



Cyclone Sidr in Bangladesh

Damage, Loss and Needs Assessment For Disaster Recovery and Reconstruction

A Report Prepared by the Government of Bangladesh Assisted by the International Development Community with Financial Support from the European Commission

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Foreword

Bangladesh is a disaster-prone country that is affected almost every year by some form of natural disaster, be it floods, torrential rains, erosion, or cyclones. Of the 508 cyclones that have originated in the Bay of Bengal in the last 100 years, 17 percent have hit Bangladesh, amounting to a severe cyclone almost once every three years. Of these, nearly fifty three percent have claimed more than five thousand lives.

Given the severity of Cyclone Sidr, the projected destruction from the storm was expected to be much higher than what ultimately occurred. This was due, in large part, to the Government's recent investments in an improved Early Warning System that served to alert the population to the impending storm as well in over two thousand emergency shelters that were able to accommodate over half of the evacuated populations. In addition, immediately after the storm, the Armed Forces launched search and rescue and early relief operations.

The Government's efforts were also immediately supported by a quick response on the part of the international and national aid communities. The Government of Bangladesh, in collaboration with the UN, the National Red Crescent Society, and the IFRC, undertook several humanitarian assessment missions and started humanitarian relief operations focused on food aid, nutrition, water and sanitation, shelter, disease surveillance and other items. The Government allocated BDT 450 million (US\$ 6.7 Million) for relief and housing construction, distributed relief items, and sent out medical teams. Forty-nine countries, including Australia, Canada, China, India, Italy, Japan, Kuwait, The Netherlands, Norway, the Kingdom of Saudi Arabia, Sweden, UK, USA, and the European Commission provided emergency relief support for the victims of Cyclone Sidr. The US Marine Forces participated in the rescue and relief operations in the affected regions.

These efforts were complemented by international donors, such as UNDP, UNICEF, OXFAM, SCF Alliance, World Vision, Care Bangladesh, Islamic Relief, Caritas, Christian Aid, Concern Worldwide, and Action Aid Bangladesh. Several national organizations, such as BRAC, Adventist Development and Relief Agency International (ADRA), and other national NGOs delivered food and nonfood relief items to the affected families. Grameen Bank, BRAC, and ASA waived loan payments for members who were affected by the cyclone. The Government's Disaster and Emergency Response (DER) subgroup of the Local Consultative Group (LCG) coordinated international humanitarian relief and early recovery planning, and the Ministry of Foreign Affairs and the Economic Relations Division (ERD) organized meetings for Development Partner countries and organizations in order to brief them about the impact of Cyclone Sidr.

Following the relief efforts, the Economic Relations Division (ERD) requested Joint Damage and Loss Needs Assessment (JDLNA) to be carried out jointly by the donor community and the Government of Bangladesh, through its Ministries of Planning, Food and Disaster Management and other line Ministries and Agencies.

The Government wishes to thank the World Bank for its coordinating role on the report, the United Nations Agencies and other Development Partners for their contributions to the assessments, and the European Commission for their generous financial support. The resulting report, initiated by the Government of Bangladesh and Development Partners could well serve as an example for the ongoing global discussion in developing generic protocols for donor response to disasters at the request of the Government.

Md. Aminul Islam Bhuiyan,
Secretary
Economic Relations Division
Ministry of Finance

Representing the Government of Bangladesh

Foreword

On 15 November 2007, Cyclone Sidr struck the coast of Bangladesh and moved inland, destroying infrastructure, causing numerous deaths, disrupting economic activities, and affecting social conditions, especially in the poorer areas of the country. However, the Government's recent investment in an early warning system served to limit these damages and led to timely evacuation of the affected populations. This report describes the assessment of damage to physical assets, the subsequent losses sustained across all economic activities, and the impact of the disaster on both the national economy and household-level activities and well-being.

In the aftermath of Cyclone Sidr, the Government of Bangladesh responded to the affected areas with timely aid and assistance, supported by civil society and donors. The Armed Forces were deployed to support the civilian authorities in charge of disaster management and Care Taker Government executed the immediate relief effort with impressive coordination. Donor funds allocated to the relief effort were managed in a judicious fashion by the Government.

On 3 December, 2007, the Chief Advisor appealed to donors for assistance in developing and implementing a medium and long-term disaster funding strategy. On 12 December 2007, members of the Local Consultative Group agreed to conduct a Joint Damage, Loss, and Needs Assessment (JDNLA) on the impact of Cyclone Sidr. The aim of the assessment was to identify priority areas to support the Government of Bangladesh in cyclone recovery efforts as well as to recommend priority interventions for a long-term disaster management strategy.

A comprehensive methodology was used to estimate damage to assets, changes in economic flows, and impacts on social and economic conditions. The estimates were based on quantitative information collected by the Government of Bangladesh and the Development Partners during field surveys in the aftermath of the disaster. This information was supplemented by completed and ongoing assessments of United Nations (UN) agencies and community-based analysis conducted by the national and international Non-Governmental Organizations (NGOs) that participated in the joint effort.

The recent disaster is one of several extreme natural phenomena—especially hydro-meteorological—that occur frequently in Bangladesh, with devastating effects on the social and economic development efforts. The analysis undertaken reveals that considerable progress has been made in recent years to reduce the impacts of disasters, but more must be done to further reduce vulnerability and risk, especially in light of increasing impact of climate change.

The analysis of the damage and loss assessment has identified the needs and quantified financial requirements that will facilitate formulating comprehensive early recovery actions, medium-term recovery and reconstruction plans, and a long-term risk

management and reduction strategy. These should be formulated, adopted and implemented to reduce the impact of future disasters which are likely to be more intense due to climate change. International support will be essential as domestic resources and capacities are limited.

The JDLNA report was prepared as a joint effort between the donor community and the Government of Bangladesh through its Ministries of Planning, Food and Disaster Management, and other line Ministries/Agencies. The donors wish to thank these Ministries for the inputs they provided for the JDLNA, and are especially grateful for the role of the ERD and the Ministry of Finance for coordinating discussions between the joint partners. The experience in Bangladesh provides a particularly salient example of joint coordination and effort not only within the donor community, but also between the joint partners in this effort: the Government of Bangladesh, civil society and the donor community.

The country must enter into the post-disaster phase of socio-economic recovery and reconstruction and face the longer-term issue of disaster reduction through risk management. This report is intended to provide the inputs to define the international support that the Government of Bangladesh will require in future years to achieve this objective.

Xian Zhu
Country Director
World Bank Office, Dhaka

Foreword

Following the devastating cyclone Sidr that hit the south-western coastal areas of Bangladesh on 15 November 2007, the European Commission (EC) has been quick in mobilizing emergency relief for the affected population. To date, the EC's Humanitarian Aid Office (ECHO) has allocated € 20.425 million for post-SIDR relief.

The Government of Bangladesh, in its drive to thoroughly plan the recovery and longer term development in the affected areas, requested the support of the donor community for carrying out an assessment of the damages and losses caused by cyclone Sidr and the resulting needs. In this respect, EC welcomed the proposal from the World Bank (WB) to field a Joint Damage Loss and Needs Assessment (JDLNA) mission in Bangladesh. This joint activity was a practical application of the principles of the Paris Declaration on Aid Effectiveness and reflected the recent commitment at the highest level of the EC, UN and WB to progress towards a global joint disaster response between donors. This JDLNA was one of the first of its kind and will contribute significantly to the development of a disaster assessment methodology, which can be used worldwide.

EC's support to the JDLNA materialized in the mobilization of EC experts as members of the JDLNA mission and a substantial financial contribution to cover the mission costs through the EC's Instrument for Stability. This Instrument aims at contributing to ensure stability in crisis situations by providing an effective response to help preserve, establish or re-establish the conditions essential to the proper implementation of the European Community's development and cooperation policies.

I wish to congratulate the JDLNA team for the very participative nature of the JDLNA process and the high quality of the resulting report. I commend the Government of Bangladesh, civil society and other donors for their continuous support to the JDLNA mission.

The EC remains committed to provide further support to the Government of Bangladesh and civil society during the ongoing recovery phase and for the implementation of long-term risk reduction and management plans, especially when keeping in mind the potential impacts of climate change on Bangladesh.

Dr. Stefan Frowein
Ambassador
Head of Delegation
Delegation of the European Commission to Bangladesh

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In the weeks following Cyclone Sidr, initial damage assessments were conducted by the Government of Bangladesh, UN agencies, and NGOs as a basis for the immediate response and short-term recovery. The JDNLA authors of this report worked closely with the involved actors. This report builds on their figures and documents of Cyclone Sidr's impacts. The JDNLA greatly benefited from the initial evaluations and the team would like to express their thanks and appreciation.

The international community team for the JDNLA was led by Masood Ahmad (World Bank) and included the following sector coordinators: Roberto Jovel (GFDRR) for methodology, Ambar Narayan for macroeconomic analysis, Mohinder S. Mudahar for agriculture and livelihood, Shakil Ahmed Ferdausi for environment and forest, Christoph Pusch and Ayaz Parvez for disaster risk management, Mohi Uz Zaman Quazi and Charles Scawthorn for infrastructure, Dinesh Nair for the social sector, and Zafrul Islam for fiduciary and safeguards aspects. The core team also included S.A.M. Rafiquzzaman as the Dhaka anchor, Doekle Wielinga, Winston Yu, Henrike Brecht, Zahed H. Khan, Zahid Hussain, Arif Ahamed, Balakrishna Menon Parameswaran, Saroj Kumar Jha, Reefat Sultana, Shakila P. Khan Tandra, Anna O'Donnell, Toufiq Ahmed, Burhanuddin Ahmed, Fabio Pittaluga, Sanjana Zaman, Glen Pearce-Oroz, A.K.M. Abdullh, Sabah Moyeen, Helen J. Craig, Iffat Mahmud, Ceren Ozer, M. Iqbal, Pema Lhazom, Qaiser Khan, Raihan Elahi, Andy Kotikula, Sandeep Mahajan (World Bank), Hector Maletta, Antonio Cruciani, Mukul Bhola (ILO), Stefan Ekelund, Zahir Uddin Ahmad, Arun Kumar Saha, Brajesh Panth, Faruque Ahmed, Firoz Ahmed, Jamal Mahmood, Rafiqul Islam, Zahid Hossain, M. M. Zillur Rahman (ADB), Arham Siddique, Andrea Gerhardinger, Elodie Pagot (EC), Sayef Uddin (IDB), and Cynthia Burton (IFRC).

The team from the Government of Bangladesh was led by M. Ayub Miah (Ministry of Food and Disaster Management) and Jafar Ahmed Chowdhury (Ministry of Planning) and coordinated by Aminul Islam Bhuiyan, Shaheedul Haque (Economic Relations Division). Staff from line ministries provided valuable input and direction for the report, for which the core team is grateful: Mohsena Ferdausi (Ministry of Food and Disaster Management), Mohammad Abu Sadeque, Probir Kr. Das (Disaster Management Bureau), Mokammel Hossain, Matiur Rahman, Khawza Nazimuddin, Abul Khair (Ministry of Fisheries and Livestock), A.R.M. Nazmus Saqib (Ministry of Finance), Fazlul Karim (Ministry of Agriculture), M. Khurshid Alam (Bangladesh Bank), Siddiqur Rahman (Ministry of Commerce), Mohammad Qamar Munir, Dilruba Yasmin (Ministry of Environment and Forests), Zahir Iqbal (Forest Department), Mohammed Solaiman Haider (Department of Environment), Jinnahatul Islam (SPARRSO), Abul Kashim Bhuiyan (Ministry of Education), Anowar Hossain (Ministry of Housing and Public Works), Akhteruzzaman, Moazzem Hossain (Ministry of Health and Family Welfare), Mohammad Arifur Rahman Sheikh (Ministry of Posts and Telecommunications), Qamrul Huda, Ali Akbar, Humayun Kabir (Water

Development Board), A.K.M. Ibrahim, Mustafizur Rahman, Amanullah Al Mahmood (Department of Public Health Engineering), M. Fouzul Kabir Khan (Ministry of Power, Energy and Mineral Resources), Iftekhar Ahmed, Wahadir Rahman, Shahidul Hassan, A.F.M. Munibur Rahman (Local Government Engineering Department), Arjumand Habib, Abdul Mannan (Bangladesh Meteorological Department), Abdus Sobhan Sikdar (Bangladesh Rural Development Board), Sunil Chandra Ghosh (Department of Livestock Services), Munshi Mustafizur Rahman (Road and Highways Department), and Shamsul Alam (Department of Agricultural Extension).

