

Part 1

The Plan

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 activity⁴. 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 sixth 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 vulnerabilities⁵. 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 programmes, with the long-term goals of sustained development based on climate-sensitive management⁶.

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.

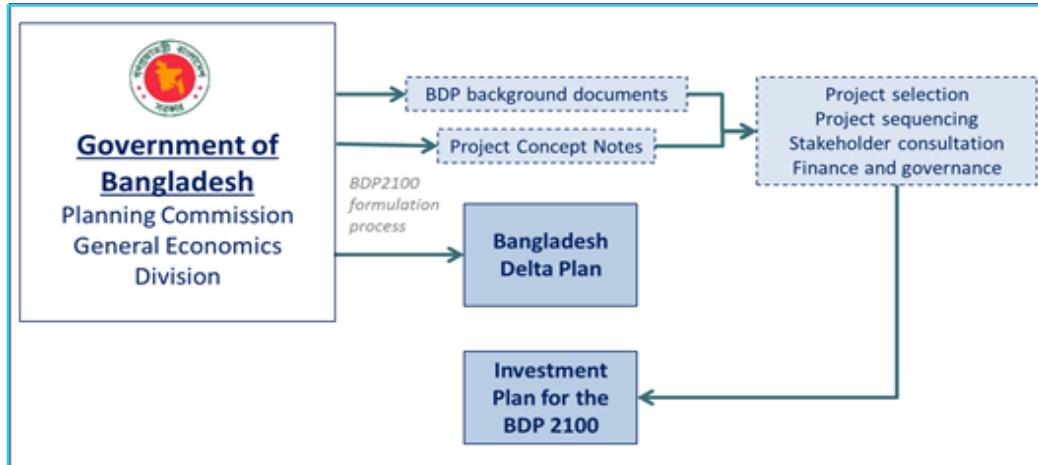
4 BDP 2100, Volume 1: Strategy.

5 BDP 2100, Volume 1: Strategy

6 BDP 2100, Volume 1: Strategy

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 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 first⁷. An integrated, comprehensive and long term delta vision might be formulated as:

"Achieving safe, climate resilient and prosperous delta"

The Mission for BDP 2100 formulated as:

"Ensure long term water and food security, economic growth and environmental sustainability while effectively reducing vulnerability to natural disasters and building resilience to climate change and other delta challenges through robust, adaptive and integrated strategies, and equitable water governance".

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 preferably 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 programmes 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.

⁷ BDP 2100, Volume 1: Strategy

Projects in the plan were proposed by more than 20 agencies involved in investments in the Delta⁸. As part of the Delta Plan formulation process, the ministries that are involved in the Delta related works were requested 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).

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 resources⁹.

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 it¹⁰. 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.

⁸ For a complete list of agencies, see Appendix C of Part 2 (pp 158-160)

⁹ BDP 2100, Volume 1: Strategy, p xvii

¹⁰ BDP 2100 Volume 2: Investment Plan, Part 3: Appendix I. This appendix covers only projects with sufficient information available to conduct a costs and benefits analysis

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.

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 each¹¹. The six geographic hotspots are as follows:

- **Coastal Zone**, comprising areas belonging to 19 coastal districts with an area of 27,738 square kilometers
- **Barind and Drought Prone Areas**, comprising 18 districts with an area of 22,848 square kilometers
- **Haor and Flash Flood Areas**, comprising 7 districts with an area of 16,574 square kilometers.
- **Chattogram Hill Tracts**, consisting of 3 districts and an area of 13,295 square kilometers¹²
- **River Systems and Estuaries**, comprising areas belonging to 29 districts along River Systems and Estuaries with an area of 35, 204 square kilometers
- **Urban Areas**, consisting of 7 districts with an area of 19,823 square kilometers

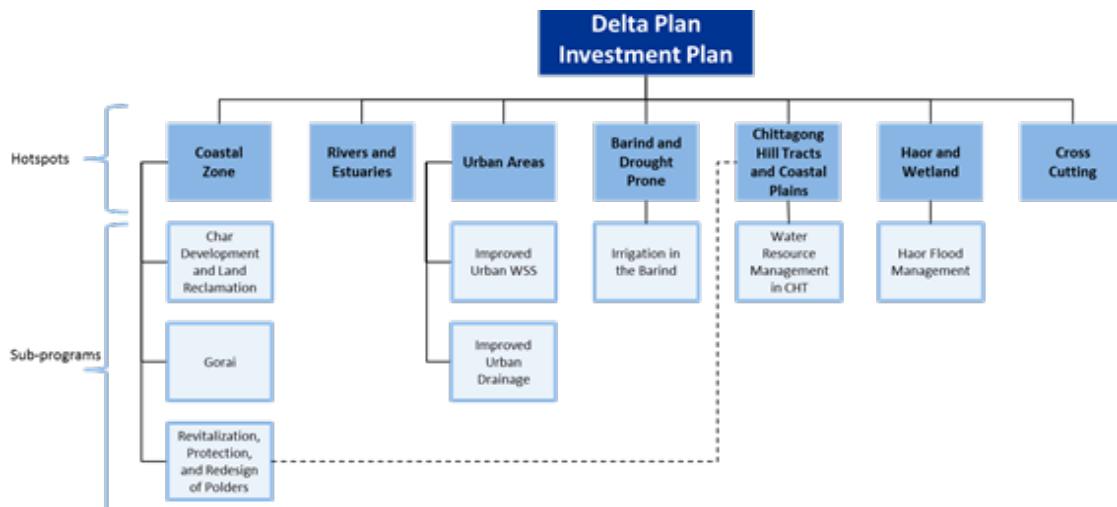
A seventh cross-cutting hotspot addresses common issues that cut across the six geographical hotspots.

