funding mechanisms, having credit-worthy offtakers, and building capacity within ministries and other agencies to implement bankable contracts.

Introducing user charges is essential to securing adequate funding for operations and maintenance, and to cover a share of the capital costs of projects. Operating cost recovery is not widely practiced currently. In the near term, all water service providers will be required to have tariffs that fully cover operating and maintenance costs.²⁹ Over time, further increases will allow tariffs to contribute to capital costs as well. Appropriate safety nets will be developed to ensure affordability for low-income families. User charges will also be applied in tolled highways, charges for use of river transportation facilities, and irrigation fees.

Preliminary financial analysis indicates that full cost-recovery user charges are achievable. For example, preliminary financial analysis of the Khulna Water Supply Project Phase II (UA23.1) indicates that it could be a financially viable DBFOM PPP with a bulk water charge of US\$0.82 (BDT68) per cubic meter of treated water.³⁰ This would increase Khulna WASA's average costs of supply from US\$0.05 to approximately US\$0.17 per cubic meter. Fully passing on this cost would increase public tariffs from US\$0.06 per cubic meter to approximately US\$0.19 per cubic meter. Although the US\$0.19 per cubic meter rate would be above Dhaka WASA's tariff of US\$0.14 per cubic meter, it would still be below that of at least four other utilities in the region, including in Cambodia (US\$0.24 per cubic meter in Phnom Penh), which has a similar GDP per capita to Bangladesh.

For the irrigation sector, private finance of 20% or more of the capital costs of irrigation projects may be possible at current market rates.³¹ Farmers are currently paying US\$100 (BDT8,333) per acre per season for groundwater-based irrigation. Bangladesh has a vibrant privately financed groundwater-based irrigation sector with full cost-recovery tariffs. Large-scale surface water irrigation schemes, on the other hand, have not performed as well historically, because of poor service quality and reliability. The success of the privately financed

²⁹ BDP 2100 DRAFT p. xxvi.

³⁰ Investment Plan Volume 2 Appendix H.5.2, pp. 232–234.

³¹ Investment Plan Volume 2 Appendix H.2.2, pp. 221–223.

groundwater irrigation schemes indicates that farmers are willing and able to pay for large-scale surface water irrigation of commercial crops at or above the current market rates, provided service improvements are made.

For the Eastern Bypass Road and Embankment portion of the Dhaka Integrated Flood Control Embankment cum Eastern Bypass Road Multipurpose Project (UA1.2), it is estimated that with a toll of BDT3.5 per vehicle per kilometer, up to 70% of the project can be privately financed.³² The remaining 30% of capital costs would require viability gap funding from the Government. This toll rate of BDT3.5 per kilometer is 30% less than the rate of BDT5 per kilometer proposed for the Dhaka-Chittagong Expressway. The proposed Dhaka-Chittagong Expressway toll rate was calculated based on a willingness-to-pay study conducted for that expressway. The Dhaka-Chittagong Expressway is an inter-city route, compared to the intra-city Eastern Bypass. Therefore, the former is more likely to have commercial truck users, who are likely to have a higher willingness to pay. A 30% lower toll rate for the Eastern Bypass therefore seems reasonable.

All this said, user charges are only expected to cover a portion of capital costs over the life of a project. This is both because phasing in cost-recovery tariffs will take time, and because of the public good benefits the projects provide. Viability gap funding (VGF) mechanisms will be used to combine public funding with private finance (with the public VGF funding expected to be as high as 80% on average for the pioneer projects). In this way, public finance can be used to leverage private finance, making each dollar of public money spent go further.

Where a PPP contract involves supply to a government authority (such as a water utility), measures will be developed to enhance the offtaker's credit-worthiness. In the near term, the Government will provide partial risk guarantees that are backed by international financial institutions, and establish revenue escrow accounts to provide security. In the medium term, water utilities will be commercialized so that they become credit-worthy offtakers. Projects to do this include UA23.2, Financial Performance Improvement of a Water Utility.




To ensure best practices are followed, procurement documentation and contracts will be prepared to international standards. In the near term, international transaction advisors will be engaged to help the PPP Authority and line ministries implement the pioneer projects and develop additional projects. As these agencies build capacity and gain experience over time, the role of international transaction advisors will be reduced.

As Table 4.2 shows, the seven projects fall into one or more of the following categories: embankment with road; large-scale irrigation; inland water transport; dredging and/or land reclamation; water supply and sewerage services. This is because many projects in these categories will be needed as the Delta Plan is implemented, because they offer revenue sources, and because precedents in Bangladesh and internationally suggest PPP in these areas can succeed, as Table 4.3 elaborates.³³ Successful implementation of the pioneer projects in these categories will create opportunities to do similar PPPs elsewhere in Bangladesh, and will thus serve as the foundation to scale up private finance. Additional details on the entire private finance strategy are provided in Appendix H (pp. 215-245).



³² Investment Plan Volume 2 Appendix H.6.2, pp. 239–241.

³³ A database of private participation in infrastructure in Bangladesh is available here: <https://ppi.worldbank.org/snapshots/country/bangladesh>. It tracks individual projects and includes a summary of investments in projects by sector.