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Acronyms

ARI	Acute Respiratory Infections
ADB	Asian Development Bank
ADRA	Adventist Development and Relief Agency International
BIDMTR	Bangladesh Institute for Disaster Management Training
BBS	Bangladesh Bureau of Statistics
BDT	Bangladesh Taka
BMD	Bangladesh Meteorological Department
BoP	Balance of Payment
BRAC	Building Resources Across Communities (formerly known as Bangladesh Rural Advancement Committee)
BRE	Brahmaputra Right Bank Embankment
BWDB	Bangladesh Water Development Board
CDMP	Comprehensive Disaster Management Programme
CEGIS	Center for Environmental & Geographic Information Services
CERF	Central Emergency Relief Funds
CFW	Cash-for-Work
CEIP	Coastal Embankment Improvement Program
CGI	Corrugated Galvanized Iron
CPP	Cyclone Preparedness Program
CRA	Community Risk Assessment
DAE	Department of Agricultural Extension
DER	Disaster and Emergency Response
DFID	Department for International Development (UK)
DLS	Department of Livestock Services
DMB	Disaster Management Bureau
DMC	Disaster Management Committee
DoE	Department of Environment
DoF	Department of Fisheries
DPP	Development Project Proposal
DRF	Disaster Response Fund
DRR	Disaster Risk Reduction
EC	European Commission
ECLAC	United Nations Economic Commission for Latin America and the Caribbean
EM-DAT	Emergency Events Database
ERR	Economic Rate of Return
EWS	Early Warning Systems
FAO	Food and Agriculture Organization of the United Nations
FAP	Flood Action Program
FD	Forest Department
FFWC	Flood Forecasting Warning Centre
FHH	Female Headed Households
FY	Fiscal Year
GDP	Gross Domestic Product
GFDRR	Global Facility for Disaster Reduction and Recovery
GoB	Government of Bangladesh
GPS	Government Primary School

HIES	Household Income and Expenditure Survey
HFA	Hyogo Framework for Action
HNPSP	Health, Nutrition, and Population Sector Program
IDA	International Development Association (The World Bank Group)
IDB	Inter-American Development Bank
IFRC	International Federation of Red Cross and Red Crescent Societies
IIRS	Indian Institute of Remote Sensing
ILO	International Labour Organization
IMDMCC	Inter-Ministerial Disaster Management Coordination Committee
IMF	International Monetary Fund
IUCN	World Conservation Union
IWM	Institute of Water Modelling
IWTA	Inland Water Transport Authority
JBIC	Japan Bank for International Cooperation
JDLNA	Joint Damage Loss and Needs Assessment
JICA	Japan International Cooperation Agency
JRC	Joint Research Centre of the EU Commission
LCG	Local Consultative Group
LDRRF	Local Disaster Reduction Fund
LGED	Local Government Engineering Department
LGI	Local Government Institutions
MoE	Ministry of Education
MoFDM	Ministry of Food and Disaster Management
MoPME	Ministry of Primary and Mass Education
MoWR	Ministry of Water Resources
NDMC	National Disaster Management Council
NDMAC	National Disaster Management Advisory Committee
NGO	Non-Governmental Organization
PGCB	Power Grid Company of Bangladesh
PKSF	Palli Karma-Sahayak Foundation
PO	Partner Organization
R&HD	Roads and Highways Department
RBIP	River Embankment Improvement Program
REB	Rural Electrification Board
RNGPS	Requisite Non-Governmental Primary School
RRAP	Risk Reduction Action Plan
SCF	Save the Children Fund
SMEs	Small and Medium Enterprises
SPARRSO	Space Research and Remote Sensing Organization
TOAB	Tour Operators Association Bangladesh
UN	United Nations
UNDP	United Nations Development Fund
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
VGD	Vulnerable Group Development
VGf	Vulnerable Group Feeding

WB	World Bank
WCS	Water Control Structures
WFP	World Food Programme
WHO	World Health Organizations
WZPDCL	West Zone Power Distribution Company Limited

Executive Summary

On 15 November 2007, Cyclone Sidr struck the south-west coast of Bangladesh with winds up to 240 kilometers per hour. The category 4 storm¹ was accompanied by tidal waves up to five meters high and surges up to 6 meters in some areas, breaching coastal and river embankments, flooding low-lying areas and causing extensive physical destruction. High winds and floods also caused damage to housing, roads, bridges, and other infrastructure. Electricity and communication were knocked out, and roads and waterways became impassable. Drinking water was contaminated by debris and many sources were inundated with saline water from tidal surges, and sanitation infrastructure was destroyed.

Figure 1: Destroyed Houses at the Coast of Bangladesh



The cyclone was the second natural disaster to affect Bangladesh in twelve months. Monsoon floods had previously caused extensive agricultural production losses and destruction of physical assets, totaling near US\$ 1.1 billion². The occurrence of these events in close succession is a reminder of the country's extreme vulnerability to frequent hydro-meteorological hazards, which stand to be further exacerbated because of climate change.

Damage and Losses

Damage and loss from Cyclone Sidr was concentrated on the southwest coast of Bangladesh. Four of Bangladesh's thirty districts were classified as "severely affected" and a further eight were classified as "moderately affected".³ Of the 2.3 million households affected to some degree by the effects of Cyclone Sidr, about one million were seriously affected.

The number of deaths caused by Sidr is estimated at 3,406, with 1,001 still missing, and over 55,000 people sustaining physical injuries. Improved disaster prevention measures, including an improved forecasting and warning system, coastal afforestation projects, cyclone shelters, and embankments are credited with lower casualty rates than what would have been expected, given the severity of the storm. Most of the destruction and related social and economic losses resulted from the harsh storm conditions and the subsequent failure of an extensive embankment system.

¹ On the Saffir-Simpson Hurricane Scale, ranging from category 1 to 5

² According to World Bank Damage Assessment, 2007

³ The four worst affected were: Bagerhat, Barguna, Patuakhali and Piroipur. The eight moderately affected districts were Khulna, Madaripur, Shariatpur, Barishal, Bhola, Satkhira, Jhalakthi, and Gopalgani.

In the wake of Cyclone Sidr, the Government of Bangladesh, together with international experts, undertook a comprehensive damage and loss, and needs assessments to ascertain the extent of the damage caused by the storm, and to define a comprehensive and feasible recovery plan. The Joint Damage, Loss, and Needs Assessment (JDNLA) estimated the total damage and losses caused by the cyclone to be Bangladesh Taka (BDT) 115.6 billion (US\$ 1.7 billion). Table 1 presents an overall summary of the damage and losses broken down by sectors.

Table 1: Overall Summary of Damage and Losses

Sector	Sub-Sector	Disaster Effects (BDT Million)			Disaster Effects (US\$ Million)		
		Damage	Losses	Total	Damage	Losses	Total
Infrastructure		71,064	2,130	73,194	1,029.9	30.9	1,060.8
	Housing	57,915	—	57,915	839.3	—	839.3
	Transport	8,006	1,725	9,731	116.0	25.0	141.0
	Electricity	576	359	935	8.3	5.2	13.6
	Water and Sanitation	157	46	203	2.3	0.7	2.9
	Urban and Municipal	1,696	—	1,696	24.6	—	24.6
	Water Resource Control	4,918	—	4,918	71.3	—	71.3
Social Sectors		4,482	1,453	5,934	65.0	21.1	86.0
	Health and Nutrition	169	1,038	1,206	2.4	15.0	17.5
	Education	4,313	415	4,728	62.5	6.0	68.5
Productive Sectors		1,734	32,083	33,817	25.1	465.0	490.1
	Agriculture	1,472	28,725	30,197	21.3	416.3	437.6
	Industry	262	2,035	2,297	3.8	29.5	33.3
	Commerce	—	1,258	1,258	—	18.2	18.2
	Tourism	—	65	65	—	0.9	0.9
Cross-Cutting Issues		420	0	420	6.1	0.0	6.1
	Environment	420	—	420	6.1	—	6.1
Total		79,904	35,665	115,569	1,158.0	516.9	1,674.9

Source: Estimates by JDNLA Team.

Damage and losses were concentrated in the housing sector (57.9 BDT billion, or 50 percent of the total), productive sectors (33.8 BDT billion or 30 percent), and on public sector infrastructure (15.7 BDT billion or 14 percent). More than two-thirds of the disaster effects were physical damages and one-third were economic losses, and most damages and losses were incurred in the private sector, rather than in the public sector. This has significant implications for the strategy that must be adopted for recovery and reconstruction.

The Impact

While the impact of Cyclone Sidr was relatively moderate when measured by impact on overall Gross Domestic Product (GDP) (estimated to be equivalent to 2.8 percent of Bangladesh's GDP), the effects of the storm were highly concentrated by district. These districts also suffer from high population density and higher poverty rates than the national average (over 50 percent in Barisal versus a national average of 40 percent). Thus, the impact is borne primarily by the poor.

Preliminary estimates indicate that overall economic growth in the country will be affected by less than 0.5 percent in the current fiscal year, although significantly higher declines are expected to occur in the economies of the most affected districts (for which no detailed

estimates of GDP are available). This decrease in growth is similar to that estimated for the 2007 floods and will detract from the pre-disaster estimated growth rate of 7.0 percent. The import bill is anticipated to increase due to the need for imported foodstuffs, mainly rice, fertilizers, and other agriculture inputs as well as some construction materials. Pressure will mount on the fiscal deficit in view of required outlays to meet emergency and rehabilitation needs after the disaster.

It is estimated that about 2 million people have lost income and employment in the more affected districts. These districts also have some of the highest poverty rates in the country; the disaster were highly concentrated in the Districts of Bagherat, Barguna, Patuakhali, Pirojpur, and Barisal where, according to data from the 2005 Household Survey, poverty levels range between 35 to more than 50 percent of the population. Thus, the brunt of the disaster was borne by some of the poorest population groups of the country and will significantly further degrade their living conditions. In addition, their income in this year is expected to be reduced to about a third of the average.

Recovery and Reconstruction Requirements

An integrated, multi-pronged approach for the economic recovery of the affected area, and for the reconstruction of destroyed physical assets, is required to ensure the protection of the most vulnerable members of society and to resume socio-economic development in the affected regions.

Given Bangladesh's vulnerability to natural disasters it is recommended that recovery and reconstruction is approached from a risk reducing 'build back better' approach. An important consideration is the utilization of local resources in the forms of human resources and materials to maximize community involvement and minimize negative environmental impact.

An early recovery stage would take care of the most immediate needs arising from the humanitarian assistance phase, and create a solid foundation for the medium- to long-term recovery and reconstruction stages. The early recovery stage includes interventions designed to provide social protection, infrastructure repairs and income recovery

Early Recovery cost estimations identified in the Recovery Action Plan, prepared by the Ministry of Food and Disaster Management⁴, are included in both the Early Recovery section as well as the Medium to Long term section of this report, based on immediate needs, nature of activities and funding and implementation feasibility in the next 4–8 months.

Medium and long term recovery and reconstruction concentrates on the recovery of sustainable production in agriculture, industry, and commerce and on restoration of livelihoods, reconstruction of infrastructure (housing, embankments, roads, and shelters) with improved risk resistance. The aim would be to reduce risk exposure and enhance coping abilities.

Financial requirements to address the most immediate as well as the longer term recovery, reconstruction needs are assessed at BDT 91 Billion (US\$ 1.3 Billion). A total of BDT 24,833 Million (US\$ 360 million) is required for immediate recovery activities during 2008 while BDT 65,753 (US\$ 953 million) is needed in the medium-to-long term recovery and reconstruction phases.

⁴ "Cyclone SIDR, Early Recovery Action Plan, February 2009", prepared by the Ministry of Food and Disaster Management

Table 2: Summary of Recovery and Reconstruction Needs

	BDT (Million)	US\$ (Million)
Early Recovery	24,833	360
Medium and Long Term Recovery and Reconstruction	65,736	953
Total	90,569	1,313

Source: Estimates by JDNLA Team.

Disaster Risk Management Requirements

Effective disaster risk management is an essential requirement for the future, especially in the aftermath of two successive major disasters in the past year and with climate change being a likely exacerbating factor. A long-term strategy and plan that effectively integrates structural and nonstructural, human-oriented interventions to reduce risk has been broadly outlined in light of lessons learned during Cyclone Sidr and during work carried out over the last two decades. A long-term disaster risk reduction framework has been defined that consists of the following five strategic pillars:

- (a) Risk identification and assessment;
- (b) Strengthening and enhancing emergency preparedness;
- (c) Institutional and community capacity building;
- (d) Risk mitigation investments; and
- (e) Introducing catastrophe risk financing in the longer term.

A 15-year plan of action⁵ would be required to achieve substantial disaster risk reduction and management. Investments required for its implementation are estimated at US\$ 4.0 billion spread over three five-year stages, as indicated in Table 3.

The fifth pillar emphasizes the establishment of a special disaster response fund, the institution of a risk transfer mechanism for low-probability catastrophic events, and the creation of a climate change multi-donor trust fund.

Table 3: Investment Program for Long-Term Disaster Risk Management

Program Component	Investment Required (US\$ Million)			Total
	5-Year Stages			
	2008-2012	2013-2017	2018-2022	
Risk identification and assessment	10	3	3	16
Strengthening emergency preparedness	240	215	245	700
Institutional capacity building	10	2	2	14
Risk mitigation	860	1,160	830	2,850
Capacity building for implementation	20	10	10	40
Disaster Response Fund ⁶	300	—	—	300
Multi-donor Climate Change Fund	80	—	—	80
Total	1,520	1,390	1,090	4,000

Note: The cost estimates provided in the table are indicative, and are based on WB Staff estimates, derived through various sources, including GoB estimates, consultations with various Development Partners, and current costs of activities funded under various ongoing programs, such as the UNDP/CDMP.

⁵ It is tentatively recommended that this action plan be carried out over 15 years, as opposed to 10, since preparation time is required for implementation of the program. However, it is suggested that this suggestion be revisited after the first five years of the program.

⁶ The proposed US\$ 300 million is a preliminary recommendation. The exact amount will have to be determined during the course of interventions and the development of a post-disaster recovery strategy.



Part A: Impact of the Disaster

This first part of the report presents an estimation of the main effects of the disaster. This includes estimating (i) the value of physical assets that were totally or partially destroyed by the disaster; (ii) the losses in economic flows from the temporary absence of those assets; and (iii) the impact on economic development and social conditions.

The estimate of damage and losses presented below is a compilation of data supplied by a joint assessment team and is broken down by sector. The estimated impact of the disaster includes an assessment of the main macro-economic variables, as well as an analysis of the individual and household-level impacts. This provides a wide-ranging overview of the disaster's effects and impacts, which were used to estimate post-disaster needs, presented in Part B of the report.