¹¹ BDP 2100, Volume 1: Strategy (p 7)

¹² The Chattogram Hill Tracts hotspot, as defined in the BDP 2100

Where appropriate, similar projects in a hotspot are grouped together into sub-programmes, 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-programme. This sub-programme 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 programme 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-programme for the Gorai aims to facilitate coordination in planning and implementation of projects in that area.

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



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

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

Prioritization and Sequencing

Within each hotspot programme, 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:

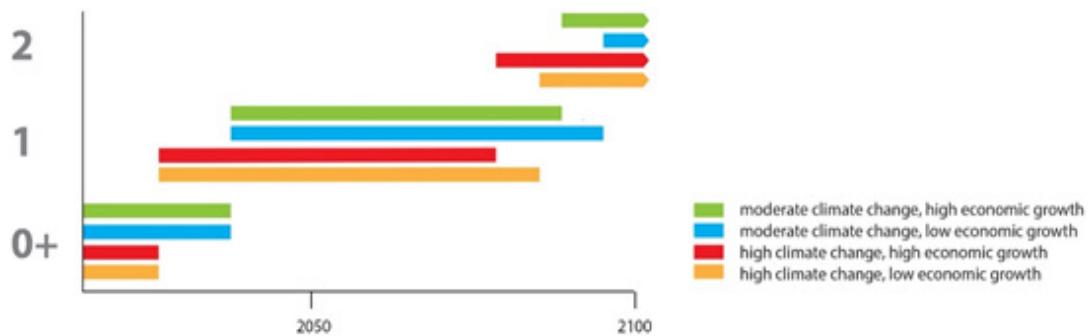
- Improvement of current system (Cluster 0+): These projects are often the low-hanging fruit or no-regrets improvements, making what already exists work better. Examples include rehabilitating existing embankments or drainage systems. Generally, it makes sense to do these projects first, before doing 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 Utrirchar-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)¹³. 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 Chattogram 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 Chattogram 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-Narayanganj-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.

¹³ BDP 2100, Volume 1: Strategy (p 179)

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.

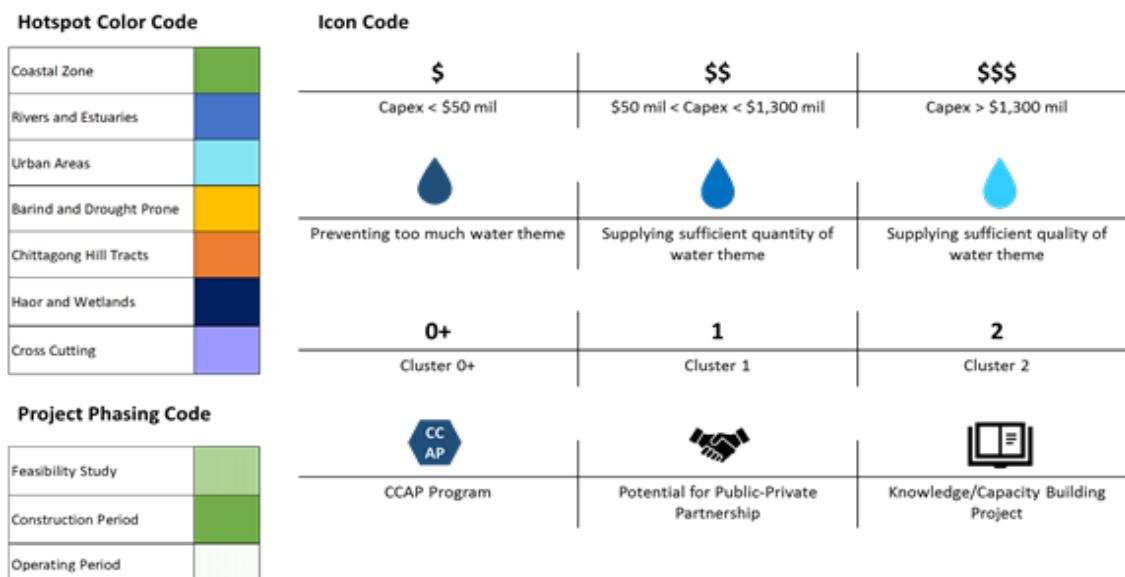
3 Investment Plan Projects and Sequencing

The first Delta Investment Plan that accompanies Bangladesh's first Delta Plan is set out in. 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-programmes 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



It 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^{14, 15}.