Table 4.3: PPP Project Groups

| PPP Project Group | Description and Rationale | Precedent |
|---|---|---|
| Large-scale irrigation  | <p>Irrigation projects can be undertaken as PPPs by engaging private firms to build and finance new irrigation infrastructure, operate and maintain the system, supply water to irrigators in accordance with specified schedules and quantities, and charge for the water supplied.</p> <p>The main challenge is that user payments for irrigation do not generally cover costs at present. However, farmers’ willingness and ability to pay for large-scale irrigation of commercial crops will often be above current charges. Preliminary analysis suggests that private finance of 20% or more of the capital costs of irrigation projects may be possible at current market rates of US\$100 per acre per season irrigation charges.³⁴</p> | <p>Irrigation PPP projects have worked in other emerging markets, such as the Pontal irrigation project in Brazil for more than 180,000ha. The Government attracted private finance for irrigation infrastructure and agriculture investments, in return for revenue from sale of agricultural products and selling water to users.</p> |
| Inland water transport  | <p>Bangladesh’s many rivers offer convenient and environmentally friendly transportation options. Private firms can build and operate new ports and terminals, rehabilitate and expand existing ports and terminals, and develop surrounding land. PPPs can also be used to improve waterway navigability and increase waterway capacity.</p> | <p>Bangladesh has already started using PPPs for inland transportation infrastructure, awarding five inland container depot projects to private developers, three of which are currently under construction. International precedents include development of the transportation route along the Mississippi-Missouri River System in the United States developed since the early 19th century, and India’s US\$650 million plan to develop 850 ports along key rivers.</p> |
| Dredging and/or land reclamation  | <p>Revitalizing inland water transport will require significant initial (capital) and ongoing (maintenance) dredging. To make these projects viable, channel navigation fees (from river users) will be established, and long-term leases for reclaimed land will be developed. Of all the PPP project groups, dredging and/or land</p> | <p>BIWTA is currently developing a master plan for the sector that envisages seven-year performance-based contracts for dredging.</p> |

³⁴ Investment Plan Volume 2 Appendix H.2.2, pp. 221–223.

| PPP Project Group | Description and Rationale | Precedent |
|---|---|--|
| | reclamation have attracted the most interest from private sector operators. | |
| Water supply and sewerage services  | <p>A private operator would design, build, finance, operate, and maintain the water treatment plant. The Water Supply and Sewerage Authority would pay a bulk water charge for the water produced. Paying the bulk water charge will increase a WASA's average cost of supply, typically necessitating an increase in user tariffs.</p> <p>WASAs may also contract for provision of wastewater treatment services by private plants, or commercial effluent producers such as garment factories may pay for services from privately financed central effluent treatment facilities.</p> | <p>Since 1990, more than 260 water PPP contracts have been awarded in the developing world,³⁵ including 13 in India over the past 10 years alone.³⁶ A preliminary market assessment for a sewage treatment plant in Dhaka indicates strong interest from the private sector.³⁷ Over a quarter of respondents were willing to finance at least part of the sewage treatment plant, provided there are sufficient guarantees of offtaker credit-worthiness and other protections. Analysis of the Gazipur City Corporation Integrated Waste Water Project also indicates that private finance is viable.³⁸</p> |
| Embankments with roads  | <p>Embankments for flood mitigation can be viable as PPPs when developed with a tolled road on top of the embankment (or dyke).</p> <p>These projects can earn toll revenues paid by highway users, and income derived from rights to develop the corridor, by providing service stations, logistics hubs, and similar facilities.</p> | <p>Technically, embankments with roads are much like other highway projects. There are significant engineering challenges, but they have been done before in Bangladesh, and internationally, such as in Uttar Pradesh, India. Private finance and tolling of roads built on flood defense infrastructure have been done successfully in the Netherlands.</p> |

³⁵ World Bank 'Public Private Partnerships for Urban Water Utilities: A Review of Experiences in Development Countries', 2010.

³⁶ Trends in Private Sector Participation in the Indian Water Sector: A Critical Review (<https://www.wsp.org/sites/wsp.org/files/publications/WSP-Trends-PSP-India-water-sector.pdf>)

³⁷ Castalia, 'Preliminary Market Assessment for PPPs in Bangladesh Sewerage Treatment Plants', 2017.

³⁸ 2030 Water Resources Group. 'Draft Report on Rapid Assessment of Wastewater Management Options for Gazipur City Corporation', 2017.

4.4 The Finance Plan Is Robust

To test that the finance plan is robust, the scenarios were modelled in which there is no private finance, no climate finance, and in which the total resources available for the Investment Plan remain at 0.8% of GDP (as now). Table 4.4 summarizes how the finance plan is affected in each of these scenarios.