Section I: The Disaster

Living with Natural Disasters

Bangladesh is a disaster-prone country that is affected almost every year by a natural disaster of some kind. Located between the Himalayas and the Bay of Bengal and with three mighty rivers (Ganges, Brahmaputra, and Meghna) converging on its territory, Bangladesh is prone to floods, torrential rains, erosion, and cyclones.

Over a period of 100 years, 508 cyclones have affected the Bay of Bengal region, of which 17 percent made landfall in Bangladesh. A severe cyclone occurs almost once every three years.⁷ Although the frequency of cyclones is not unusual compared to other cyclone hotspot countries, the impact it causes stands out: 53 percent of the cyclones that claimed more than 5,000 lives took place in Bangladesh (Table 4).

Table 4: Deaths Associated with Noteworthy Tropical Cyclones in the World

Year	Location	Deaths	Year	Location	Deaths	Year	Location	Deaths
1584	Bangladesh	200,000	1897	Bangladesh	175,000	1963	Bangladesh	11,520
1737	India	300,000	1900	Texas, USA	6,000	1963	Cuba-Haiti	7,196
1779	India	20,000	1906	Hong Kong	10,000	1965	Bangladesh	19,279
1780	Antilles	20,000	1912	Bangladesh	40,000	1965	Bangladesh	12,000
1822	Bangladesh	40,000	1919	Bangladesh	40,000	1970	Bangladesh	500,000
1833	India	50,000	1923	Japan	250,000	1971	India	10,000
1839	India	20,000	1937	Hong Kong	11,000	1977	India	10,000
1854	India	50,000	1941	Bangladesh	7,500	1985	Bangladesh	11,069
1864	India	50,000	1942	India	40,000	1988	Bangladesh	5,708
1876	Bangladesh	100,000	1960	Bangladesh	5,149	1989	India	20,000
1881	China	300,000	1960	Japan	5,000	1991	Bangladesh	138,000
1895	India	5,000	1961	Bangladesh	11,468			

This can partly be attributed to the high population density in the coastal region of Bangladesh (over 1,000 persons per sq km), where abundant natural resources provide people with a source of livelihoods).

Cyclones occur mainly during April–May and September–December, with most forming during November. Climate change, which could lead to a potential rise in sea level and sea surface temperatures, is likely to increase the severity of cyclones.

Super Cyclone Sidr

Cyclone Sidr was first observed on 9 November 2007, southeast of the Andaman Islands, with weak low-level circulation near the Nicobar Islands. It showed indications of the formation of a tropical cyclone on 11 November while located a short distance south of the Andaman Islands, and by 13 November, the depression had turned into a cyclonic storm with a core of hurricane-force winds.

Cyclone Sidr hit Bangladesh's offshore islands at approximately 6:30 pm on the evening of 15 November and made landfall across the Barisal coast at 9:00 pm during ebb tide. At landfall, Sidr was a category 4 storm⁸, with a diameter of nearly 1000 km and sustained winds of up to 240 km per hour.

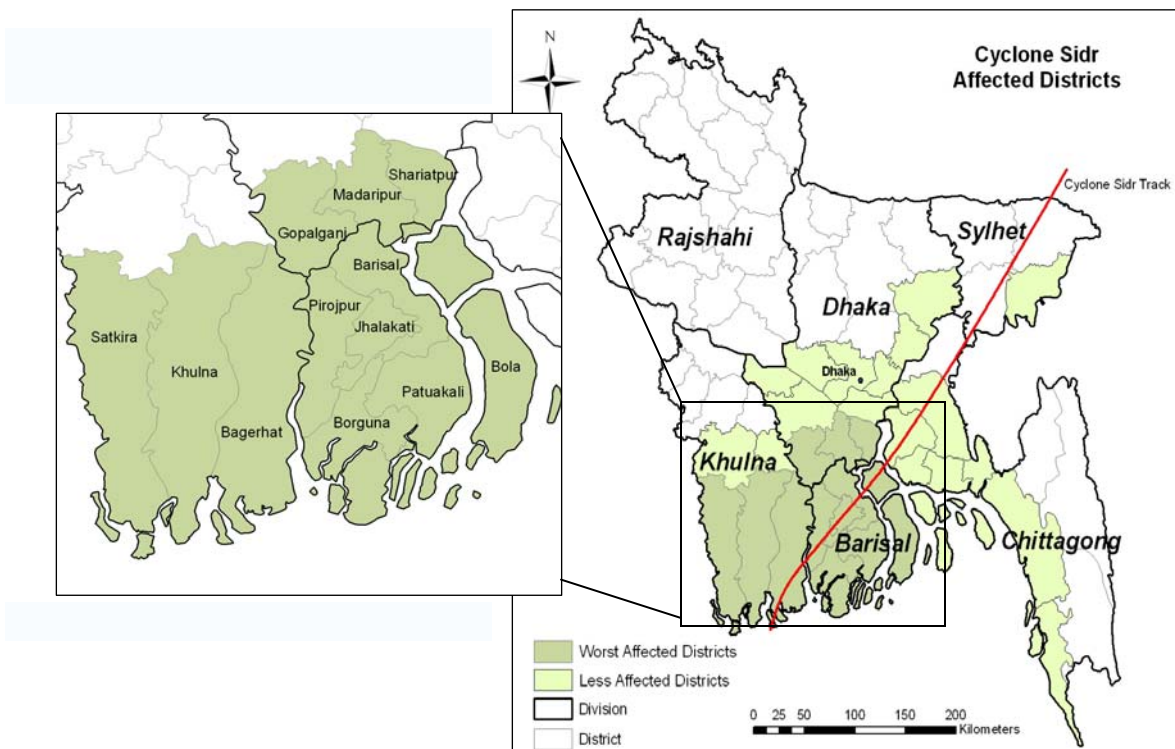
⁷ Ali A., Climate change impacts and adaptation assessment in Bangladesh, *Climate Research*, Vol. 12, 1999.

⁸ As defined in the Saffir-Simpson hurricane intensity scale

Storm surge analysis by the Institute of Water Modeling (IWM) indicates surge levels of 5.5 to 6 meters at the outfall of Baleswar River; 5 meters at Sharankhola and Bagerhat; and 3.5 meters at Hiron Point. These levels exceeded the polder embankments but did not exceed the seafacing embankment, which are at more than 6 meters in Barguna, Barisal and Bagerhat districts. Sidr was the second most destructive disaster of the 14 to hit Bangladesh in the past 15 years.

Bangladesh is divided into six administrative divisions, each named after their respective divisional headquarters: Barisal, Chittagong, Dhaka, Khulna, Rajshahi, and Sylhet. Three of these divisions, namely Barisal, Khulna, and Dhaka were severely affected by Sidr. The divisions are partitioned into altogether 64 districts (*zilas*). Of the twelve worst affected districts, six districts are in Barisal, three in Khulna, and three in Dhaka (see Figure 2). Some of the affected districts had also been affected by floods earlier that same year. Each district is further divided into *upazilas* (subdistricts) and the area of each *upazila* is segregated in multiple unions in rural areas and *pourashavas* (municipalities) in urban areas.

Figure 2: Districts Affected by Cyclone Sidr



The Human Toll

The total population in the 12 main affected districts is estimated to be 18.7 million, one-third of whom lives in the four worst affected districts in coastal areas.

Cyclone Sidr claimed 3,406 lives and 1,001 people are missing. More than 55,000 were injured and close to 9 million people in 30 districts were affected. As Sidr struck during the late evening, many families were caught inside their homes.

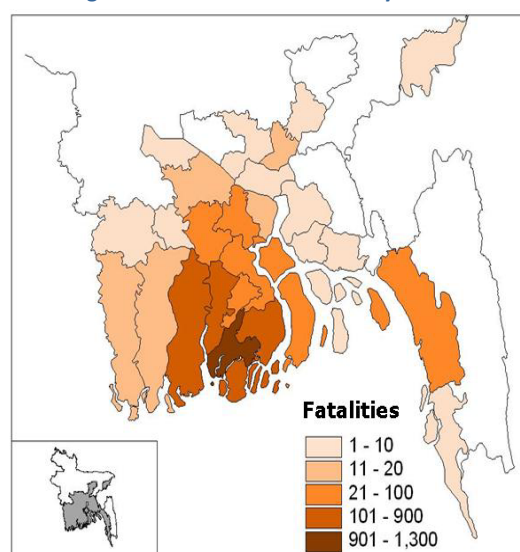
Table 5: Cyclone Sidr Death Toll, People Missing and Number of Injured People

Name of Division	No. of Deaths	No. of Missing People	No. of Injured People
Barisal	2,378	902	42,238
Chittagong	36	93	36
Dhaka	139	3	1,396
Khulna	851	3	11,612
Sylhet	2	—	—
	3,406	1,001	55,282

Source: MoFDM, 2008.

Given the cyclone level and the intensity of the storm, the expected number of casualties was expected to be higher. Three factors served to reduce the number of potential fatalities. First, over the last decade, Bangladesh has invested in Early Warning Systems (EWS) and constructed over 2,000 emergency shelters. During Cyclone Sidr, 3 million people were evacuated and 1.5 million were accommodated in cyclone shelters. Second, Sidr struck the Sunderbans, the world's largest mangrove forest, before it reached populated areas. The forest reduced the intensity of the wind and surge. Finally, Sidr made landfall during low tide, which resulted in relatively lower surge waves.

Figure 3: Number of Fatalities by District



Source: MoFDM, 2008

The Immediate Response

Figure 4: Search for Salvageable Materials



In the days before Sidr's landfall, the Bangladesh Meteorological Department (BMD) issued cyclone warnings, including advisory messages using the Government's warning signal system. Warnings were sent to communities regularly, and once, warning signal number four was even hoisted on 14 November, resulting in 44,000 volunteers who immediately activated community-based warning systems, utilizing megaphones and other devices.

After the storm, the Armed Forces immediately launched massive search and rescue and early relief operations. They also played an important role in helping communities bury their dead and remove dead livestock. By Saturday, 17 November, despite access problems, the search and rescue and relief activities had been scaled up considerably. While telephone communications were partially restored, power was still out and was not restored for weeks to come.

The Disaster and Emergency Response (DER) subgroup of the Local Consultative Group (LCG) coordinated international humanitarian relief and early recovery planning. A number of coordination meetings were held among the Government, NGOs, and donors. Later, the Ministry of Foreign Affairs and the Economic Relations Division also organized meetings for Development Partner countries and organizations in order to brief them about the impact of Cyclone Sidr.

The Government of Bangladesh, in collaboration with the UN, the National Red Crescent Society, and the IFRC, undertook several humanitarian assessment missions and started humanitarian relief operations focused on food aid, nutrition, water and sanitation, shelter, disease surveillance and other items. The Government allocated BDT 450 million (US\$ 6.7 Million) for relief and housing construction, distributed relief items, and sent out medical teams.

Both the international and national aid communities responded quickly to the crisis. IFRC and World Vision, for instance, launched relief operations in the most affected districts on 18 November and 16 November, respectively. They distributed plastic sheets, blankets, and cash, as well as family packages that included rice, lentils, and oil. The World Food Programme (WFP) had distributed High Energy Biscuits and rice through NGO partners to 249,187 families in the affected districts as of 3 December 2007. UNDP, UNICEF, OXFAM, SCF Alliance, World Vision, Care Bangladesh, Islamic Relief, Caritas, Christian Aid, Concern Worldwide, and Action Aid Bangladesh also distributed relief packages.

Several national organizations also launched relief operations. Building Resources Across Communities (BRAC), for instance, distributed more than 80,000 food packets to families in 11 districts. Their 13 medical teams also treated more than 7,800 patients. BRAC, Adventist Development and Relief Agency International (ADRA), and other national NGOs delivered food and nonfood relief items to the affected families. Grameen Bank, BRAC, and ASA waived loan payments for members who were affected by the cyclone.

Table 6: Distribution of Food by Different Agencies

Responding GoB/A	No of Families	No of Beneficiaries	Food (MT)	Food Commodities
GoB	1,126,000	5,630,000	16,890	Rice
UNICEF	46,272	231,360	93	BP5 biscuits
UNDP	70,000	350,000	420	Flattened rice, molasses
WFP	249,187	1,250,000	1,088	Biscuits, rice
Action Aid	17,000	85,000	426	Rice, pulse, oil, salt, sugar, suji
ADRA	3,927	19,635	100	Rice, lentils, flattened rice, sugar, salt
BRAC	148,825	744,125	2,130	Rice, lentils, flattened rice, sugar, salt
CARE	24,000	120,000	600	Flattened rice, molasses, rice, salt, pulse, oil, potato, onion
CARITAS	51,000	255,000	1,051	Rice, pulse, oil, salt
Christian Aid	19,086	95,430	284	Rice, lentils, oil
Concern	26,000	130,000	810	Rice, pulse, oil, salt, sugar, suji
Islamic Relief	80,000	400,000	360	Flattened rice, molasses, salt
IFRC	64,800	324,000	560	Rice, pulse, oil, salt
Netz Partnership	20,050	100,250	352	Rice, pulse, oil, salt, sugar, suji, molasses, potatoes, flattened rice
OXFAM	30,000	150,000		Rice, pulse, oil
Salvation Army	3,000	15,000	75	Rice, lentils, oil, salt, potatoes
SCF Alliance	186,470	932,350	130	Biscuits
World Vision	24,400	122,000	456	Flattened rice, molasses
Total	2,190,017	10,954,150	25,825	

Source: DMB, Emergency Response and Action Plans Interim Report, 27 December 2007.