¹⁴ Capital costs for all projects are taken from the Project Concept Notes developed through the BDP 2100 formulation process

¹⁵ Average 2015 BDT to USD exchange rate (<https://www.oanda.com/currency/average>)

The projects are grouped by hotspot programme. 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-programmes are connected by arrow brackets, with the name of the sub-programme.

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

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 Gumi - 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 Gora-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 Gora-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 Gumi - 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 Costal 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 Chandona-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

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/CZ1.2	\$																	CC AP	0+	0+			
CZ 1.11	\$																	CC AP	0+	0+			
CZ 1.26	\$\$																	CC AP	0+	0+			
CZ 1.3	\$																	CC AP	0+	0+			
CZ1.48		\$\$																CC AP	0+	0+			
CZ1.41		\$\$																CC AP	0+	0+			
CZ1.44		\$\$\$																CC AP	0+	0+			
CZ1.40		\$\$\$																CC AP	0+	0+			
CZ1.45		\$\$																CC AP	0+	0+			
CZ1.47		\$\$																CC AP	0+	0+			
CZ1.30		\$\$																CC AP	0+	0+			
CZ12.6	\$																	CC AP	0+	0+	0+		
CZ1.39	\$																	CC AP	0+	0+			
CZ1.52	\$																	CC AP	0+	0+			
CZ1.53	\$																	CC AP	0+	0+			
CZ4.1	\$																	CC AP	0+	0+	0+		
CZ 1.4	\$																	CC AP	0+	0+			
CZ 1.5	\$																	CC AP	0+	0+			
CZ 1.7			\$\$															CC AP	1	1			
CZ 1.6				\$\$														CC AP	1	1			
CZ12.8		\$\$																CC AP	0+	0+	0+		
CZ17.1	\$																	CC AP	0+	0+			
CZ 1.1					\$\$\$													CC AP	2	2			
HOTSPOT: Rivers and Estuaries																							
MR 1.2	\$																	CC AP	0+	0+			
MR 1.5	\$																	CC AP	0+	0+			
MR 1.1			\$\$\$															CC AP	0+	0+			
MR 1.46				\$\$\$														CC AP	1	1			
MR 3.1		\$\$																CC AP	0+	0+			
MR 1.6		\$																CC AP	0+	0+			
MR12.1		\$\$																CC AP	0+	0+			

Investment Plan Portfolio of Projects				Total Capital Costs	
Project Code	Name	Description	BDT (mil)	US\$ (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 124km ² of Dhaka City; mitigate damage and loss of life and wealth due to flooding by the Buriganga 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 Halti	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	

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+	0+	0+	
UA.10.1																				CC AP	0+	0+	0+	
UA.11.1																				CC AP	0+	0+	0+	
UA.3.1		\$\$												Improved Urban Drainage Program				CC AP				0+	0+	
UA.9.3		\$\$																CC AP				0+	0+	
UA.1.2		\$\$												Handshake CC AP				1				0+	0+	
UA.9.1 (20.1)		\$\$\$												Handshake CC AP				0+				0+	0+	
UA.9.1		\$\$												Handshake CC AP				0+				0+	0+	
UA.23.2		\$																0+				0+	0+	
UA.23.1		\$\$								Improved Urban Water Supply and Sanitation Program				Handshake CC AP				1				0+	0+	
UA.9.2		\$\$																0+				0+	0+	
UA.1.1		\$\$												Handshake CC AP				1				0+	0+	
HOTSPOT: Barind and Drought Prone																			CC AP				0+	0+
DP.1.21		\$\$												CC AP				0+				0+	0+	
DP.1.3		\$\$												Handshake CC AP				1				0+	0+	
DP.1.1		\$\$												Handshake CC AP				0+				0+	0+	
DP.1.2		\$\$												CC AP				0+				0+	0+	
DP.14/1.5		\$\$								Irrigation in the Barind Program				Handshake CC AP				0+				0+	0+	
DP.25.1		\$												Book CC AP				0+				0+	0+	
DP.25.2		\$												Book CC AP				0+				0+	0+	
DP.25.3		\$												Book CC AP				0+				0+	0+	
DP.15.3		\$																0+				0+	0+	
HOTSPOT: Chittagong Hill Tracts																			CC AP				0+	0+
CH1.11		\$												CC AP				0+				0+	0+	
CH1.10		\$\$								Revitalization, Protection, and Redesign of Polders Program				CC AP				0+				0+	0+	
CH26.2		\$								Water Resources Management Program in Chittagong Hill Tracts				Book CC AP				0+				0+	0+	
CH9.2		\$\$																0+				0+	0+	
CH12.4		\$\$												CC AP				0+				0+	0+	
CH26.1		\$																0+				0+	0+	
CH1.1		\$																0+				0+	0+	
CH26.5						\$				\$								1						

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 Netwrok & 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	