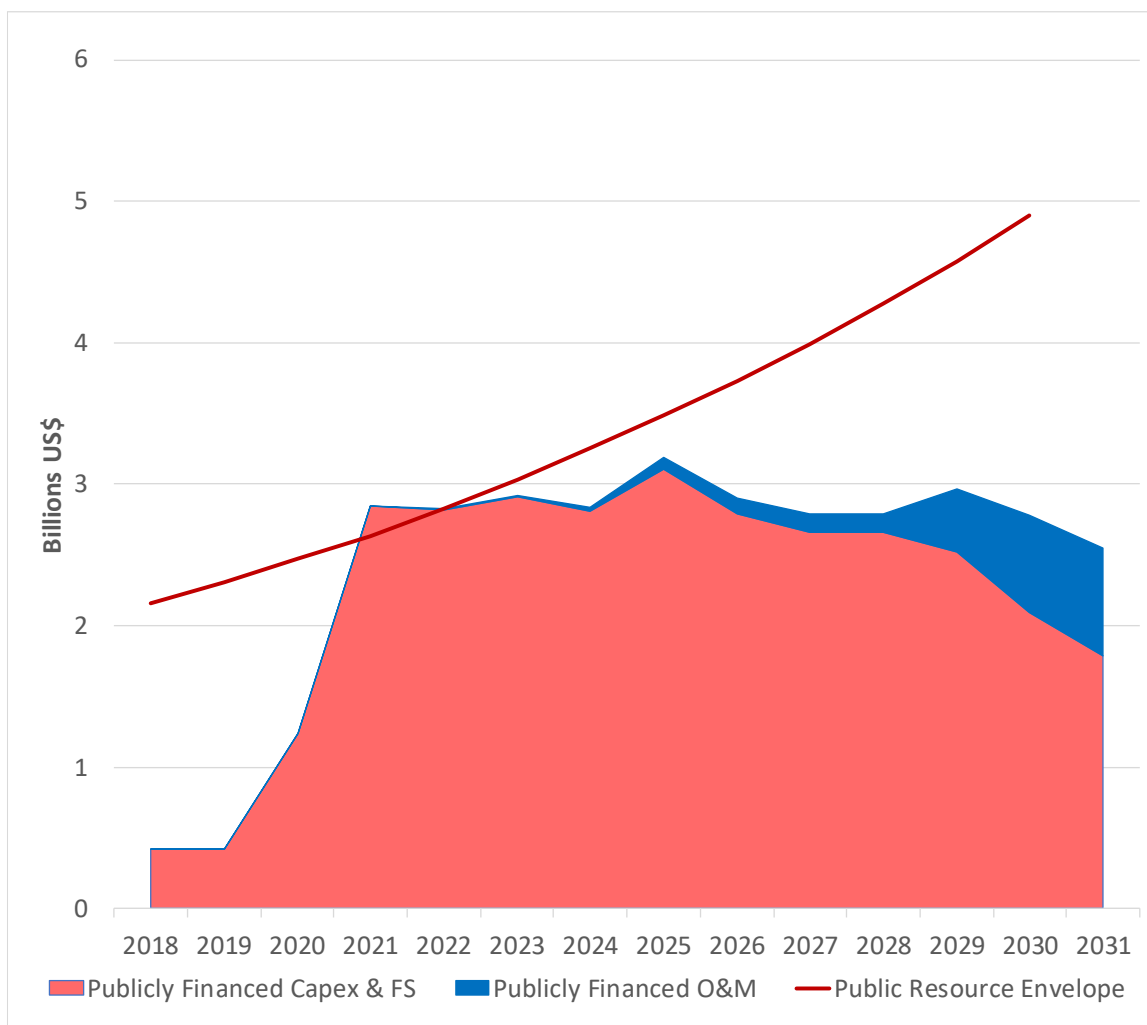
Table 4.4: Results of Finance Plan Scenario Analysis

| Scenario | Result | Explanation |
|--|--|--|
| No private financing | No change in project implementation | Sufficient public resources available to cover a lack of private finance |
| No climate financing | No change in project implementation | Sufficient public resources available to cover any lack of climate finance |
| No private or climate financing, public financing remains at 0.8% of GDP | Six projects (out of 80) are delayed by up to four years | Budget constraints in some years mean that the lowest MCA projects are postponed in some years |

In the first case with no private finance, the Investment Plan can be entirely financed through public resources and climate finance. The absence of private finance would increase the total amount of capital investment from public resources by BDT34 billion (\$429 million) over the plan period. In the scenario with no climate finance, the shortfall of BDT370 billion (\$5 billion) may be covered within the targeted public resourcing.

In the third case with neither private nor climate finance, and the public resource envelope constant at current levels of 0.8% of GDP, four projects would need to be delayed by a few years due to budget constraints. With the current phasing of projects, the total investment estimated in year 2021 is BDT226 billion (\$3 billion). This amount is BDT17 billion (\$214 million) more than the available fiscal envelope would be for 2021 in this third case, as shown in Figure 4.2.