Although no formal international appeal for foreign assistance was made by the Government, the international community was quick to respond and pledged approximately US\$ 241.7 million in aid as of 17 December 2007 (see Table 7).

Table 7: Donor Commitment (over \$1m)

Donor	Commitment	Donor	Commitment
Saudi Individual	\$130 m	Italy	\$4.47 m
Saudi Arabia	\$102.88 m	Norway	\$4.37 m
Japan	\$90 m ⁹	Switzerland	\$3.36 m
United Nations	\$28.4 m	Denmark	\$2.96 m
USA	\$20.2 m	Germany	\$2.64 m
United Kingdom	\$19.8 m	Belgium	\$2.18 m
European Commission	\$12.3 m	China	\$2.05 m
Kuwait	\$10.02 m	Iran	\$1.38 m
Australia	\$9.84 m	Spain	\$1.25 m
Netherlands	\$8.16 m	India	\$1 m
Sweden	\$7.54 m	Libya	\$1 m
Islamic Relief	\$5.64 m	Turkey	\$1 m
Canada	\$4.9 m		

Source: DMB, February 2008

Although the above figures were pledged, the amounts actually disbursed still need to be assessed.

Different agencies of the United Nations system distributed food items and shelter material to an estimated 850,000 affected people and requested US\$ 9 million from the Central Emergency Relief Funds (CERF).

A large number of NGOs, including Save the Children, IFRC, CARE, Oxfam, Islamic Relief, Muslim Aid, Act, and ADRA also stepped up their activities and committed US\$ 26.1 million to assist cyclone victims.

During this assessment the World Bank contributed a quick-disbursing US\$ 100 million budget for support to reduce the fiscal pressure on the Government. In addition, US\$ 100 million is allocated to the restoration of livelihoods to support post-cyclone recovery and a further US\$ 125 million is allocated to the medium- and long-term restoration and rehabilitation of critical infrastructure assets. The Asian Development Bank has also approved a project for US\$ 150 million in order to finance reconstruction of damage caused by the floods and the cyclone.

⁹ Includes a Loan for US\$60 million, Grant US\$15 million, and DRGCF US\$15 million (as of 23/03/2008)

Social and Economic Background of the Affected Area

Geography and Population

The 12 worst-affected districts are located in the Lower Ganges delta, which makes up about 80 percent of the country. The delta consists of very low-lying land, mostly no more than 3 meters above sea level, and is vulnerable to floods and storm surges. The delta is characterized by high fertility and agricultural productivity. Land holdings are usually small due to a high population growth leading to shortages of land that are not already committed to agriculture, and a growing demand for other land uses such as infrastructure, industry, and urban settlement, making land the scarcest factor of production. The wetland areas, located in the southern part of the Satkhira, Khulna, and Bagerhat districts, were also significantly affected by Cyclone Sidr. The storm also destroyed large part of the mangrove forests, called the Sunderbans, a world heritage site with rare flora and fauna (see Figure 5).

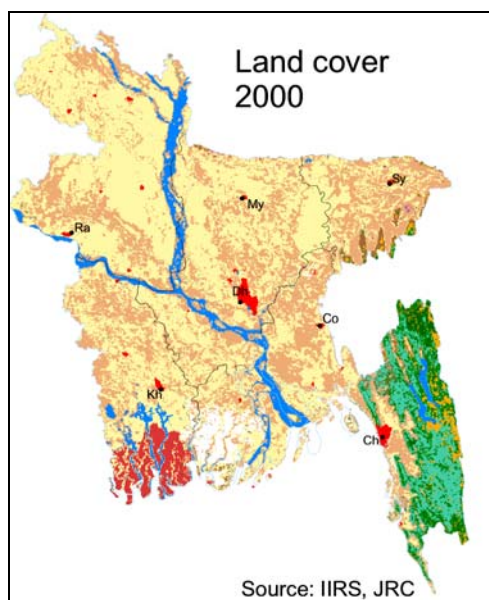
The 12 worst affected districts reflect the country's high population density. Bangladesh is one of the most densely populated countries in the world, with an average of 1,045 persons per square km. Even rural population densities are high. The two worst affected districts, Barguna and Bagerhat, have a population of 0.9 million and 1.6 million, with population density of 711 and 644 persons per sq km, respectively. In the other ten most affected districts, the population is approximately 16.2 million, with an average density of 887 persons per sq km. Table 8 presents a brief demographic summary for the worst affected districts.

Table 8: Demographic Summary for Worst Affected Districts

District	Population est. 2007	Area sq. km.	Population Density per sq. km.	Population (% of Bangladesh)
Bagerhat	1,637,133	2,542	644	1.1
Barguna	903,592	1,271	711	0.6
Barisal	2,465,854	2,752	896	1.6
Bhola	1,882,295	3,245	580	1.3
Gopalgang	1,244,475	805	1,546	0.8
Jhalokathhi	714,597	1,031	693	0.5
Khulna	2,676,252	3,236	827	1.8
Madaripur	1,203,661	1,095	1099	0.8
Patuakhali	1,607,706	2,090	769	1.1
Pirojpur	1,145,864	1,929	594	0.8
Satkhira	2,078,210	1,854	1,121	1.4
Shariatpur	1,183,094	1,589	745	0.8
12 Districts	18,742,733	23,439	800	12.5
Bangladesh	150,448,340	144,000	1,045	100

Source: Population estimates were calculated by extrapolating Population Census data from 2001 (BBS) using the national growth rate (2001–2007).

Figure 5: Land Cover in Bangladesh



Light colors indicate agriculture; green tones are forests, urban areas are red, and wetlands in the southwest are rust colored

Economic Framework

Per capita Gross Domestic Product (GDP) in Bangladesh was US\$ 488 in 2006–07, which reflects consistent growth rates of 6 percent annually from 2003–07. Much of this growth, however, reflects gain to the economy as a whole, rather than to all sectors and regions of the country. GDP, on a sub-national level, was last recorded in 2000, when it was approximately US\$ 363 per person (BBS 2002). However, this rate varied quite a bit by district and region; GDP was highest around Dhaka and in the Chittagong division. The Dhaka district alone, with 6.2 percent of the population, produced 15 percent of total GDP.

The twelve most affected districts together produced 13.8 percent of total GDP with 14 percent of the total population. In these twelve districts, agriculture made up 34.6 percent of regional GDP in 2000. Industry and service amounted to 15.5 percent and 46.8 percent, respectively. Compared to the national sectoral share, agricultural production in these areas was 10 percent higher, while industrial production was nearly 10 percent lower.

Table 9 gives an overview of domestic remittances received by division. It shows that the percentage of households that receive remittances is higher in the divisions that suffered the most losses from Sidr than the national average (21.1 percent in 2005): 29.5 percent in Barisal and 24.1 percent in Khulna. These figures suggest that the population of the most affected divisions tended to migrate to other areas of Bangladesh, possibly because of insufficient economic opportunities.

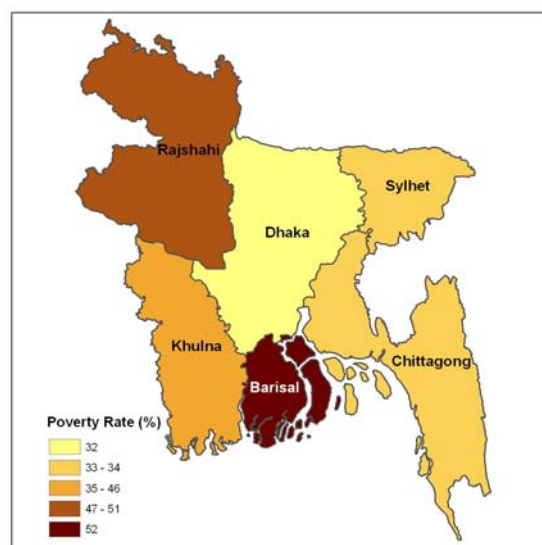
Table 9: Percentage of Households Receiving Domestic Remittances by Division

Division	2005	2000
Barisal	29.5	37.2
Chittagong	25.3	16.1
Dhaka	13.5	17.5
Khulna	24.1	21.0
Rajshahi	27.0	13.6
Sylhet	10.4	33.3
Total	21.1	18.9

Note: Household weighted, Source: HIES 2000, 2005.

Poverty

Bangladesh is a poor country with a national poverty rate of 40 percent (2005) (Upper Poverty Line) (Table 10). Stable economic growth helped this rate decline by 9 percent between 2000 and 2005. However, while the decline was sharp in the central and eastern parts of the country, the two most affected divisions, Barisal and Khulna, have poverty rates that are higher than the national average. In Barisal, the rate remained unchanged between 2000 and 2005, and in Khulna, it increased during the same period, signifying a high level of stagnation in the region. Barisal, the worst affected division, has the highest poverty rate in the country at 52 percent and Khulna has a rate of 45.7 percent (2005) (Figure 6).

Figure 6: Poverty Rates by Division

Source: HIES 2005

Table 10: Poverty Rates by Division

Division	Poverty Headcount Rate* (%)	Population Share (%)	Population (million)	Number of Poor (million)
Barisal	52.0	6.4	9.1	4.8
Chittagong	34.0	19.3	27.4	9.3
Dhaka	32.0	32.2	45.9	14.7
Khulna	45.7	11.7	16.7	7.6
Rajshahi	51.2	24.0	34.2	17.5
Sylhet	33.8	6.3	9.0	3.1
National	40.0	100.0	142.4	57.0

Note: * Using Upper Poverty Line.

Source: HIES 2005.

Figure 7: Destruction along the Coast





Section II: Estimation of Damage and Losses

Methodology

In the aftermath of Cyclone Sidr, the JDNLA team conducted several detailed field trips to assess the damages and losses attributable to the storm. During these trips, estimates were made of the destruction to physical assets and of the losses to the country's economy as a result of the disaster.

The estimates were made using the damage and loss assessment methodology, first developed in the 1970s by the United Nations Economic Commission for Latin America and the Caribbean (ECLAC). It has been continually updated and expanded, and is being customized and simplified for application in different regions of the world (Box 1).¹⁰ This methodology, which has been applied in previous assessments by the World Bank, provides a satisfactory framework for identifying and quantifying the social, economic and environmental impact of natural disasters. Under this framework, damage estimates provide an initial indicator of reconstruction requirements, and losses represent the reduction or decline in economic activity and personal and family income.

Baseline data for each of the sectors as well as for the performance of the Bangladesh economy were assembled from a variety of sources, and collected by the JDNLA team.

Box 1 **Estimation of Damage and Losses – The ECLAC Methodology**

For estimation of the effects and impact of Cyclone Sidr the methodology developed by the UN Economic Commission for Latin America and the Caribbean (UN-ECLAC) was. Damage and Loss Assessment (DaLa) was developed in the 1970s and since then has been strengthened, simplified and customized for application in different areas of the world.

DaLa bases the assessment of disaster impacts on the overall economy of the affected country as well as on household level. This provides a basis for defining the needs for recovery and reconstruction following any disaster. DaLa estimates:

Damage as the replacement value of totally or partially destroyed physical assets that must be included in the reconstruction program;

Losses in the flows of the economy that arise from the temporary absence of the damaged assets;

The resulting *impact* on post-disaster economic performance, with special reference to economic growth, the fiscal position and the balance of payments

¹⁰ Handbook for Estimating the Socio-Economic and Environmental Impact of Disasters, Economic Commission for Latin America and the Caribbean, 2003.

Summary of Damage and Losses

The total amount of damage and loss caused by Cyclone Sidr in Bangladesh has been estimated at BDT 115,600 million (US\$ 1,675 million)¹¹ (Table 11). Damages, which are an expression of the destruction of physical assets, were estimated at BDT 79.9 billion (69 percent of total effects), while losses were estimated at BDT 35.7 billion (31 percent of the total).

Table 11: Overall Summary of Damage and Losses

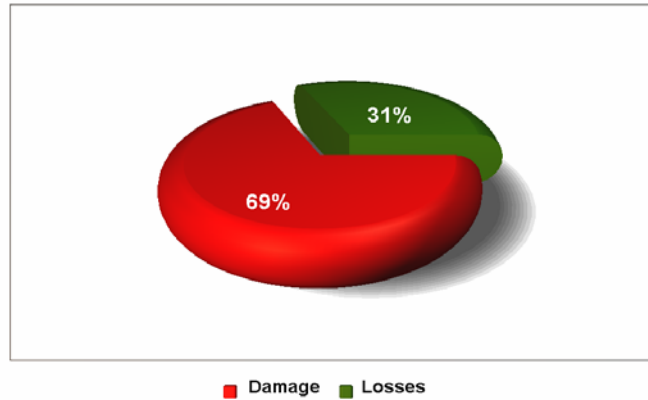
Sector	Subsector	Disaster Effects (BDT Million)			Ownership	
		Damage	Losses	Total	Public	Private
Infrastructure		71,064	2,130	73,194	15,758	57,436
	Housing	57,915	—	57,915	—	57,915
	Transport	8,006	1,725	9,731	8,006	1,725
	Electricity	576	359	935	935	—
	Water and Sanitation	157	46	203	203	—
	Urban and Municipal	1,696	—	1,696	1,696	—
	Water Resource Control	4,918	—	4,918	4,918	—
Social Sectors		4,482	1,453	5,934	5,485	449
	Health and Nutrition	169	1,038	1,206	1,188	18
	Education	4,313	415	4,728	4,297	431
Productive Sectors		1,734	32,083	33,817	19	33,798
	Agriculture	1,472	28,725	30,197	19	30,178
	Industry	262	2,035	2,297	—	2,297
	Commerce	—	1,258	1,258	—	1,258
	Tourism	—	65	65	—	65
Cross-Cutting Issues		420	0	420	420	0
	Environment	420	—	420	420	—
Total		79,904	35,665	115,569	21,682	93,888

Source: Estimates by JDNLA Team.