Investment Plan Portfolio of Projects		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	\$\$																		CC AP	0+	0+			
Haor Flood Management Program																								
HR 1.1	\$\$																		CC AP	0+	0+	0+	0+	0+
HR 2.4	\$																		CC AP	1	1			
HR 14.1	\$																			0+	0+			
HR 15.4/5	\$\$																			0+	0+			
HR 14.3																			CC AP	1	1			
HOTSPOT: Cross Cutting																								
CC18.5	\$\$\$																		CC AP	0+	0+	0+	0+	0+
CC12.37	\$\$																		CC AP	0+	0+	0+	0+	0+
CC1.4	\$\$\$																		CC AP	0+	0+	0+	0+	0+
CC1.3	\$																		CC AP	0+	0+	0+	0+	0+
CC 1.41	\$																		CC AP	0+	0+	0+	0+	0+
CC 1.43	\$\$																			0+	0+	0+	0+	0+
CC9.18	\$\$																		CC AP	0+	0+	0+	0+	0+
CC9.10	\$\$																			0+	0+	0+	0+	0+
CC9.11	\$\$																		CC AP	0+	0+	0+	0+	0+
CC9.17	\$\$																		CC AP	0+	0+	0+	0+	0+
CC9.13	\$\$																			0+	0+	0+	0+	0+
CC 1.45	\$\$																			0+	0+	0+	0+	0+
CC1.46	\$																			1	1	1	1	1
CC9.12	\$\$																			0+	0+	0+	0+	0+
CC 16.19	\$																			0+	0+	0+	0+	0+

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 Barind and Barind and Drought Prone Areas Hotspot

In the Barind and Barind and Drought Prone Area, 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 o+ projects that can advance immediately.

Three more Cluster o+ 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 o+ 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 o+ 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 o+ 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.

3.3 Haor and Flash Flood Areas Hotspot

The Investment Plan contains six projects for the Haor and Flash Flood Areas 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 o+ 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 o+ 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 Programme 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.

3.4 Chattogram Hill Tracts Hotspot

Eight projects are planned for the Chattogram 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 Chattogram Hill Tracts' is planned after the completion of project CH26.2 for the same reason.

3.5 River Systems and Estuaries Hotspot

The River Systems 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 River Systems 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.

3.6 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 protection schemes, two aim to protect parts of the Dhaka metropolitan area. The first of these is a Cluster 0+ project to improve drainage and raise floodwall heights in the Dhaka-Narayanganj-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 Chattogram (UA10.1), Barishal (UA11.1), Khulna (UA3.1), as well as the Barishal, Sylhet, Rangpur, Cumilla, 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 Barishal, Sylhet, Rangpur, Cumilla, 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).

3.7 Cross-Cutting Area

The last section of the Investment Plan contains 15 projects, each of which cut across multiple hotspots. The total capital expenditure¹⁶ across these projects is estimated at BDT689 billion (\$9 billion). Among the 15 projects, 14 are classed as Cluster o+. 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 o+ 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 o+ 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.

¹⁶ Including the cost of the feasibility studies

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 Programme 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)¹⁷. 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 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 programme, 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 River System and Estuaries.

¹⁷This 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

Table 3.1: Investments by Hotspot Programme

Hotspot	Total Capital Expenditure		Total Feasibility Study Costs		Total Costs	
	BDT (mil)	\$ (mil)	BDT (mil)	\$ (mil)	BDT (mil)	\$ (mil)
867,501	10,931	16,860		212	884,361	11,143
Barind and Barind and Drought Prone	160,965	2,028	2,181	27	163,145	2,056
Haor and Flash Flood	27,511	347	471	6	27,982	353
Chattogram Hill Tracts	58,798	741	1,067	13	59,865	754
River System 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
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 Programme