Figure 4.2: Delta Plan Expenditures as Planned with Reduced Finance Targets

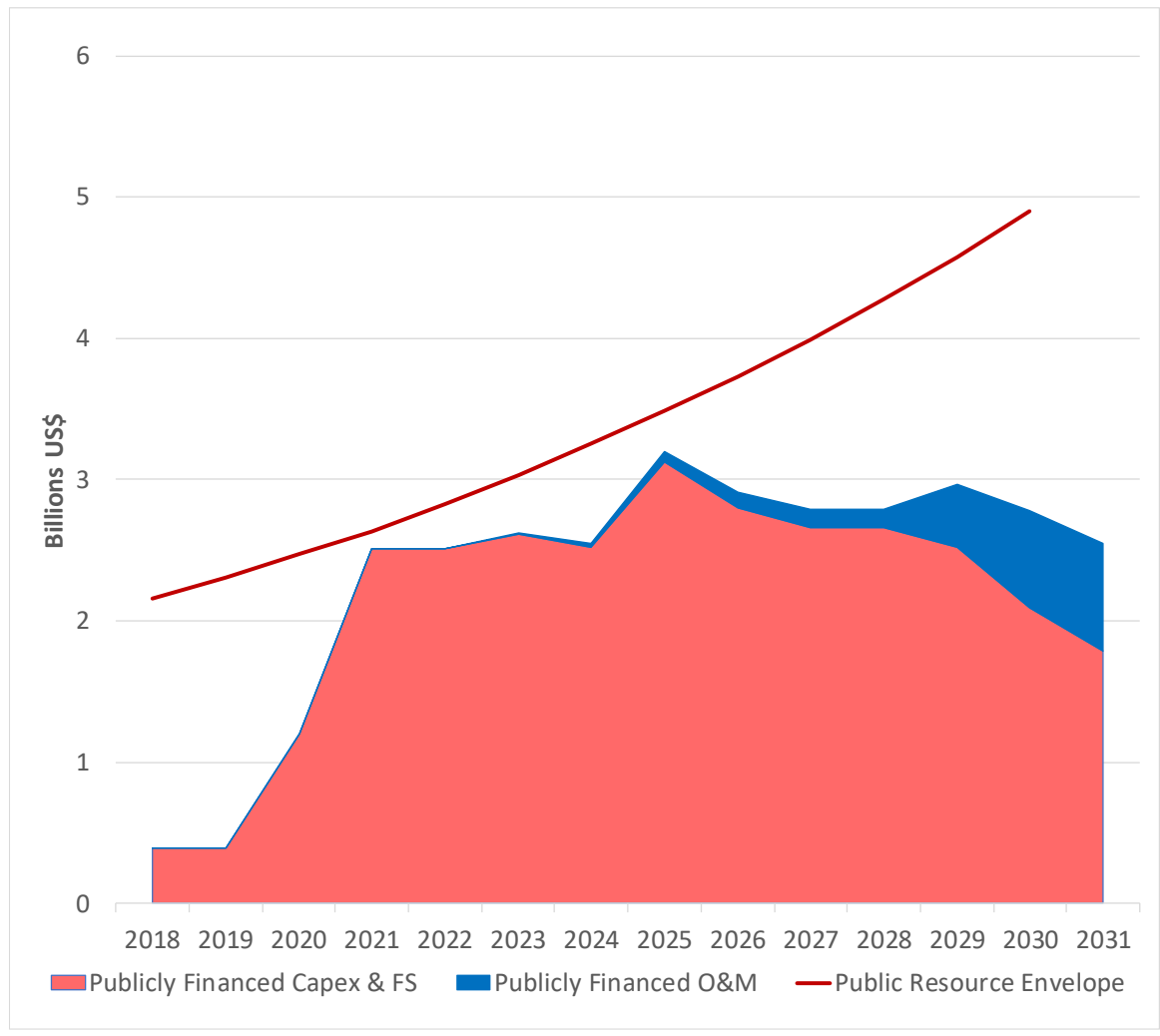


As described in section 2, when there is a budget constraint, the project with the lowest MCA-ranking infrastructure project would be postponed, followed by the next lowest-ranked project, and so on until the budget constraint is relieved. In this case, the following changes to the project phasing would be required:

- Construction for project CC16.19, Climate Resilient Livestock Production, would start in 2021 instead of 2018 and complete in 2026 instead of 2023
- The feasibility study for project DP15.3, Barind Area Fisheries Development Project, would start in 2020 instead of 2018 and complete in 2022 instead of 2020
- Construction for project CH26.1, Kaptai Lake Rehabilitation Study and Pilot Project, would start in 2022 instead of 2018 and complete in 2026 instead of 2022
- The feasibility study for project CC1.4, Development/Improvement of Multi-Purpose Disaster Shelters and its Management Information System (MDS&MIS), would start in 2022 instead of 2018 and complete in 2024 instead of 2020.

Four out of 80 projects would be delayed by up to four years. Figure 4.3 shows how the profile of Investment Plan expenditures would change in this case.

Figure 4.3: Delta Plan Expenditures Modified with Reduced Finance Targets



5 Policy and Institutional Reforms to Facilitate Implementation of the Investment Plan

To ensure the successful implementation and sustainability of the Investment Plan, policy and institutional reforms are planned so that an increasingly integrated and adaptive approach can be taken to planning and implementing investments in the Delta. The new Bangladesh Delta Commission will be responsible for ensuring that this is done.³⁹

The key functions of the Delta Commission will be national coordination, planning, programming, and assisting with resource mobilization. The Delta Commission will facilitate program and project preparation and implementation. It will monitor and evaluate progress on the Delta Plan, including delta investments; develop policies; and ensure the development and sharing of knowledge needed for adaptive delta management (ADM).