The effects of Cyclone Sidr were disproportionately located in certain sectors of the economy (e.g. housing), and among certain districts and *upazilas* where the damage and losses were concentrated. Thus while the overall damages and losses from the disaster were not pronounced, the effects were felt more severely in relatively poor areas of the country. Most of the effects were also damages, or lost physical assets, rather than economic losses (see Figure 8), further exacerbating problems for the poor in the worst affected districts.

¹¹ It is to be noted that the aggregation of disaster effects shown in the table differs slightly from the summation of all estimates of each and all sectors taken separately. This is because special care has been taken to avoid double accounting in the above summary table.

Figure 8: Distribution of Disaster Effects

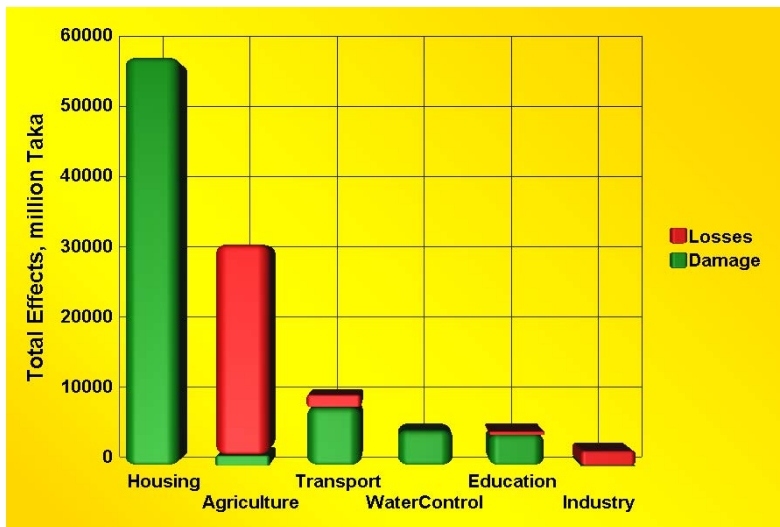


Source: Estimates of JDNLA Team

The effects of the disaster were also concentrated unevenly in the different sectors of the economy. Damage and losses in the housing sector amount to BDT 57.9 billion or 50 percent of the total; those in the productive sectors of agriculture, industry, and commerce were 33.8 billion (29 percent); infrastructure sector effects (excluding housing) represent a further 16 percent, and the social sectors amount to 5 percent.

The most affected individual sectors, in order of decreasing magnitude of total effects, were housing (BDT 57.9 billion), agriculture (BDT 30.2 billion), transport (BDT 9.7 billion), water resource management and control (BDT 4.9 billion), and education (BDT 4.7 billion). When only losses are considered, the most affected were agriculture (BDT 28.7 billion), industry (BDT 2.0 billion), transport (BDT 1.7 billion), and commerce (BDT 1.3 billion) (Figure 9).

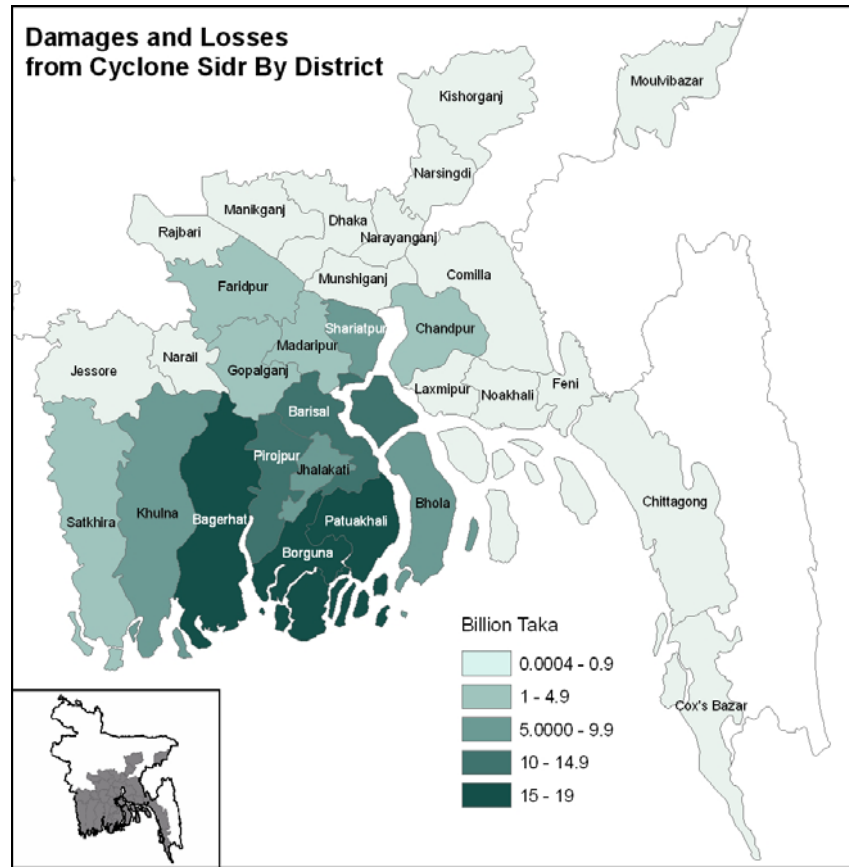
Figure 9: Damage and Losses Caused by Cyclone Sidr in Most Affected Sectors



Source: Estimates of JDNLA Team

The effects of the disaster were also highly concentrated geographically in the Districts of Bagherat, Barguna, Patuakhali, Pirojpur, and Barisal where, according to the 2005 Household Survey, poverty levels range between 35 to more than 50 percent of the population (see Figure 10). Therefore, the brunt of the disaster will be borne by some of the poorest population groups of the country, and will significantly further degrade their living conditions.

Figure 10: Most Affected Districts in Damage and Loss Terms



The total estimated amount of the disaster effects- both damage and losses- represents 2.8 percent of the country's Gross Domestic Product for the previous fiscal year. This reflects relatively moderate levels of losses to the overall economy. However, this is the second such disaster to hit Bangladesh in the same year, leading to an estimated BDT 189.4 billion in disaster effects, or 4.7 percent of GDP. In addition, the effects just from Cyclone Sidr alone must be further examined on the district level, given the disproportionate effects on the coastal and poor districts.

Infrastructure

Housing

Summary

The total value of damage to housing is BDT 57.9 billion (US\$ 839 million), representing more than half of the total damage and losses of all sectors. Rebuilding and rehabilitating homes will be the most important reconstruction effort following Cyclone Sidr, since it will also provide an opportunity to improve construction quality and disaster resilience.

Pre-Disaster Situation

Prior to the disaster, there was wide variation in the quality of housing, ranging from permanent housing to temporary or shanty types of housing (see Figure 11). The Household Income and Expenditure Survey (2005) classified housing into four categories based on quality: Pucca (permanent quality), semi-Pucca, Kutcha, and Shanty. These classifications depend on the roof and wall materials used in construction, as shown in Table 12.

Table 12: Housing Type Characteristics

Households in 2005 (%)	Roof Type				Total
	Cement	C.I. Sheet	Tile/wood	Hemp/hay/bamboo	
Brick/cement	8	12	0	0	20
C.I. Sheet/wood	0	35	0	1	36
Mud brick	0	14	1	2	18
Hemp/hay/bamboo	0	21	0	4	26
Total	8	84	1	7	100
	Pucca	Semi-Pucca	Kutcha		

Source: (HIES 2005)

Figure 11: Semi-Pucca and Kutcha Housing



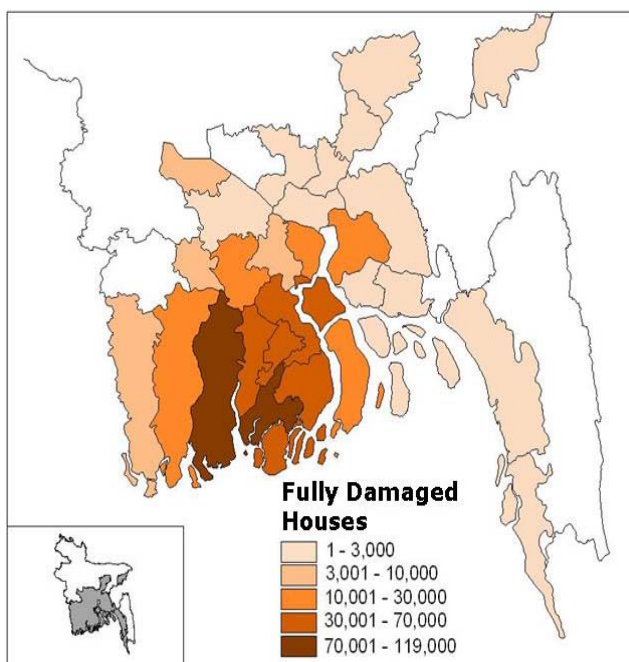
Damage and Loss Assessment

Total housing damage was estimated at BDT 57.9 billion (US\$ 839 million) (see Annex 1 for a detailed breakdown of this assessment).

Cyclone Sidr caused damage in three ways—storm surge, flooding and wind. Pucca houses were much more resistant to wind, often serving very well as local ad hoc shelters, but still sustaining destruction by flooding and surge. Storm surge was by far the most powerful agent of destruction in some areas resulting in total destruction to housing and non-engineered structures. Wind caused some direct destruction which was generally quickly repairable, as well as a substantial number of tree blow downs—a major cause of wind-related housing destruction.

Source: MoFDM, 2008.

Figure 12: Fully Destroyed Houses by District



Most of the damage to the housing sector was concentrated in the districts of Barguna, Jhalokathi, Bagerhat, Pirojpur, Patuakhali, and Shariatpur (see Figure 12 and Table 14), that were among the twelve most affected districts. These districts sustained BDT 42.7 billion (US\$ 619 million) in total damages, representing 74 percent of the total damages caused in from all 30 districts (see Table 13). Of the existing total of 12.4 million households in the 30 affected districts, 565,000 households were totally destroyed, and over 950,000 were partially but significantly destroyed. In the 12 most affected districts, nearly 540,000 households' dwellings (15 percent) of the 3.5 million households were completely destroyed, and another 854,000 (24 percent) were partially damaged. As many as nine million people were without shelter initially, and 3.5 million were without shelter over a significant period.

Table 13: Damage in the Housing Sector

	Damaged Households	
	Full	Partial
Total No. (12 Dist)	537,775	854,344
Damage (BDT billion)	23.0	24.7
Damage (US\$ million)	334	358
Total No. (30 Dist)	564,967	957,110
Damage (BDT billion)	30.2	27.7
Damage (US\$ million)	437.7	401.4
Total Damage (BDT billion)	57.9	
Total Damage (US\$ million)	839	

Table 14: Housing Damage in the Twelve Worst Affected Districts

District	Population 2007 est.	Damaged Households	
		Full (% of District)	Part (% of District)
Barguna	984,323	47%	53%
Jhalokati	805,308	48%	52%
Bagerhat	1,796,876	37%	41%
Pirojpur	1,288,839	27%	34%
Patuakhali	1,694,506	19%	47%
Shariatpur	1,255,468	13%	5%
Barisal	2,732,922	9%	19%
Bhola	1,975,616	5%	6%
Khulna	2,759,606	4%	14%
Madaripur	1,329,765	2%	3%
Satkhira	2,163,057	1%	3%
Gopalganj	1,351,717	11%	39%

High resolution satellite images can provide useful and timely information on housing damage after a disaster. The International Charter 'Space and Major Disasters' aims at providing a unified system of space data acquisition and delivery to those affected by natural or man-made disasters. Shortly after the disaster, the International Charter was triggered by United Nations Office for Outer Space Affairs (UNOOSA) and subsequently the Charter-satellites were tasked to acquire data. The resulting damage maps identified damages to certain housing infrastructures. In some regions, the damage detection was hampered by dense vegetation cover (see Annex 9).

Preliminary Recommendations and Needs

While the value of damage is high, the population is relatively resilient and a significant portion has already partially restored their dwellings. This recovery was assisted by timely Government distribution of small rebuilding grants and materials, which greatly reduced the ongoing economic losses associated with temporary shelters. However, a shelter assessment (organized by the Shelter Cluster and reported by Disaster Management Bureau (DMB)¹² estimated that as many as 34 percent of households with fully destroyed houses and 17 percent with partially destroyed houses may still need external assistance for rebuilding. This equates to a need of approximately BDT 11.5 billion (US\$ 167 million) for rebuilding. However, the quality in construction needs to be improved and therefore, the total housing reconstruction need is estimated at BDT 14 billion (US\$ 200 million) taking into account reinforced structures.

Assistance needs to be fast-tracked with highest priority for vulnerable households (approximately 70,000) at an estimated cost of BDT 1.4 billion or US\$ 20 million.

Because rebuilding is occurring rapidly, future comparable cyclones will result in comparable losses. Progress can probably be most effectively achieved by integrated community flood management (including storm surge protection) and better housing standards. For cyclones,

¹² Ministry for Food and Disaster Management (2008) *Cyclone Sidr, Early Recovery, Reconstruction and Rehabilitation Report*, 14 January 2008 Draft Outline for Internal Review.

this can probably best be achieved by development and mass production of low-cost, standardized housing components that raise the first floor above frequent flooding levels and strengthening the envelope against wind. This is a significant development need for Bangladesh.