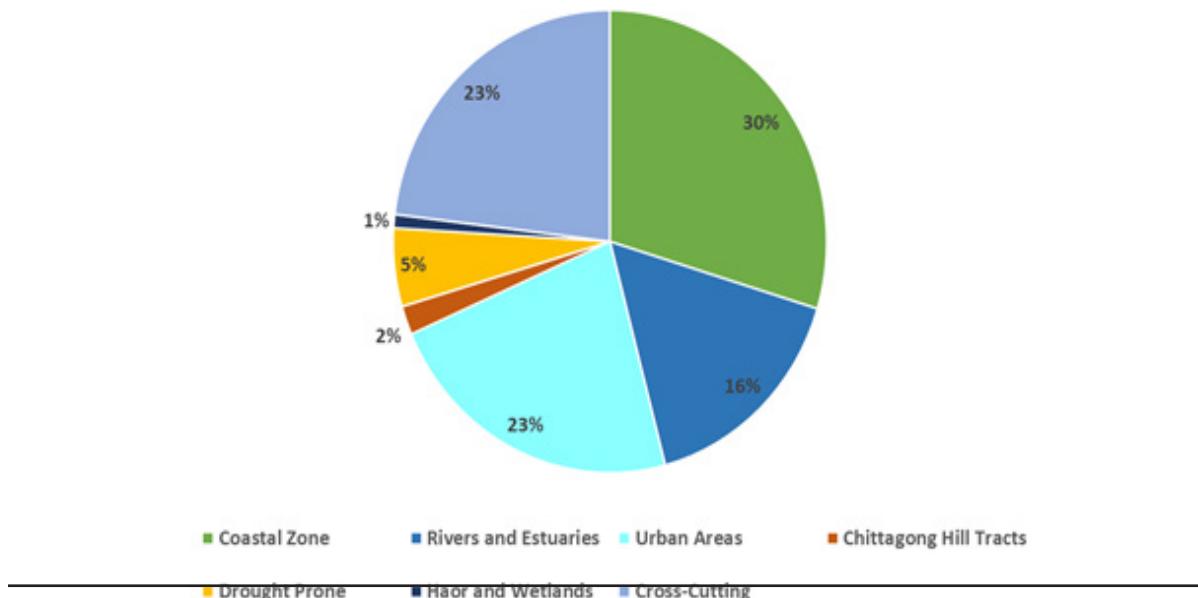


Table 3.2 shows the total investment by theme. Most investments are for the theme preventing too much water, followed by supplying sufficient quantity of water, and supplying sufficient quality of water. Some themes are more prominent in some hotspots than in others. Projects that fall under multiple 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
Barind and Drought Prone	107,565	1,355	159,494	2,010	3,652	46
Haor and Flash Flood	17,269	218	5,896	74	16,609	209
Chattogram Hill Tracts	44,067	555	16,641	210	5,467	69
River System 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
Cross-Cutting	493,371	6,216	190,400	2,399	40,264	507
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

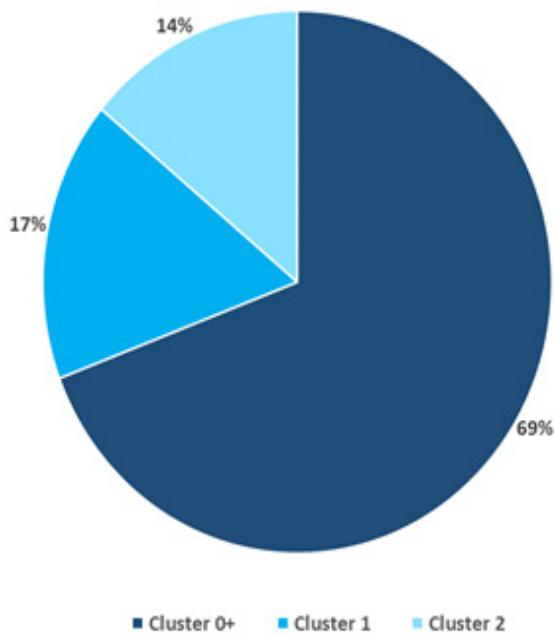
Hotspot	Theme 'Preventing Too Much Water'		Theme 'Supplying Sufficient Quantity of Water'		Theme 'Supplying Sufficient Quality of Water'	
	BDT (mil)	\$ (mil)	BDT (mil)	\$ (mil)	BDT (mil)	\$ (mil)
Public Capital Expenditure (without Climate Finance)	1,427,968	17,992	1,203,414	15,163	523,872	6,601
Climate 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	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	462,472	5,827	5,002	63	416,887	5,253
Barind and Drought Prone	71,833	905	91,312	1,151	0	0
Haor and Flash Flood	23,615	298	4,367	55	0	0
Chattogram Hills Tracts	59,227	746	638	8	0	0
River System and Estuaries	187,014	2,356	295,596	3,725	0	0
Urban Areas	570,024	7,182	101,499	1,279	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

