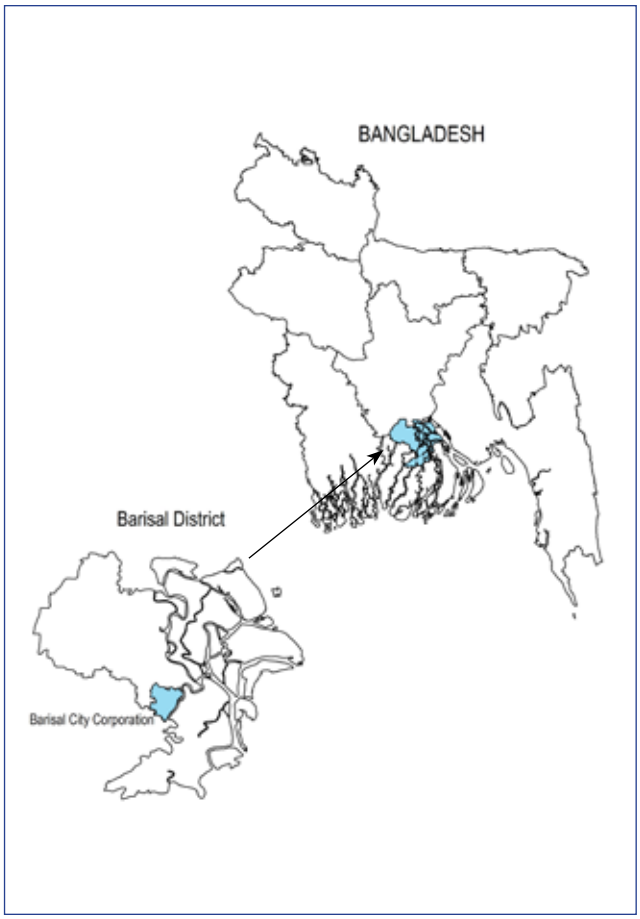
City Resilience Strategy: Barisal

Barisal city is the sixth largest city of Bangladesh with respect to population, but is one of the smallest in terms of geographical area (58.05 sq. km.). It is located in the southern region of Bangladesh, on the western part of the river Kirton Khola between 22°37' N and 22°45' N and 90°16' E and 90°32' E. The population of Barisal City Corporation (BCC) was 328,278 in 2011. Barisal is a river port city with several established trade and commerce centres. Moreover, the city is one of the most important rice producing centres of Bangladesh. Barisal city is one of the oldest municipalities in Bangladesh established in the year 1876 and became a City Corporation in 2002. BCC regulates most of the civic functions and services in the city.

The annual average temperature reaches a maximum of 35.1°C and a minimum of 12.1°C while the average annual rainfall is 1,955 mm. Cyclones and floods are the main natural hazards in the city. Barisal has always been located in a cyclone prone area and the frequency of high intensity cyclones in recent years is increasing.



Climate Risks

The three climate risks identified through the ICLEI ACCCRN Process (IAP) for Barisal are:

Changing Climate Conditions	Climate Scenario Summary Statements
High intensity rainfall	There will be an increase in the amount of run-off and rainfall intensity.
Increased temperature	Mean temperatures across Bangladesh are projected to increase between 1.4°C and 2.4°C by 2050 and 2100, respectively.
Increase in the frequency of cyclones	The frequency of tropical cyclones in the bay of Bengal may increase and, according to the Intergovernmental Panel on Climate Change's Third Assessment Report, there is "evidence that the peak intensity may increase by 5% to 10% and precipitation rates may increase by 20% to 30%" (IPCC 2001). Cyclone-induced storm surges are likely to be exacerbated by a potential rise in sea level of over 27cm by 2050.