Fallen trees were a significant cause of destruction and injury. Since strengthening housing against this hazard is not feasible, frequent tree trimming and maintenance should be encouraged in communities highly exposed to this hazard.

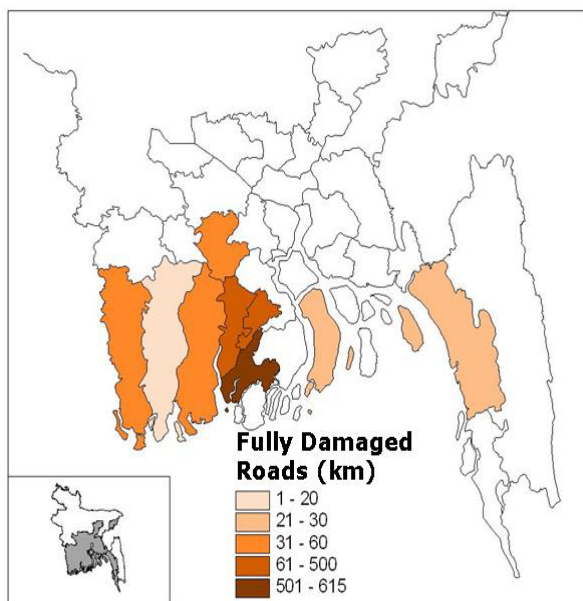


Figure 13: Destroyed Houses

Transport

Summary

Figure 14: Road Damage by District



Source: MoFDM, 2008

Damages to the road network provide an opportunity to repair them to modern standards, and at higher elevations to limit the scope of damage from future disasters. As such, the needs for the transport sector are estimated to be BDT 10 billion (US\$ 145 million). For more detail on the transport sector, see Annex 2.

Pre-Disaster Situation

Figure 15: Ferry as an Important Mode of Transportation



Inland Water Transport

The inland water transport system is important to Bangladesh and is 8,370 km in length, with 3,060 km of main cargo routes. The network is reduced to 5,200 km in the dry season (data as of 2006).

Roads

Bangladesh has approximately 273,000 km of roadways, of which 23,000 (9.5 percent) are paved. About 21,500 km of roads are under the jurisdiction of the

Cyclone Sidr's effects on the transport sector were largely confined to the road system (including bridges, culverts, and ferries) and to inland water transport.

Sidr damaged an estimated 8,075 km of roads in 11 districts at a cost of approximately BDT 8 billion (US\$ 115 million). The increased cost of road transport, arising from the damage, is estimated to be BDT 1.7 billion (US\$ 25 million).

About 25 percent of the national inland water transport navigation aids were disrupted by the disaster, at a total damage cost of BDT 72 million (US\$ 1 million)

Roads and Highways Development, while the remaining 240,000 km is under the jurisdiction of LGED. The arterial road network, under the jurisdiction of the Roads and Highways Department (RHD), includes over 3,000 km of national roads, 2,000 km of regional roads and 16,000 km of *Zila* feeder roads. About half of *Zila* (district) roads, and smaller feeder roads, are unpaved. Given the frequency of flooding, roads are generally constructed on raised embankments.

The crest width of embankments and that of road pavement and shoulder are 12.2 m, and 7.3 m, respectively, and 1.83 m for national highways; 10 m, 5.5 m, and 1.83 m for regional highways; and 7.3 m, 3.66 m and 1.83 m for *Zila* and *Upazila* feeder roads. However, more than two-thirds of the national highways have pavement widths lower than the prescribed amount.

While some roads are of good quality, inadequate capacity—exacerbated by the mix of heavy truck and bus traffic with pedestrian and rickshaws—results in excessive congestion and unsafe conditions. Subgrades are often of poor quality, and most embankments are inadequately compacted, with pavements that are sensitive to moisture content. The growth of the road network across flood plains of rivers has created drainage problems. Consequently, due to impeded drainage, the duration and depth of floods tend to be prolonged. Roads in deeply flooded areas experience wave erosion and nearby rivers are affected by river erosion.

Damage and Loss Assessment

Cyclone Sidr impacted 8,075 km of roads in 11 of the 30 affected districts. Of the 8,075 km, 1,714 km are fully damaged, and 6,361 km are partially damaged. Major destruction occurred in Barguna, Jhalakathi, Pirojpur, and Patuakhali districts. Roads are mainly affected in the districts located along the coastline or on the banks of estuarine rivers. Most of the affected roads are embankment-cum-roads and were destroyed by the high tidal surge during the cyclone. Total value of the damage to roads, bridges, culverts, and ferry damage is estimated to be approximately BDT 8 billion (US\$ 115 million)¹³. Estimating losses in the use of damaged road transport is very difficult, because data are lacking on traffic, locations of road outages, and so forth. Based on two alternate approaches, however, the losses were estimated to be BDT 1.7 billion (US\$ 25 million), or about 22 percent of the value of damage, assuming that repairs and reconstruction are completed within one year.

Approximately, about 25 percent of the national inland water transport navigation aids were disrupted by Cyclone Sidr. The Inland Water Transport Authority (IWTA) is performing the repairs at a total cost of BDT 72 million (US\$ 1 million).

¹³ This figure includes an estimated BDT 3.28 billion (US\$ 47.5 million) in damages to LGED infrastructure, including 1,988 km of paved roads, 1,670 km of unpaved roads, 7,878 m of bridges/culverts, and 2,791 m of bridge approaches (Source: LGED, March 2008) and an estimated BDT 4.3 billion (US\$ 62 million) in damages to RHD roads, including 155.5 km of National Highways, 251 km of Regional highways, 851.5 km District Roads (*Zila*) for a total 1,258 km of roads in 11 of 30 districts.

Figure 16: Ferry Pontoon with Stranded Ferry



Preliminary Recommendations and Needs

The road impacts need to be seen in the context of the overall inadequacy of the entire road system. More and larger roads are needed and, in particular, the replacement of numerous ferry crossings with bridges. This is an unavoidable and critical requirement for development. As the road system is developed, efforts should be made to assure that proper design and elevation standards make it less vulnerable to future flooding and storm surge.

Main roads are being restored as a first priority, but efforts should be made to avoid lags in secondary road restoration that can delay recovery in hard-hit communities. If damaged roads are repaired to modern standards and at a higher elevation, transport needs are estimated to be BDT 10 billion (US\$ 145 million). For a detailed analysis, see Annex 2.

Power

Summary

Figure 17: Damaged Power Pole



Power was the only energy sector significantly affected by Cyclone Sidr, with rural distribution bearing the brunt of the damage.

Damage to the power sector totaled BDT 576 million (US\$ 8.2 million), with 90 percent borne by the Rural Electrification Board (REB); losses were estimated at BDT 359 million (US\$ 5.1 million) for a damage and loss total of BDT 935 million (US\$ 13.4 million). Cyclone Sidr's strong winds caused major destruction to Bangladesh's power supply system, as well as disrupting the supply of electricity for the entire country for almost a full day. Damage was incurred by several transmission lines--due to high sustained winds and fallen trees--and certain substation components, as well as in the entire distribution network in the most affected areas, especially

those serviced by the West Zone Power Distribution Company Limited (WZPDCL), based in Khulna. No significant damage was sustained by power plants.

Damage and Loss Assessment

Immediately following the disaster, repair crews from the affected electrical utilities—including the Power Grid Company of Bangladesh (PGCB), the Rural Electrification Board (REB), and the aforementioned WZPDCL—were sent out to repair the damage, using spare parts and equipment from stock. Within five days, the transmission system was fully operational. Distribution systems were expected to be restored by mid-December; however, during the field mission for the assessment, it became evident that certain limited zones in the most affected areas were still without power.

Demand for electricity fell immediately after the cyclone as a result of extensive physical damage to housing, industries (especially small-scale units), commerce, and other sectors caused by the storm surge and the wind brought by Sidr. At the time of this report, demand was not fully back to pre-disaster levels, with the corresponding negative impact on power utilities revenues.

The total amount of damage and losses in the electrical sector was estimated at BDT 935 million (US\$ 13.4 million). Of this total, BDT 576 million refer to the value of damage to physical assets (61 percent of the total) and BDT 359 million represent the losses in revenues (Table 15). For a detailed analysis of damage and losses calculations, see Annex 3.

Table 15: Damage and Losses in the Power Sector

Item	Disaster effects, BDT million		
	Damage	Losses	Total
Transmission system			
Power Grid Company of Bangladesh (PGCB)	19.49	—	19.49
Distribution			
West Zone Power Distribution Company Ltd (WZPDCL)	45.30	—	45.30
Rural Electrification Board (REB)	511.00	—	511.00
Entire country sales for 1 day	—	197.7	197.00
Distribution losses in most affected areas	—	161.2	161.20
Total sector (BDT million)	575.79	358.90	934.69
Total sector (US\$ million)	\$ 8.2	\$ 5.1	\$ 13.4

Sources: Damage values supplied by electrical utility enterprises; losses were estimated by JDNLA Team.

Preliminary Recommendations and Needs

In January 2008, WZPDCL prepared a Development Project Proposal (DPP) to rehabilitate, restore, and expand its Power Distribution System and take preventive measures against future cyclones in the Sidr-affected 27 *upazilas* of the 15 districts of the WZPDCL area. This two year (2008–10) project is estimated to cost BDT 2,927 million (US\$ 42.4 million).

Telecommunications

Summary

The official report of Bangladesh Telegraph and Telephone Board (BTTB) stated that the infrastructures of telecommunication systems had severely damaged in highly cyclone affected 11 districts. The damages included microwave backbone links, frequency distribution tower, transformers, distribution cables, cabinets and underground lines. The highest damages were occurred in Pirojpur, Bagerhat, Jhalakathi, Barisal and Bagerhat districts due to high wind speed and fallen of trees on distribution lines. BTTB report showed that total estimated damage and loss was about BDT 2 billion (US\$ 29.5 million). The Ministry of Post and Telecommunications reported a proposed project with an estimated cost of 1.78 billion (US\$ 25.8 million) has been sent to the planning commission to address losses and damages caused in the sector. Needs in the sector have been identified to include the latest technology, training and research development, as well as infrastructure development of the telecommunication sector in the coastal areas.

Mobile operators were not significantly affected by Cyclone Sidr; as of 22 November 2007, only seven percent non-operational facilities in the affected area.

Figure 18: Typical Mobile Telecommunications Tower



Water Supply and Sanitation

Summary

The primary impact of Cyclone Sidr on water supply and sanitation facilities was in rural areas. The Department of Public Health Engineering (DPHE) reported damage to 11,612 tube wells, 7,155 ponds and over 55,000 latrines. Damage for these totals BDT 157 million (US\$ 2.28 million) and loss totals BDT 46 million (US\$ 0.67 million) (Table 16).

Pre-Disaster Situation

Larger towns in Bangladesh have underground piped municipal water supply served from either elevated tanks or deep water wells. Such supplies serve only a small fraction of the population, and most Bangladeshis are served from tube wells (accessing either shallow or deep aquifers) and surface ponds. Water supply and sanitation was vulnerable in coastal districts, even prior to Cyclone Sidr. Human waste was generally not treated and, outside of urban areas, pit latrines are the most common facility. Waterborne disease was a major public health problem.

Damage and Loss Assessment

Drinking water sources (tube wells and ponds) in many communities were contaminated by saline water and debris and power outages affected water supplies in areas with piped water. In addition, in many areas groundwater sources were contaminated by arsenic and salinity in shallow aquifers, and the non-existence of deep aquifers. The people of this area rely on pond water, and often use Pond Sand Filters (PSF).

Damage to sanitation facilities and infrastructure was also significant in all the worst affected *upazilas* surveyed. Most of the damages were concentrated in the rural areas. Sanitation needs are significant for an estimated 1.3 million people. For some of the worst affected areas, physical damage to household latrines was fairly common, with one estimate putting the percentage of slab latrines damaged or destroyed as high as 70 percent. The affected population is now also vulnerable to diarrhea and other hygiene-related diseases.

Table 16: Damage and Losses in the Water Supply and Sanitation Sector

Sector	Damage	Loss	Total	Total
				US\$ millions
		BDT millions		
Rural	140.3	46.1	186.4	2.7
Urban	17.2	0	17.2	0.2
Total	157.5	46.1	203.6	3.0

Preliminary Recommendations and Needs

Taking Sidr-affected districts as an initial focus area, a needs assessment has been outlined by DPHE considering two aspects: (i) restoring water supply to pre-cyclone conditions and further development of services, and (ii) emergency preparedness to address future natural disasters, which is estimated by DPHE to cost BDT 8,663 million (US\$ 124 million).

These recommendations include:

- The consideration of medium-term solutions will require not only prioritizing investment, but also identifying appropriate institutional arrangements between central government and municipal governments in line with the current decentralization trend being promoted on many fronts by the Government of Bangladesh;
- In areas where surface water sources are the only option for drinking water, rehabilitation or reconstruction of pond sand filters is required;
- For users of sanitary latrines, replacement of slabs and other infrastructural rehabilitation is required;
- To mitigate future crises at times of natural calamities, construction of water points is to be carried out in schools, community facilities and cyclone shelters;
- Rehabilitation of water options is necessary to ensure it is properly functioning;
- De-watering of ponds and removal of sludge before the monsoon is required;
- In places where contamination of groundwater can be treated, the most appropriate and sustainable (given the target community of users) water treatment technologies need to be installed.