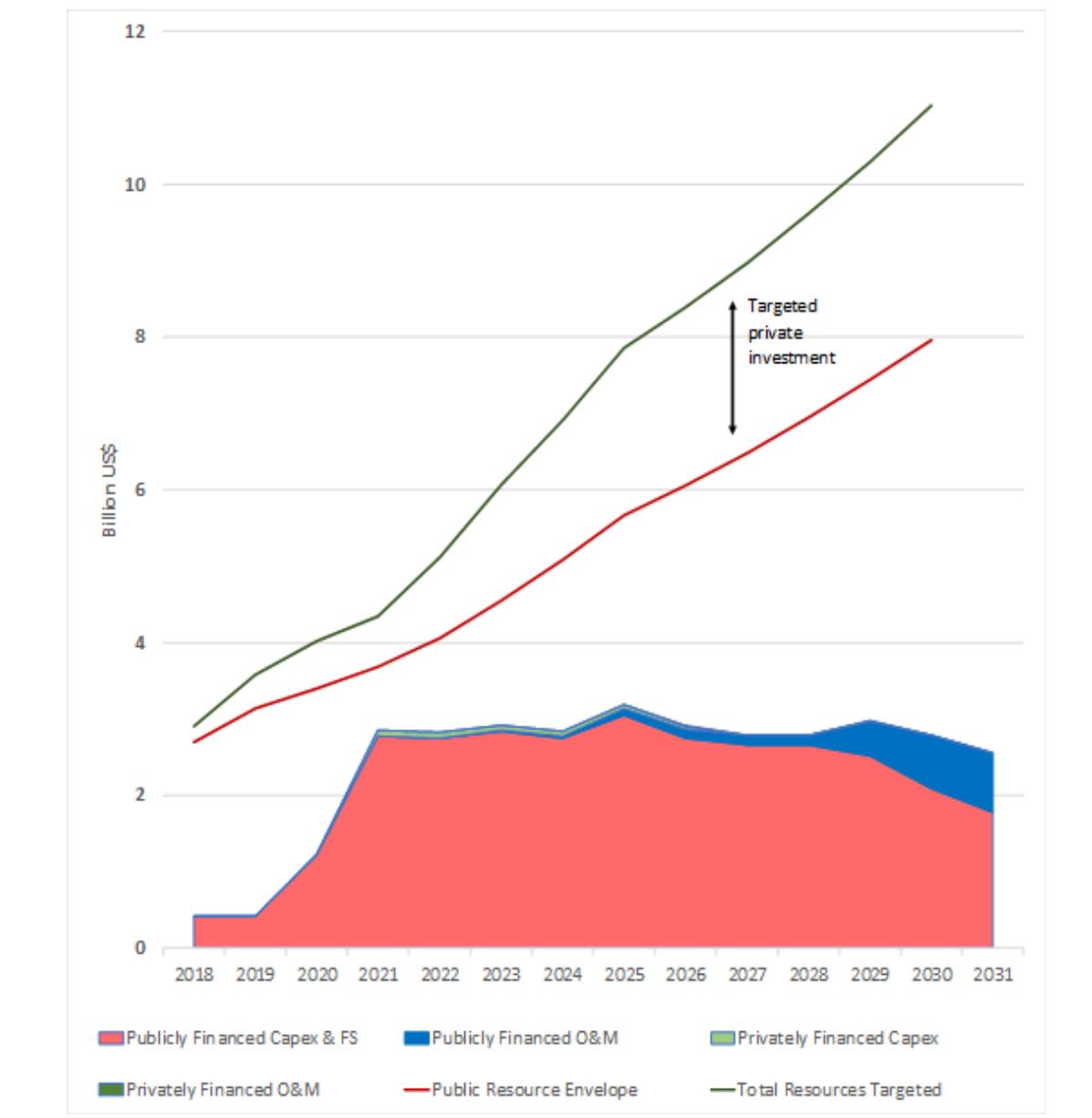
Figure 3.4: Investments by Cluster



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 costs¹⁸, 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



¹⁸ 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 FY2025¹⁹; and to be sustained at that percentage thereafter²⁰. 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 4.1²¹. 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 manageable²².

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 Programme, 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.

¹⁹ The targeted fiscal allocation percentages for Delta investments are taken from Figure 11.3 of the BDP 2100, Volume 1: Strategy (pp 558-559)

²⁰ BDP 2100, Volume 1: Strategy, Chapter 11

²¹ Although the figure only shows up to 2031, the resource envelope and Investment Plan expenditures continue beyond this date

²² BDP 2100, Volume 1: Strategy, Chapter 11

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.

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 country²³.

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 1996–2015²⁴. 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 intrusion²⁵. 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

²³ BDP 2100, Volume 1: Strategy, Chapter 11

²⁴ 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

²⁵ 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

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 Programme (CCAP). The CCAP is a holistic programme 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.

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 CCAP²⁶

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 programme 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

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.

The CCAP facilitates the process of obtaining climate finance. By presenting an entire programme 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 Programme 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 programmes 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)²⁷. More than 40 PPP projects are currently under development.

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 off takers. 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.

²⁷ <https://ppi.worldbank.org/snapshots/country/bangladesh>

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 Esti- mated	PPP Groups	Project	
			B D T bil	U S \$ 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 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 programme 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 off takers, 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 costs²⁸. 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 water²⁹. 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.

²⁸ BDP 2100, Volume 1: Strategy, Chapter 11

²⁹ Investment Plan Volume 2 Appendix H.5.2 (pp 235-238)

For the irrigation sector, private finance of 20% or more of the capital costs of irrigation projects may be possible at current market rates³⁰. 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 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 financed³¹. 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-Chattogram Expressway. The proposed Dhaka-Chattogram Expressway toll rate was calculated based on a willingness-to-pay study conducted for that expressway. The Dhaka-Chattogram 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.

³⁰ Investment Plan Volume 2 Appendix H.2.2 (pp 221–225)

³¹ Investment Plan Volume 2 Appendix H.6.2 (pp 241-245)

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 elaborates³². 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 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 	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. 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. ³³	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.
Inland water transport 	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.	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.
Dredging and/or land reclamation 	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 reclamation have attracted the most interest from private sector operators.	BIWTA is currently developing a master plan for the sector that envisages seven-year performance-based contracts for dredging.
Water supply and sewerage services 	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. WASAs may also contract for provision of wastewater treatment services by private plants, or commercial	Since 1990, more than 260 water PPP contracts have been awarded in the developing world ³⁴ , including 13 in India over the past 10 years alone ³⁵ . A preliminary market assessment for a sewage treatment plant in Dhaka indicates strong interest from the private sector ³⁶ . 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

³³ Investment Plan Volume 2 Appendix H.2.2 (pp. 221–223)

³⁴ World Bank 'Public Private Partnerships for Urban Water Utilities: A Review of Experiences in Development Countries', 2010

³⁵ 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>)

³⁶ Castalia, 'Preliminary Market Assessment for PPPs in Bangladesh Sewerage Treatment Plants', 2017

PPP Project Group	Description and Rationale	Precedent
	effluent producers such as garment factories may pay for services from privately financed central effluent treatment facilities.	and other protections. Analysis of the Gazipur City Corporation Integrated Waste Water Project also indicates that private finance is viable. ³⁷
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>

³⁷ 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.