The Delta Commission will recommend fund allocations from a Delta Fund, which will consolidate the current Annual Development Program spending of 0.8% of GDP and manage it in a way that ensures integration between projects and application of ADM principles. Government, donor, and climate financing will be pooled in the Delta Fund. Total allocations to the Fund are expected to grow to 1.3% of GDP by 2025. This consolidation of funding will ensure integration between projects and application of ADM principles, and provide an ability to make multi-year funding commitments to projects, once the decision to proceed is made.

The Investment Plan itself will be updated annually to take emerging information into account. Once approved to go ahead, though, a project will be guaranteed funding through to completion. In time, funding will be devolved to decentralized institutions. This will happen progressively, as those institutions are created and gain capacity.

The Delta Commission and Fund will be the central instruments for ensuring that ADM and resilience to climate change are the guiding principles for implementing the Delta Investment Plan, and for progressively adapting it. New policies will apply the beneficiary-pays principle and attract private finance to delta projects. Public participation in Delta investment planning will be increased; policies reformed to increase coordination in key hotspots; and Delta management institutions will be streamlined and strengthened. The matrix in Appendix F (pp. 197-203) summarizes the policy and institutional reforms to underpin implementation of the Investment Plan.

5.1 Implementing and Adapting the Delta Investment Plan to Achieve Climate Resilience

The Delta Commission and Delta Fund will integrate ADM principles into Bangladesh's public financial management. The Investment Plan in this document is the first manifestation of this. The Delta Commission is expected to implement, adapt, and revise the Investment Plan through:

- Recommending the go-ahead of the physical projects listed for the first year, as well as the studies and capacity building

³⁹ The Delta Plan provides for the creation of a Delta Commission (BDP2100 Chapter 12.5(a) p.568). While the Delta Commission is being established, the Investment Plan may be managed by a similar coordinating committee, such as the Executive Committee of the National Water Resources Council.

- Encouraging development of alternative projects through the studies so that adaptation pathways become richer. More *Cluster 0+* and *Cluster 1* projects will be developed for possible implementation ahead of higher-risk or irreversible projects
- Updating the Plan annually as additional information and projects are developed. This will result in additional projects being added, and some projects being dropped. Others may be pushed back in the Plan, with their actual implementation date being determined by when a tipping point is reached, or when the effects of a project earlier in the adaptive pathway have been observed.

As projects and programs are approved, a multi-year budgetary commitment will be made to the project from the fund. This will ensure that, once started, projects can be completed in an efficient and timely manner.

Climate resilience

As the plan is implemented, climate resilience planning will be mainstreamed into project appraisal. Bangladesh is one of the most vulnerable countries in the world to the effects of climate change. Climate change is predicted to increase river flooding from rainfall, produce more frequent and intense periods of drought, increase coastal flooding and salinity intrusion from sea-level rise, and lead to more frequent and intense cyclones and storm surges.

All project feasibility studies slated to be done under the Investment Plan will consider each of the Delta Scenarios for climate change and economic development. This will be done consistently with the ‘Climate Fiscal Framework’ developed by the Finance Division of the Ministry of Finance (2014).

Feasibility studies will test whether projects are needed immediately. If they are not, then tipping points will be identified that indicate when a project should go ahead. If they are needed immediately, project design will consider the performance of the project under all Delta Scenarios, so that a design and phasing can be recommended that is robust to the unpredictability of the future. The one constant will be applying the latest information and ADM principles to project development, including by progressively adapting the Investment Plan and the projects within it.

Integration of land and water management

Bangladesh is a country of land and water. Developments in one inevitably affect the other. Saline intrusion hurts farmlands. Settlement in low-lying areas increases flood risks by increasing the amount of damage caused by flood events. In addition, upstream developments impact on downstream areas. Therefore, planning in the water and land use sectors needs to be integrated, as well as river system and estuary management. The Investment Plan does this by grouping projects by hotspot, and by the cross-cutting themes of preventing too much water, ensuring adequate water, and improving water quality. These groupings transcend agency and sector boundaries. Projects are also combined in programs that include both land and water elements.

As the Delta Commission adapts and refreshes the Investment Plan in the future, it is expected to reinforce the integration of land and water decisions. Projects that affect land in an area, and projects that affect water in that area, will both be funded from the Delta Fund. In recommending fund allocations, the Commission is expected to require consistency between land and water management. As an example, a project to create flood protection embankments

on the edge of a major city would need to be considered in light of factors such as whether this would encourage urban encroachment on valuable wetlands, or prevent drainage and create water-logging: both factors which might contribute to the very flooding that the project was intended to prevent.

Five-year rolling planning cycle

It is envisaged that annual updates to the Plan will adapt it to new information. A more comprehensive update of the Delta Investment Plan will be done on a five-year rolling cycle. Work on the first comprehensive refresh will start in 2021. At this point the Commission and other Delta agencies will have benefited from capacity building (to start in 2018), and will then have two years to develop comprehensive, integrated plans ready for the first major revision of the Investment Plan in 2023.

In this planning process, linkages between projects that serve common goals or interact with common hydrological systems will be identified, and once again sequenced along adaptation pathways. Tipping points for project commissioning will be identified, and information collection systems put in place to track progress toward those tipping points.