The areas for medium-term (four-year horizon) reconstruction have been identified by DPHE as follows

- Installation of shallow/deep tube wells is needed in the worst affected *upazilas* where safe groundwater can be detected;
- Installation of new latrines to improve sanitation;
- Excavation and re-excavation of ponds;
- Feasibility studies to identify potential and appropriate technology that can be operated and maintained on a sustainable basis;
- Establishment of water quality testing and monitoring systems;
- Capacity building of the service provider and the community in respect to water point installation and operation and maintenance (O&M) of the water services along with pond management;
- Hygiene promotional program for communities;
- School sanitation;
- Development of water source having protection from natural disaster e.g. ponds with raised embankment;
- Raised community latrines;
- Mobile treatment plants including desalination facilities;
- Improve water transport facilities during disaster; and
- Capacity building of the community and Local Government Institutions (LGI) in terms of water supply and sanitation to cope with the crisis and emergency response period during natural disasters.

To mitigate recurrent storm damage (from cyclones and floods) and the potential spread of waterborne diseases, a long-term program is required that includes a focus on safe water supply and sanitation facilities. It is also recommended to work towards institutional decentralization to increase effectiveness of services.

Urban and Municipal Infrastructure

Summary

Fifty municipalities were affected in 15 districts, for an estimated cost for reconstruction or rehabilitation of BDT 1.7 billion (US \$24.6 million). Of this amount, the total estimated cost of rehabilitation of the damaged infrastructure in the 14 municipalities in the most severely damaged districts is estimated to be BDT 953 million (US \$13.8 million).

Damage and Loss Assessment

Fifty municipalities (*pourashavas*) in fifteen districts were affected by Cyclone Sidr, according to a summary provided by the Local Government Engineering Department (LGED). The damaged infrastructure in these municipalities includes 825 km of municipal roads and 16,880 meters of drainage. For the 14 most severely affected municipalities (in Bagerhat, Barguna, Patuakhali, and Pirojpur districts), 392.8 km of roads and 7,541 m of drainage were damaged.

The 2007 monsoon floods also affected 28 municipalities in the moderately affected districts (Barisal, Bhola, Gopalganj, Madaripur, and Shariatpur) and seven *pourashavas* in Madaripur and Shariatpur. Fifteen towns were marginally affected by Cyclone Sidr in Jessore, Satkhira, Chandpur, Comilla, and Cox's Bazar districts.

The total cost for reconstruction or rehabilitation of infrastructure in the 50 affected municipalities is estimated to be BDT 1.7 billion (US \$24.6 million), on a preliminary basis. Of this, the total estimated cost of rehabilitation of the damaged infrastructure in the 14 towns in severely damaged districts amounts to BDT 952.86 million (US \$13.8 million).

Preliminary Recommendations and Needs

The total estimated cost of rehabilitation of the damaged urban and municipal infrastructure is estimated to be BDT 1.7 billion (US \$24.6 million). In each of these towns, in addition to the damages reported to the municipal infrastructure in the LGED summary, there have been damages to private housing and business structures that have not been included here. The concomitant losses to livelihood, trade, and industry in these urban areas have not yet been estimated by the Government or *pourashavas*.

Embankments and Water Control Structures

Summary

Embankments in many places in the coastal area provided protection against Cyclone Sidr. However, in areas where the structures had not been properly maintained or where they had eroded (especially in areas where the forest cover in front of the structures was negligible), the impact of the storm surge had devastating consequences for those nearest and behind the inadequate infrastructure. The total damages to over 2000 km of embankments and other critical water control structures amounted to about BDT 4.9 billion (US\$71 million). This had severe consequences for the agriculture and housing sectors.

Pre-Disaster Situation

Over the last four decades, about 125 polders have been constructed in 19 districts of the coastal area, covering an area of about 13,000 km². The polders consist of peripheral embankments with water control structures/regulators for drainage. The primary objective is to support agriculture and provide protection to life and properties of the inhabitants during cyclones or tidal surges. The dykes do not cover the entire sea coast, though they provide the first line of defense against storm surges and possible climate change-induced sea level rise. The coastal polders consist of about 5,000 km embankment and about 2500 water control structures (WCS). Out of 5000 km of embankments, about 1000 km of sea dykes were constructed at locations facing the Bay of Bengal and along the banks of major rivers or channels. Prior to the cyclone, these embankments were vulnerable in many places mostly due to disrepair or river erosion.

Damage and Loss Assessment

This Cyclone affected around 2,290 km of embankment in 15 districts¹⁴, of which 13 were in the coastal area. Of the 2,290 km affected embankments, 362 km were fully destroyed while the rest were partially damaged.

Total damages were estimated at BDT 4,918 million (US\$ 71.0 million), by the Bangladesh Water Development Board (BWDB). This damage estimate is based on the current unit values for pre-cyclone physical dimensions (Table 17).

The damages to the polder infrastructure in the four worst affected districts (Barguna, Patuakhali, Pirojpur and Bagerhat) amount to about BDT 2.7 billion (US\$ 40 million), which is about 58 percent of the total.

¹⁴ Barguna, Patuakhali, Pirojpur, Bagerhat, Barisal, Jhalakathi, Bhola, Satkhira, Khulna, Jessore, Cox's Bazar, Chittagong, Laxmipur, Noakhali, and Chandpur (15 districts)

Table 17: Damage Assessment for Coastal Polders by Type of Works

S1. No.	Type of Works	Unit	Extent of Damage		Total Damage Value	
			Full	Part	BDT million	US\$ million
1	Embankment	Km	362	1,927	2,238	32 (46%)
2	Irrigation/ Drainage channels	Km	82	139	28	0.4 (0 %)
3	Water Control Structures (WCS)	No.	318	546	1086	16 (23%)
4	Protective Works	Km	29	20	1,341	19 (27%)
5	Others (office and residential bldgs.)	No.	—	143	225	3 (4%)
Total					4.918	71 (100%)

Source: BWDB

1. All these are public goods, managed by the Ministry of Water Resources through BWDB.
2. Damage estimate is based on the current unit values for pre-cyclone physical dimensions.

Figure 19: Embankments Washed Away By Sidr's Storm Surge



Embankment and riverbank protection works account for almost 65 percent of the damage; the remaining 35 percent of damage is comprised of water control structures and drainage-irrigation systems. Breakdown of damage costs by types of works is the following: (i) embankments: 46 percent; (ii) water control structures: 23 percent; (iii) erosion protection works: 19 percent; and (iv) irrigation system and water control structures: 0.4 percent

These cyclone-induced failures caused losses to agriculture crops, aquaculture fisheries, livestock, anti-erosion plantation and so forth, which have been separately assessed and reported in the appropriate sections of this report.

Preliminary Recommendations and Needs

Reconstruction and Rehabilitation Needs

In the short-term, the Government plans to re-construct or rehabilitate damaged embankments and water control structures (including the drainage system) following current design standards. This reconstruction would also create employment opportunities for local communities, which will contribute to livelihood security in the cyclone-affected areas. The reconstruction and rehabilitation needs for the short term is about BDT 8 billion (US\$ 116 million), excluding the cost of plantation. For the four worst affected districts (Barguna, Patuakhali, Pirojpur, and Bagerhat) about BDT 3.8 billion (US\$ 55 million) will be needed, which is about 48 percent of

short-term total needs. On average, each km of embankment costs BDT 8 - 10 million and reconstruction costs of one km of partially damaged embankment are BDT 2-2.5 million (BWDB estimate). BWDB reconstruction cost estimates are based on current design standards, which may require upgrading. Estimated reconstruction costs include an additional BDT 3 billion (US\$ 44 million) to cover the new protective works, acquisition of 145 ha of land, incremental staff, operating costs, transport, office equipment, and consultancy services.

Table 18: Short-Term Needs Assessment for Coastal Polders by Type of Works

Type of Works	Total Damage Cost		Total Rehabilitation [*] Cost		Remarks
	BDT million	US\$ million	BDT million	US\$ million	
Embankment	2,238	32	3,000.0	43	Following current design standards
Irrigation/ Drainage channels	28	0.4	38.0	0.5	Following current design standards
Water Control Structures (WCS)	1,086	16	1,343.0	19	Following current design standards
Protective Works	1,341	19	2,544.0	36	Includes new areas
Land Acquisition (145 ha)	225	3	116.0	1.7	For relocating existing infrastructure
Others	—	—	811.0	12	For implementation support : transport, office equipment, incremental staff, operating cost
Consultancy services	—	—	120.0	1.8	To provide implementation support and M&E
Total	4,918	71	8,010	116	

Note: (BDT 69.0 =US\$1.0).

Source; BWDB

* Rehabilitation/Re-construction following BWDB design standards. Additional items are new protective works, acquisition of 145 ha land, incremental staff & operating cost, transport, office equipment, and consultancy services.

In the medium-term, the Government must consider a plan to upgrade the embankments and water control structures following improved design standards, including necessary bank protective works and anti-erosion plantation in priority areas. This is estimated to cost about BDT 12.4 billion (US\$180 million).

Social Sectors

Education

Summary

An estimated 5,927 educational institutions were fully or partially damaged by Cyclone Sidr, resulting in a total value of damage and losses of BDT 4.7 billion.

However, the education sector's needs are approximately BDT 7.8 billion (US\$ 113 million), due primarily to increased cost of constructing new schools that would also serve as emergency shelters.

Pre-Disaster Situation

Figure 20: School Girls



The Ministry of Primary and Mass Education (MOPME) is responsible for formal primary education in Bangladesh. About 16.2 million students are enrolled in over 80,000 primary education institutions in the country¹⁵. Primary education is provided mainly by the Government, the private sector and NGOs, but it remains essentially publically financed. About 47 percent of schools are Government primary schools (GPS), accommodating 58 percent of total enrollment. Registered non-Government primary schools (RNGPS) represent 25 percent of primary schools and NGOs 7 percent. The rest are of the schools are religious school (Ebtedayee Madrasahs), non-registered schools, or other types of primary level institutions. Most of these institutions, including the private providers, are subsidized by the Government. Close to 1.2 million children currently receive primary education in NGO schools.

The Ministry of Education (MOE) manages junior and senior secondary education (grades 6-9) and tertiary education. Bangladesh has a unique system of secondary education: 98 percent of institutions are privately managed, but supported through the Government providing 100 percent of teacher salaries. There are over 3.8 million students enrolled in over 18,500 institutions with a teaching force of 238,000, and four types of Madrasah schools with 3.8 million students. The transition to and retention within junior secondary school is estimated at about 20 percent of primary school students.

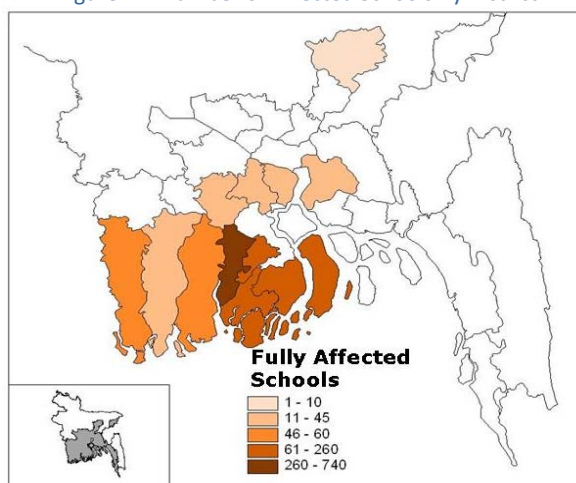
In the five severely cyclone-affected districts, about 1.17 million primary children are enrolled in institutions.

¹⁵ Baseline Survey of PEPD II, 2005

Damage and Loss Assessment

The highest numbers of fully destroyed primary schools are located in Barguna (230), Pirojpur (149), Patuakhali (98), Barisal (91), and Bagerhat (68). The highest numbers of partially destroyed primary schools are in Barisal (632), Patuakhali (550), Pirojpur (401), Jhalakathi (340), and Barguna (335). The worst affected, both fully and partially destroyed, schools are in Barisal (723).

Figure 21: Number of Affected Schools By District



Source: MoFDM 2008

According to the initial assessment, a total of 9,655 educational institutions have been fully or partially destroyed in 19 of the 30 cyclone affected districts. Table 19 summarizes the extent of destruction to Formal as well as Non-Formal Educational Institutions.

Table 19: Number of Affected Educational Institutions

Institutions		Type of Destruction	
		Full Destruction	Partial Destruction
Primary Education	Formal	784	3,705
	Non-Formal	435	254
Subtotal Primary Education		1,219	3,959
Secondary Education	Formal	786	2,942
	Non-Formal	58	83
Subtotal Secondary Education		844	3,025
Non-Formal Education	Pre-primary learning centers	102	75
	Adult Literacy centers	72	58
	Post-literacy Education Centers	192	109
Subtotal Non Formal Education		366	242
Total		2,429	7,226

In the twelve badly affected districts (namely Bagerhat, Barguna, Barisal, Bhola, Gopalganj, Jhalakathi, Khulna, Madaripur, Patuakhalki, Pirojpur, Satkhira, and Shariatpur) an estimated 4,879 registered secondary and higher secondary schools, colleges and madrashahs existed prior

to the disaster. Out of these, a total of 3,736 (76.6 percent) were either fully or partially damaged, of which 787 (16 percent) were fully damaged. It was found that most of the affected institutions were made of C.I. sheet roofing with wooden pillar and bamboo fencing.

The Ministry of Education has decided to undertake a short-run program to resume academic activities in the cyclone-torn institutions by erective temporary structures, providing books and study materials, waiving examination fees and rescheduling public examinations. In the long-run, the Government has planned to construct academic building-cum-cyclone shelters in the cyclone affected coastal areas.