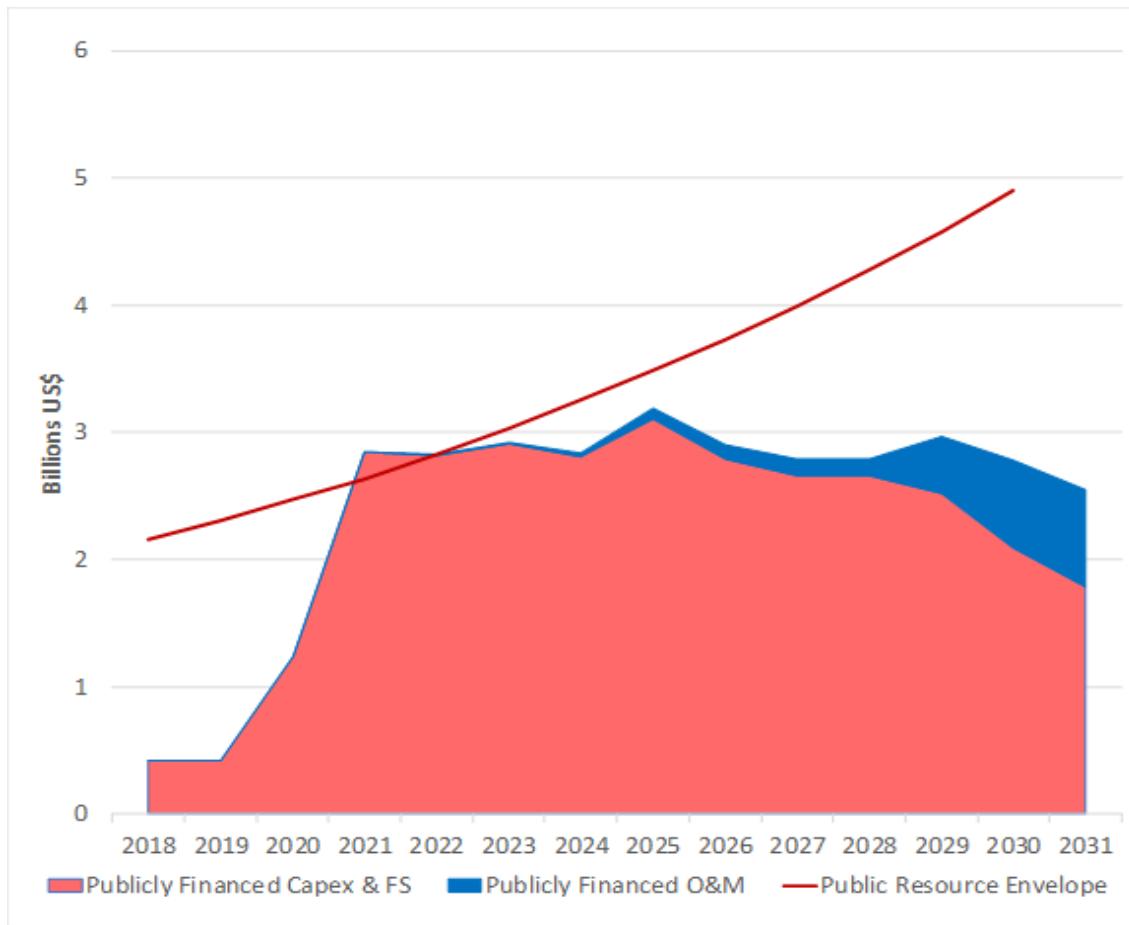
Table 4.4: Results of Finance Plan Scenario Analysis