5.2 Introducing the Beneficiary-Pays Principle

In addition to introducing more flexible long-term public finance management practices through the Delta Fund, it is important to secure adequate funding for operations and maintenance. Without resources for operations and maintenance, water-related infrastructure cannot be properly maintained, and the effectiveness or quality of service decreases.

Wherever possible, operating and maintenance costs will be recovered from beneficiaries. As this is achieved, agencies will assess the extent to which users could be expected to contribute to capital costs. Beneficiary charges will progressively be increased toward full cost-recovery levels, subject to exceptions necessary to enable the provision of public goods and to ensure affordability of essential services for all.

In the near term, all water service providers will be required to cover 100% of operating and maintenance costs through their tariffs. Government will then assist the providers to develop plans to achieve full cost recovery through tariffs. Service standards will be set, monitored, and enforced. The goal is for the WASAs to provide high-quality, universal access to water and sanitation services in a financially sustainable way.

5.3 Creating an Enabling Environment for Private Sector Engagement

Public sector finance alone will not be sufficient to successfully implement the Delta Plan and Investment Plan. There is significant opportunity to increase private sector participation in the financing and implementation of Investment Plan projects.

The legal framework and institutions needed to attract private finance to infrastructure projects have been progressively established over the last decade, and are now ready to be used for Delta Plan investments. A PPP Authority was established in September 2010, and has since developed a pipeline of 23 projects with an estimated initial value of \$14 billion across several sectors. A PPP Law was enacted in September 2015. Contracts for seven PPP projects (estimated total value of \$1.3 billion) have been signed. The PPP Authority issued procurement

guidelines for solicited and unsolicited PPP projects in May 2016.⁴⁰ This is the framework that will be used for privately financed projects in the Investment Plan.

Although Bangladesh already has a strong foundation in PPPs, private finance for the types of Delta investments in this Plan has been negligible. Nevertheless, if a comprehensive reform agenda is implemented, significant private finance can be mobilized for these types of projects. The current Investment Plan identifies seven pioneer projects to be developed as PPPs on the Design Build Finance Operate Maintain (DBFOM) basis. These projects can then serve as the foundation to develop similar PPP projects in the future.

As part of the comprehensive reform agenda, promoting user- and beneficiary-pays principles as described above will provide the revenue sources to attract private finance. Tariffs will be reformed, with measures gradually phased in to reach cost-recovery levels while providing adequate protections for the poor. The capacity of the PPP Authority will be bolstered with increased resources and training to allow it to handle the volume of transactions expected in the Investment Plan.

The current Investment Plan identifies seven pioneer PPP projects. Implementing these projects will build capacity within the PPP Authority and line ministries to do similar PPPs. Additional capacity building will be needed, however, to scale up private finance to the levels targeted in the Delta Plan. International transaction advisors will be engaged for each transaction, working with members of the PPP Authority and implementing agencies throughout the process. In this way, capacity within each ministry will increase over time, and responsibilities will gradually be transferred from the transaction advisors to the Government agencies. In addition, members of the PPP Authority and implementing agencies will attend international training courses and be seconded to international PPP units with a track record of success.

As the Delta Commission is established, its investment-planning guidelines will require that, as part of each project's preparation, an assessment is made as to whether private finance of the project would be possible and offer net benefits for the country. Where it is found to be desirable for a project to be privately financed (in whole or in part), the PPP Authority will coordinate with the implementation agency to prepare the transaction and attract private finance. Because many projects will require a mix of public and private finance, the Delta Fund will be structured in such a way that it can provide viability gap grants and concessional loans to PPP projects that are part of the Delta Investment Plan.

The PPP Authority will work with implementing agencies on the Investment Plan projects identified as suitable for private finance. These projects will be developed and implemented in accordance with the standard PPP process. The PPP Authority will ensure that investment-grade studies on demand and costs are prepared; potential bidders are consulted, and their views considered in project structuring; and that world-class competitive procurement processes are followed. To ensure access to best international practices, the Government will work with development partners who are willing to assist in project feasibility studies and transaction advice.

⁴⁰ http://www.pppo.gov.bd/events2016_first-board-of-governors-meeting-Under-the-ppp-act.php

5.4 Engaging the Public

Stakeholders have emphasized the need for participatory water management. Engagement of local stakeholders helps enormously in planning, operating, and maintaining water-related works properly. Bangladesh has already developed Guidelines for Participatory Water Management.⁴¹ These have not been fully implemented yet. In carrying out the Investment Plan, the Guidelines will be reviewed, updated, and then implemented with a focus on:

- Establishing local water bodies to manage the operations and maintenance of water-related infrastructure
- Aligning Water Management Organizations with the institutional framework, and providing formal service agreements defining their roles, responsibilities, and financial arrangements
- Identifying knowledge gaps, and providing training and capacity building to Water Management Organizations, particularly on implementing projects following the ADM approach
- Empowering and encouraging local government institutions to follow ADM principles in managing water resources
- Ensuring representatives of water users are also included in water resource planning.