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Vulnerability Assessment

The fragile urban systems and their corresponding climate fragility statements for Barisal are:

Fragile Urban Systems	Climate Fragility Statements
	• Will lead to more growth of disease causing vectors in river/canal water polluted by septic tank sludge which impacts health of citizens.
	• Can cause overflow of septic tanks, leading to greater water pollution and more health impacts.
	• Excessive rain and water logging may cause septic tank overflow and water pollution leading to health issues.
	• Will lead to greater use of tubewells to meet increased water demand, depleting the ground water table and exacerbating arsenic pollution.
	• Can cause greater run off leading to lower percolation and lower recharge of ground water, putting stress on drinking water resources.
	• Excessive rainfall and water logging will cause contamination of water sources - both surface and ground water, leading to drinking water scarcity and health impacts.
	• May cause changes in crop pattern.
	• Can damage agriculture/livestock/fishery impacting livelihood.
	• Can affect agriculture/fishery/livestock and therefore livelihood is impacted.
	• In case of unplanned development will result in water logging and urban flooding, with related impacts on the health and socio-economic structure of the city.
	• Can cause damage to urban service infrastructure resulting in financial losses to BCC and disrupting urban services.
	• Can cause greater damage to personal property, life and livelihood in case of unplanned development.
	• May cause heat stress and related health disorders, e.g. diarrhoea, thereby increasing demand on health infrastructure.
	• Can cause overflow of drains leading to urban flooding and impacting health.

Through the vulnerability assessment, the adaptive capacity of the key actors identified in the IAP was scored based on three parameters: capacity to organize and respond, availability of resources, and access to information. Actors who receive a low adaptive capacity score are classified as vulnerable while those who receive medium and high scores are classified as supporting and can aid the local government in resilience building activities. The table below presents an overall analysis of actors across the different fragile urban systems.

Overall the BCC scored as a supporting actor because of its technical capacity and strength of manpower.

Actor Analysis for Barisal City

Vulnerable Actors	Supporting Actors
• Residents of slum areas • Low Income Labourers • Fishery Owners • Citizens • Rickshaw Pullers & Auto Rickshaw Drivers • Floating Population • Women • Children • Small Shop Owners • Farmers	• NGOs • BCC • Health and Conservancy Department of BCC • Department of Agriculture • Department of Environment • District Collector Office • Bangladesh Police • Bangladesh Power Development Board • Department of Fire Service & Civil Defence

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The adaptive capacities of the fragile urban systems are assessed on the basis of five broad categories – economic, technology/ infrastructure, governance, social, and ecosystem services. Each of these five categories was rated as high/medium/low and averaged across all the urban systems to generate an overall score for each parameter in the city as detailed in the following table.

Overall Adaptive Capacity of Systems in Barisal City

Adaptive Capacity Parameters	Adaptive Capacity Score		
	Low	Medium	High
Technological/ Infrastructural			
Economic			
Governance			
Societal			
Ecosystem services			

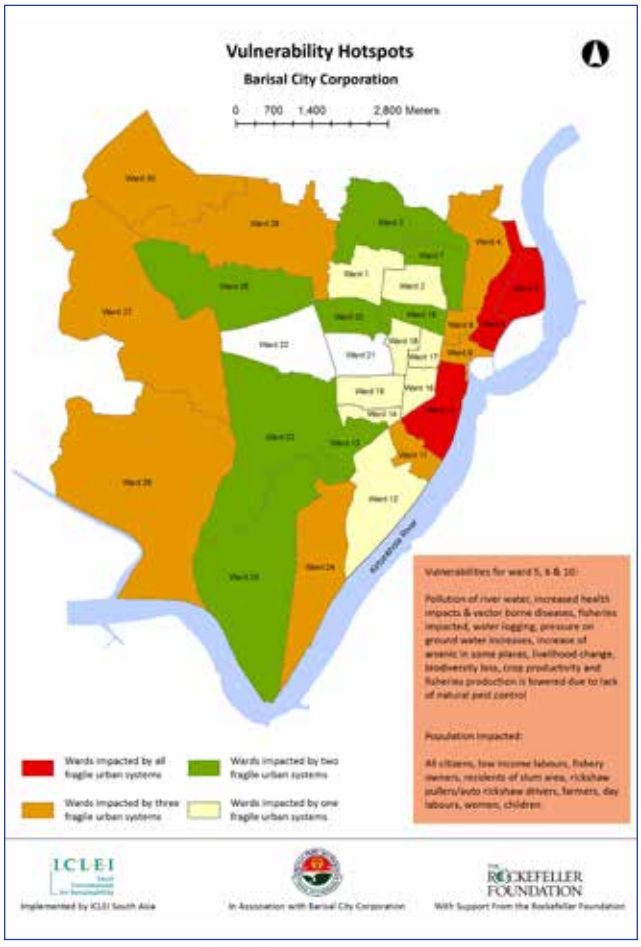
In Barisal the area found to be most vulnerable is ward 5 which is vulnerable to all six fragile urban systems, while ward 6 and 10 are vulnerable to four fragile urban systems. It is important to note that all three wards are situated near Kirton Khola River and have substantial slum population. Other wards 4, 8, 9, 11 and fringe areas belonging to wards 24, 26, 27, 28, 29 and 30 are impacted by multiple fragile urban systems (refer map).