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

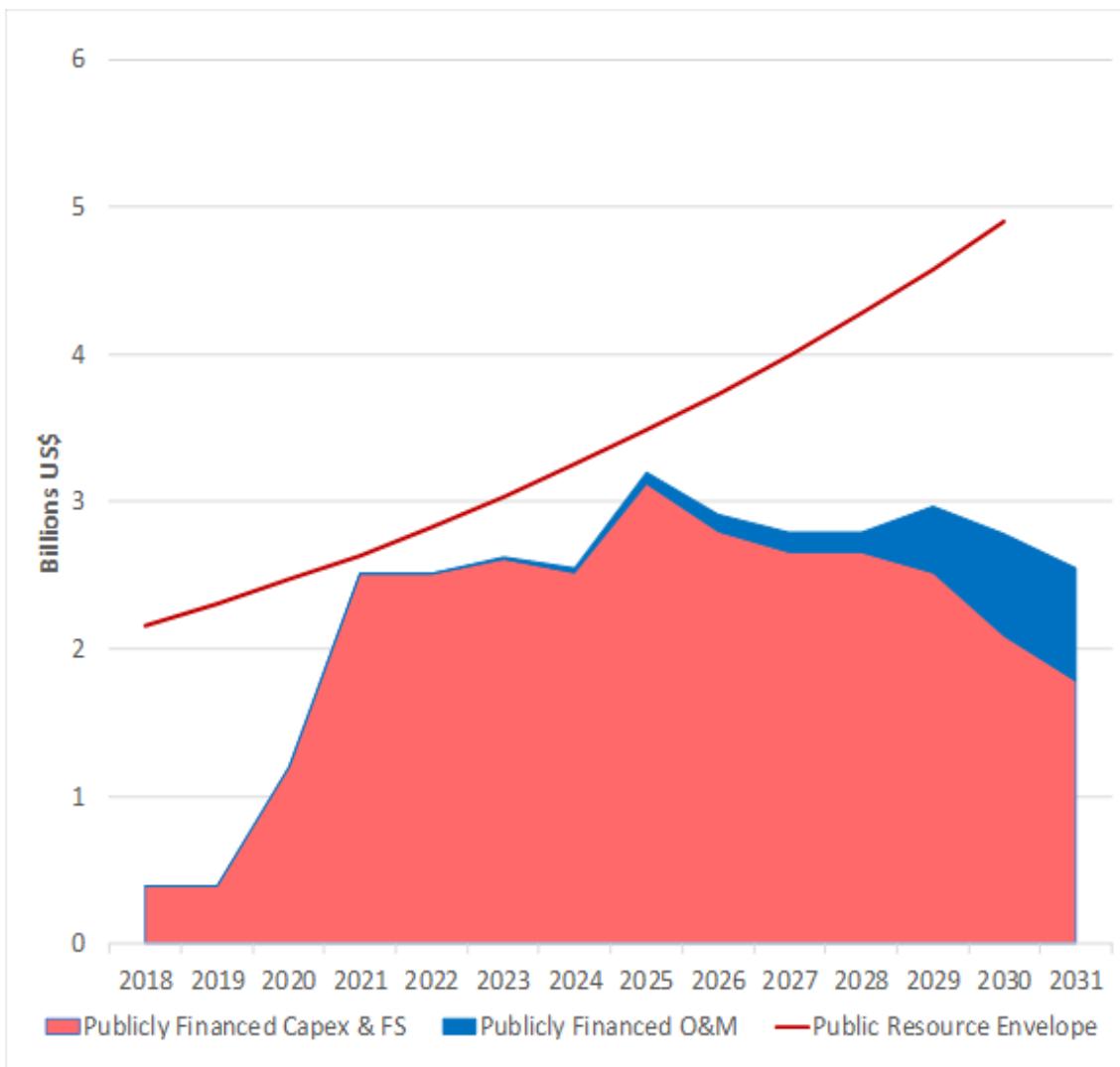


As described in section 2, when there is a budget constraint, the project with the lowest MCA-ranking infrastructure project would be postponed, followed by the next lowest-ranked project, and so on until the budget constraint is relieved. In this case, the following changes to the project phasing would 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. General Economics Division (GED) of Bangladesh Planning Commission will be responsible for overall coordination and facilitation.³⁸

The key functions of GED in this respect will be national coordination, planning, programming, and assisting with resource mobilization. GED will facilitate programme 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).

GED will recommend fund allocations from a Delta Fund, which will consolidate the current Annual Development Programme 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.

GED 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 summarizes the policy and institutional reforms to underpin implementation of the Investment Plan.

³⁸ The Delta Plan provides for the creation of a Delta Wing in GED (BDP 2100, Volume 1: Strategy, Chapter 12)

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

GED 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. GED is expected to coordinate, 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
- 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 programmes 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 programmes that include both land and water elements.

As GED 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 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. At this point GED 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 2016³⁹. 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.

³⁹ http://www.pppo.gov.bd/events2016_first-board-of-governors-meeting-Under-the-ppp-act.php

GED's 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.

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.⁴⁰ 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:

⁴⁰ Ministry of Water Resources, Government of the People's Republic of Bangladesh. (November 2000). Guidelines for Participatory Water Management

- 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.

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.⁴¹

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 planning⁴²
- 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

⁴¹ National Water Policy (1999) Section 4.2(b)

⁴² National Water Management Plan, Volume 2 (p 12)

- 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 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 programmes are a mechanism to promote coordination. By grouping together projects that are similar, or closely linked, programmes 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.

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 levels⁴³
- **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

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.⁴⁴

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.

⁴³ BDP 2100, Volume 1: Strategy, Chapter 13

⁴⁴ 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 GED. GED 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's Result Based Monitoring and Evaluation Framework.

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 programmes 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.