Public engagement and support are also essential to sustaining good water management practices. Capital investments and infrastructure are not enough if individual practices do not also adapt. Government will develop public awareness initiatives in areas including:

- Improving agricultural water productivity by shifting to less water-intensive crops, implementing more efficient irrigation techniques, and applying other existing technology solutions
- Investing in sustainable wastewater treatment models to increase urban wastewater treatment and recycling
- Conserving water, and the role of subsidies and user charges in incentivizing responsible, sustainable, and adaptive water use.

5.5 Policy Reforms to Increase Coordination in Hotspots

Because the Delta Plan addresses many water resource and water management issues, one key policy reform will be to mainstream ADM principles into existing water sector-related policies and regulations, as well as policies and regulations for other sectors. These include the National Water Policy (1999), and policies on land use, aquaculture, and coastal zone management.

Because Bangladesh is a land of rivers, issues outside of the water sector, such as agriculture, forestry, and land use, are inextricably linked with water issues. Therefore, intersectoral coordination and collaboration are essential. In addition to mainstreaming ADM principles into the existing policies and regulations, policies and regulations across sectors will be reviewed to ensure that they are consistent with and support one another.

⁴¹ Ministry of Water Resources, Government of the People's Republic of Bangladesh. (November 2000). Guidelines for Participatory Water Management.

National Water Policy

The National Water Policy's objectives are to address water management issues, ensure availability of water, accelerate the development of water delivery systems, decentralize water management, develop a sound legal and regulatory environment, and build knowledge for water resource management. All these elements are critical for successful implementation of the Investment Plan. WARPO is responsible for periodically updating the National Water Policy, and will work with the Delta Commission to update the policy to incorporate ADM principles.⁴²

National Land Use Policy

To promote coordination between land and water management in the Delta, the National Land Use Policy will be reviewed and updated in coordination with updating of the National Water Policy. The National Land Use Policy will provide for:

- Establishing principles to guide management of land use planning, including land tenure reform, displacement and settlement issues, and natural disaster planning⁴³
- Reforming the land administration and land zoning process to provide greater legal clarity
- Implementing computer systems for land registration and record, land surveys, and a Digital Land Management System to integrate land ownership records nationally and to provide easily accessible records for the people
- Governing land reclamation, including by enacting laws governing the land reclamation process and rights to newly formed land. This is important to ensure equitable benefits; to provide adequate protection against possible negative social and environmental effects; and to provide a legal framework for engaging with the private sector in case there is the opportunity to develop any such projects as PPPs
- Managing sediment in all its forms. Accretion and erosion are major forces in the Bangladesh Delta, and many investment projects are aimed at sediment management in one way or another, be it through cross-dams for land reclamation, or dredging for channel navigability. The Government will therefore develop a national policy for sediment management
- Controlling river basin settlement to promote environmental protection, land use planning, and to help limit economic and social damages from flooding. The policy will address protecting rivers from encroachment and demarcating riverbanks, courses, and wetlands.

Related policies

Additional policies will be developed to cover the following hotspots and delta management issues:

- **Strategic environmental and social assessments**—Water, environment, agriculture, and irrigation are key sectors of the Investment Plan. To promote holistic planning, the Government's policy is that strategic assessments will be

⁴² National Water Policy (1999) Section 4.2(b).

⁴³ National Water Management Plan, Volume 2, p. 12.

undertaken for each of these sectors. For individual projects, environmental impact assessments (EIAs) will be conducted along with social impact assessments, and a rigorous standard will be applied for both to form part of the project selection and development process for the Investment Plan

- **Sustainable aquaculture policies**—Fisheries and aquatic crops form an increasingly important part of Bangladesh’s economy. Policies to promote sustainable, environmentally responsible development of aquaculture will be developed, to ensure that aquaculture investments operate within a clear and responsible framework
- **Integrated Coastal Zone Management Plans (ICZM)**—the Government’s policy is to establish integrated coastal zone management plans for each of the country’s unique coastal zones. Nowhere is this more important than in the Sundarbans, a vital ecological asset for the country. In this area, an Integrated Coastal Zone Management Plan that provides for mangrove conservation and plantation will help ensure that initiatives are aligned and cohesive.

5.6 Reforming and Strengthening Institutions

Policy reforms will be complemented with reforms to ensure that institutions are properly structured and empowered to carry out their functions. During consultations to develop the Investment Plan, line ministries highlighted overlapping and sometimes contradictory mandates across implementing agencies as a barrier to adaptive delta planning. The Government will therefore review the mandates of agencies and governance bodies related to the Delta Investment Plan, with a view to avoiding overlap, conflicts, areas of inflexibility, and gaps in representation. Mandates will be reformed, and improved coordination established, to facilitate holistic water resource management approaches, linking together the management of water security, food security, environment sustainability, economic growth, and social and institutional development.

Cross-sectoral and inter-agency coordination is critical for successful implementation of the Investment Plan. As described in Section 2, these programs are a mechanism to promote coordination. By grouping together projects that are similar, or closely linked, programs make it possible to develop common implementation approaches. The programmatic approach creates economies of scale, increases consistency in policy development and implementation, may streamline funding, and simplifies both internal and external communications.