Possible adaptation interventions were identified for the six fragile urban systems in Barisal on the basis of their climate risks and vulnerabilities, the vulnerable areas and the vulnerable actors to adapt to the possible impacts of climate change on these systems. These prioritized interventions were inter-linked with ongoing programmes and projects. The way forward for the city to build resilience includes:

- Land Use Change – The land use pattern is changing in Barisal and government regulations need to be strictly implemented so as to manage and regulate indiscriminate construction. This will also lead to better drainage, health and ecosystem services in the city.

- Water supply, sanitation and drainage – Planned construction with timely Operation and Maintenance of these systems will help to reduce their vulnerability. Service delivery also needs to be improved in the city.

- Ecosystem Management – A large population, especially poor and marginalised sector, depend on the ecosystem for their livelihood through agriculture, livestock, fishery, etc. In order to protect their livelihood, it is essential to take actions to protect the ecosystems in and around the city, the forests, gardens, water bodies, farmlands, etc.



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Key Interventions Identified for Barisal City

Infrastructural Measures	Non-Infrastructural/ Policy Measures
Water Supply	
• Implementation of a city wide rainwater harvesting program for both reuse and recharging of water where appropriate. **Costs associated** (Cost of construction, training, maintenance): USD 10,000 per unit. **Co-benefits:** Can help reduce runoff and prevent soil degradation.	• Awareness building activities on how to access and store potable water during floods. **Costs associated:** USD 2,500 per training. **Co-benefits:** Can be used for awareness generation on related issues such as health, water, and environment.
Sanitation	
• Decoupling septic tank outlets from storm water drains. **Costs associated** (Staff costs, staff training, equipment costs): USD 50,000. **Co-benefits:** Can help reduce incidences of vector borne diseases in places with water logging problems.	• Increase monitoring and supervision for usage of safe and well designed sanitary latrines by all and encourage people not to connect their latrine outlets with open drains, any ponds or canals. BCC could publish a regulatory notice mentioning a penalty or fine if any open linkage is found. **Costs associated** (Staff costs, staff training, formulation of policy, meetings): USD 1,000. **Co-benefits:** Will improve the system of water resources management.
Land Use	
	• Community based disaster management measures – forming informal groups for relief and rehabilitation after disasters, providing disaster management training to these groups, mock drills. **Costs Associated:** USD 7,500 per training. **Co-benefits:** Can help to increase social cohesiveness.
Ecosystem	
• Tree plantation. **Costs associated** (Cost of plants, staff costs, materials, maintenance costs, labour): USD 30,000 per drive. **Co-benefits:** Can provide livelihood options.	• Communication and coordination with concerned agricultural/ fisheries/ livestock departments to protect existing variety of crops, animals, etc.; or promote new species. **Costs associated** (meeting costs, formulation of policy): USD 10,000. **Co-benefits:** Employment opportunities will be regained.
Health	
• Establishment of Primary Health-care Centres. **Costs associated** (Construction costs, materials, staff costs, training): USD 75,000. **Co-benefits:** Will increase the storage of medicine.	• Preparation of a health emergency response plan to respond to climate and disaster emergency events. This may include – regular drill/practice sessions with local emergency response organizations, staff specific emergency situation guidelines, containment of risks, check lists for post emergency situation and treatment etc. **Costs associated** (Cost of meetings, cost of policy formulation, policy ratification, trainings, staff costs): USD 40,000. **Co-benefits:** Will establish a planned and organized health service system and people will be benefited around all over the year.
Storm Water Drainage	
• Maintenance of drains. **Costs associated:** Per km costs of staff, materials, repair: USD 2,500 per km.	• Awareness among the citizens on the effects of dumping waste in the open and in drains. Education programs can be undertaken which must be aimed at encouraging the sharing of lessons learned with families. **Costs associated** (Material costs, training, staff costs, logistics): USD 10,000 per training. **Co-benefits:** Can be used for awareness generation on related issues such as health, water, and environment.

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