Under the guidance of the Delta Commission, a steering committee and implementing agency will be appointed for each hotspot program or sub-program. The steering committee and implementing agency for each program and sub-program will provide the institutional framework to coordinate implementation. The steering committee will include the implementing agency, and other agencies with whom coordination is vital for success. As an example, the Bangladesh Water Development Board will be the implementing agency for the polder sub-program, while the steering committee will include the Department of Livestock Services and the Department of Fisheries (among others); since helping people to make the polders productive is essential to achieve the ultimate goals of the program. Similarly, while the Haor sub-program would be implemented by the Haor and Wetland Development Department, the steering committee would include the Department of Agricultural Extension and the Department of Fisheries.

The role of the steering committee will be to review and monitor program implementation, and to resolve any interdepartmental differences related to the implementation of the projects. The steering committee will also advise on how to prioritize components of the projects. The implementation agency will be responsible for the actual implementation, and for reporting progress to the steering committee. For more details on the program and institutional arrangements, see Appendix E (pp. 183–189).

Other areas of institutional reform that are already contemplated are:

- **National Agricultural Extension**—Improving coordination and resolving conflict among agencies related to crops, livestock, fisheries, and water resources at the local and national levels⁴⁴
- **Inland Water Transport**—Improving coordination and clarifying allocation of responsibilities for navigation and other inland water issues between the BDWB, Department of Shipping, BIWTA, BIWTC, and the port authorities
- **Establishing a Sundarbans Planning Agency**—The Sundarbans are a vital ecological asset for Bangladesh. Having an agency for this unique area will provide dedicated resources to the study, restoration, and preservation of the Sundarbans, and for development of the Integrated Coastal Zone Management Plan mentioned above.

The implementing agencies for the Investment Plan need capacity building to implement the projects successfully. Capacity building for monitoring and evaluating projects is also needed. To this end, BWDB will be assisted to improve capacity to assess ecological, environmental, and social components of water management projects. These components are essential to planning and implementing projects in an adaptive and holistic manner.⁴⁵

Capacity building will also be provided for the Implementation Monitoring Evaluation Division (IMED), WARPO, and relevant monitoring and evaluation (M&E) units of other agencies to fully assess the effects (positive and negative) of adopting ADM measures. Currently, M&E focuses on tracking expenditure against project budgets. To improve the effectiveness and usefulness of M&E, this will be expanded to tracking project performance against quantifiable development results.

⁴⁴ BDP 2100 DRAFT, Chapter 13.

⁴⁵ Final Report on Institutional Improvement of BWDB, November 2014. Water Management Improvement Project.

6 Monitoring and Evaluation

The integrated and adaptive strategies for management of the Bangladesh Delta set out in BDP 2100 aim to manage uncertainties and risks appropriately. This requires careful monitoring and evaluation, not just of the implementation of the plan, but of environmental, economic, and social developments across the Delta. The overall approach to monitoring and evaluation (M&E) of BDP 2100 is set out in Chapter 13 of that document, while the creation of a Delta Knowledge Hub and data management systems that will (among other things) facilitate monitoring and evaluation is set out in Chapter 14. The Investment Plan includes several important projects that will enable real-time monitoring of developments in the Delta.

Overall monitoring and evaluation of the Delta Investment Plan itself will be the responsibility of the Delta Commission as a part of its role under the Delta Act. The Delta Commission will roll up into its overall system the monitoring of individual projects and policies done by the agencies and ministries responsible. The central component of the Delta Monitoring and Evaluation System will be the Delta Investment Plan Results Forecasting and Monitoring Framework, presented in Appendix G (pp. 204–214).

A BDP 2100 knowledge portal will be set up for tracking projects undertaken under BDP 2100, based on a development results framework (DRF). This constitutes the Monitoring and Evaluation (M&E) of the overall BDP 2100. The Delta Investment Plan Results Forecasting and Monitoring Framework will be part of this. Using this system, it will be possible for all stakeholders to assess the quality, relevance, and adequacy of the Investment Plan projects, and the need for changes due to new developments or evidence on influential factors like climate change.

Monitoring and evaluation of the Investment Plan will supply information on the physical and financial progress of projects in the regional hotspot programs and for the IP as a whole. Three types of reports will be produced.

- **Annual progress report** of the Investment Plan implementation, done on an annual cycle to inform the annual monitoring and adaptation of the Investment Plan
- **Medium-term assessments** done three years into the planning implementation period. These assessments will go beyond reporting on progress indicators to assess what is working, what is not, and why. The medium-term assessments will inform the development of the next five-year rolling plan
- **Five-yearly reports.** These will report on what was achieved over the five years of plan implementation, and complement new plans setting out what will be done for the coming five years.

Monitoring and evaluation capacity building will be coordinated with knowledge-gathering and data-management initiatives to ensure adequate and accurate information for measuring results. Having adequate, reliable data is essential to the M&E process. Therefore, as the scope of M&E expands, the knowledge base must match. The creation of a Delta Knowledge Bank managed by WARPO will facilitate this. Good-quality M&E will allow implementing agencies to adapt projects to changing circumstances. A sound knowledge base will also provide implementing agencies with the best information to develop new projects in line with ADM principles.