The Ministry of Education took immediate initiatives to restore the educational activities by undertaking an emergency program for rebuilding the fully damaged and repairing the partially damaged institutions. The Government has allocated BDT 359 million (US\$ 5.2 million) for rehabilitation of the cyclone-torn institutions. Each Partially damaged institution received BDT 50,000 (US\$ 725) and fully damaged institutions received BDT 250,000 (US\$ 3,623), of which BDT 200,000 (US\$ 2,898) and BDT 50,000 (US\$ 725) was allocated for construction of temporary structures and procurement of furniture, respectively. In addition, each affected *upazila* was allocated BDT 50,000 (US\$ 725) to distribute between students to purchase books and study materials. This emergency restoration was implemented by the local School Managing Committees (SMCs) under the supervision of relevant Deputy Commissioners and *Upazila Nirbahi* Officers. As of March 2008, 3,071 educational institutions (82 percent) have been rehabilitated.

Losses incurred by providing interim facilities during reconstruction are estimated at BDT 415 million (US\$ 6 million). The Government has already provided funding of BDT 745 million (US\$ 10.8 million¹⁶) for repairs to the 3,705 partially destroyed schools. It is reported that 95 percent of school repairs have been completed.

Additional textbooks from the Government's stock were provided to affected students, so there were no additional costs associated with this.

Preliminary Recommendations and Needs

It is expected that makeshift schools will need to be constructed for about 60 percent of the 784 schools that were fully destroyed, as some communities have already established arrangements for schools to resume classes.

Pucca-constructed schools maintained building integrity, so the priority is to reconstruct affected schools adopting higher design standards. The rebuilding of a large number of schools offers an excellent opportunity to build well-engineered multistory buildings that can also serve as emergency shelters during natural disasters and other emergencies. This will entail a significantly increased (but justifiable) cost. Preliminary estimates indicate that the educational sector's need is around BDT 7.6 billion (US\$ 110 million), see Table 20.

¹⁶ Based on unit cost BDT 200,000 (US\$ 2,900) per school.

Table 20: Summary of Reconstruction Cost of Educational Institutions

Institutions		Reconstruction Requirements	
		BDT million	US\$ million
Formal Education Institutions	Fully destroyed	7,100	103.00
	Makeshift schools	421	6.10
Subtotal Formal Education		7,521	109.00
Non Formal Education Institutions	Primary Learning Centers	65.7	1.00
	Adolescent Education Centers	1.2	0.02
	Pre-primary learning centers	4.9	0.07
	Adult Literacy centers	1.1	0.02
	Post-literacy Education Centers	7.7	0.10
Subtotal Non Formal Education		80.6	1.21
Total		7,602.0	110.00

With the start of the new academic year, the regular supply of new books will be available for students. The Government also proposes to provide book bags (which should be water resistant) and some stationery to students in severely affected areas. The costs are estimated at approximately BDT 10 million (US\$ 147,000¹⁷).

In the long term, the Ministry of Education will undertake a joint development program in collaboration with the Ministry of Food and Disaster Management and other relevant ministries and agencies to further improve educational institutions in the Sidr-affected areas. With a view to improve the security of lives, programs have been finalized to establish academic building-cum-cyclone shelters in the high risk zones (HRZs) of the coastal areas. To date, 600 institutes have been identified for contribution of academic building-cum-cyclone shelters in the entire coastal belt from Satkhira to Cox's Bazaar.

¹⁷ At this time, the exact number of students is not known, but is estimated to be 40,000, which is 40% of total students (970,000) from the severely affected areas Bagerhat, Barisal, Pirojpur, Barguna, Patuakhali. The unit cost for assistance is BDT 250. Total cost = US\$147,000.

Health and Nutrition

Summary

The total value of damage and losses in the health, nutrition, and family planning sector in the nine districts affected by Cyclone Sidr is estimated to be BDT 1,206 billion (US\$ 17.5 million). The damage to physical facilities reported here is for public health facilities, as estimated by the Ministry of Health and Family Welfare's Construction and Maintenance Management Unit.

Pre-Disaster Situation

While no district-based information exists on health indicators, the average values for the Barisal and Khulna Divisions, where the nine cyclone-affected districts are located, are at par with or better than those in the rest of the country.

Table 21: Health Indicators in the Two Cyclone-Affected Divisions

Indicator	Barisal	Khulna	National
Infant mortality rate (per 1,000 live births)	61	66	65
Total fertility rate	2.9	2.8	3
% children stunted	49	32	43

Source: Bangladesh Demographic and Health Survey 2004.

In Khulna and Barisal, as in the rest of the country, there is a multi-tiered health care system. Health care personnel at this level include physicians, nurses, and allied health professionals. There is at least a 31-bed health complex in each *upazila*. There are also health posts throughout the *upazila* which offer simpler services for people unable to access the main health complex. Community health workers are also available throughout the country.

The intermediate level of the health care system is the district level. Each district has a hospital which offers a range of primary and specialty services. In addition to the hospital, the district health center has a disease surveillance unit which collects and integrates data from the *upazilas* and lower subunits. Districts also have epidemiologic investigative teams (also known as rapid response teams).

The highest level of the health care system consists of a national network of medical college hospitals and specialized referral hospitals. Private medical centers and hospitals are also present in Bangladesh. Outside of the major urban centers, these hospitals are usually small clinics with minimal in-patient facilities. However, within the urban centers there are larger hospitals which can offer services at international standards. In most rural areas there is a wide network of village doctors and pharmacies that provide about 50 to 60 percent of the ambulatory care.

Damage and Loss Assessment

The cyclone caused total or partial destruction of public facilities worth BDT 168.8 million (US\$ 2.45 million), while the estimate for losses is about BDT 1037.6 million. There is a high concentration of private medical practices and pharmacies in the 9 worst-affected districts. As these are most often located in houses, the estimated damage they sustained is assumed to be proportional to overall housing damage (Table 22).

Table 22: Damage to Health Facilities

Facilities	No of facilities Affected	Total (BDT)
District Hospitals	5	8,950,000
Barisal	1	2,000,000
Bhola	1	1,500,000
Barguna	1	3,000,000
Jhalakathi	1	1,650,000
Pirojpur	1	800,000
Upazila Health Complex	34	48,775,000
Barisal	9	9,350,000
Bhola	6	6,650,000
Barguna	4	8,950,000
Jhalakathi	3	7,800,000
Patuakhali	6	9,450,000
Pirojpur	6	6,575,000
Union level health facility of DGHS	5	6,350,000
Barisal	0	
Bhola	1	3,000,000
Barguna	2	1,500,000
Jhalakathi	1	1,500,000
Patuakhali	1	350,000
Pirojpur	0	
Sub-Centre/Rural Dispensary	38	11,330,000
Barisal	12	2,680,000
Bhola	1	200,000
Barguna	5	1,850,000
Jhalakathi	5	1,650,000
Patuakhali	12	4,150,000
Pirojpur	3	800,000
Union Health and Family Welfare Centre	248	82,142,000
Family Welfare Visitor Training Institute	1	1,600,000
Maternal and Child Welfare Centre	5	2,500,000
Barisal	1	300,000
Barguna	1	200,000
Patuakhali	1	1,050,000
Pirojpur	2	950,000
Nurses Training Institute	2	1,500,000
Bhola	1	1,200,000
Barguna	1	300,000
Rural Training Centre	2	1,450,000
Others	11	4,225,000
TOTAL (Physical Damage)	351	168,822,000

Source: Damage Assessment done by the Construction and Maintenance Management Unit of the Ministry of Health and Family Welfare (These estimates will be validated through the MERLIN survey)

Damage to the physical structure includes destruction of supplies, windows, doors, water pumps, electric generators, and septic tanks.

Losses in the health sector refer to additional expenditures, such as treatment of injuries and increased morbidity rates. The cyclone can be blamed for 3,200 deaths and increased numbers of diarrhea, respiratory tract infection, eye infection, various skin diseases, and fever. Most of these were caused by a shortage of clean drinking water.

The Government was prompt in deploying medical personnel to affected areas. Initially, medical personnel from public facilities in neighboring districts were sent. They were followed by nationally formed medical teams. In addition, the military set up their own medical camps to provide health care services, and NGOs, Development Partners, and other organizations also provided medical teams.

The Government had procured emergency medicines and accessories worth BDT 472 million (US\$ 6.8 million) within a few days of the cyclone, using funds from the health sector-wide program (Health, Nutrition and Population Sector Program – HNPSP).

The cyclone eroded the household capacity to access adequate food supplies—due to the destruction of standing crops and gardens, household food stocks and assets, and livelihoods that poor households depend on to purchase food. Under these circumstances, infants, young children, and pregnant and lactating women (PLW) were vulnerable to malnutrition and micronutrient deficiencies, especially since their nutritional requirements are relatively high, but they are least able to negotiate their fair share of food within the household. Even though in normal years, the nutritional status of children is poor, it is exacerbated in a disaster situation. A study by Hellen Keller International, for example, revealed that prevalence of night blindness increased after the devastating floods of 1988. UNICEF is initiating a detailed assessment on the effects of the disaster on nutrition.

Many people are still missing and thousands of others have sustained physical trauma and mental setbacks; it is impossible to quantify these associated losses at this time. The World Health Organization will initiate a training program for health workers to counsel mentally ill patients. There are other costs associated that have not been quantified: reduced productivity, the effects on reproductive health, increased snake bites, long term disability, increased morbidity, and other longer-term effects of under-nutrition and mental stigma.

Relief efforts have concentrated on measures to prevent and control outbreaks of disease. A basic disease surveillance system has been created in and around cyclone-affected areas. Case definitions and disease surveillance formats have been revised with special emphasis on age and gender segregation to identify vulnerable groups. To date, no significant outbreaks have occurred.

Table 23: Losses in the Health Sector

Public Health Problem	Total cases	Cost per case (BDT)	Total cost (BDT)
A. Prompt Physical Morbidity			
Injury—Total Reported	15,045		2,515,524
Severe	150	3,850	579,233
Moderate	14,895	130	1,936,292
Diarrhea	13,967		4,190,100
Severe	3,492	900	3,142,575
Moderate	10,475	100	1,047,525
Respiratory tract infection	15,442	250	3,860,500
Skin disease	35,127	110	3,863,970
Eye infection	11,007	60	660,420
Typhoid/fever	50,249		9,933,570
Typhoid	5,025		888,750
Fever	45,224	200	9,044,820
TOTAL (Prompt physical morbidity)			25,024,084
B. Reduced Nutrition			
Protein energy malnutrition of children under 5	1,000,000	500	500,000,000
Micro nutrient powder to children under 5 and pregnant and lactating women	20,000,000 (no. of sachets)	1,035	20,700,000
TOTAL (Reduced nutrition)			520,700,000
C. Emergency Procurement Done using HNPSP Fund			
Protective equipment			111,000,000
Vitamin A			40,000,000
Disinfectant			6,350,000
Water purifying tablet			7,000,000
Medicine			301,938,000
Ointment			500,000
Nebulizer machine			400,000
TOTAL (Procurement)			467,188,000
D. Field Medical Teams			
Neighboring District Government Medical Teams			2,128,000
National Government Medical Teams			595,000
Military Medical Teams/Camps			1,600,000
Other and NGOs			20,400,000
TOTAL (Medical teams)			24,723,000
GRAND TOTAL (A+B+C+D)			1,037,635,084

Notes:

- The numbers for injuries and other diseases have been taken from the Flood Control Room of the Directorate of Health Services.
- The costs of various items procured for the cyclone have been calculated from the procurement plans submitted to the World Bank for clearance.
- The costs for the diseases include cost of treatment only. These do not include the cost of caring and the cost of medical personnel attending them. The cost estimation has been made based on consultation with key informants.
- De-worming and vitamin A supplement are also needed due to reduced nutrition of the people. The costs for these have been taken into account under category C (Emergency procurement done using HNPSP fund).
- In estimating the cost of medical teams, the salaries of the medical personnel have not been included. These are direct costs for transport, accommodation and food.

Preliminary Recommendations and Needs

Relief efforts provided by the Government, the Army, UN organization(s), and relief agencies are in the form of temporary outreach health services, medical supplies, and emergency medical and nursing staff. Efforts in the health sector are being coordinated at the central and district level. However, there are still unmet demands for food, water, and shelter.

Along with access to basic foodstuffs, meeting specific nutritional needs was identified as an immediate and long-term requirement in affected districts. Supplements containing both macro- and micronutrients (vitamin A, zinc, and iron foliate) were incorporated into the national immunization days for polio eradication on 8 December, and zinc is being dispensed as an anti-diarrhea. To provide additional micronutrients to children under five and PLW micronutrient powder (MNP) in single-dose sachets is being provided to be added to meals. Children 6-59 months old will receive 90 sachets for daily consumption, each containing a full recommended intake of 16 vitamins and minerals. PLW will receive 180 of the same sachets, two of which should be consumed per day, every day. In total, approximately 20 million sachets will be required costing about BDT 20,700,000.

A disaster of this kind has significant immediate effects on the health of the population, particularly in the worst affected areas. Initial concerns focus on treating cyclone-related injuries, preventing outbreaks of disease, addressing mental health issues relating to shock and bereavement, and providing basic health services.

Table 24: Recorded Disease Burden between 27 December 2007 and 15 January 2008

Name of disease	Total
Injury	1,787
Diarrhea	3,572
RTI	3,210
Skin Disease	7,538
Eye Infection	2,309
Typhoid/Fever	10,359
Jaundice	44

Providing safe drinking water is critical. A number of agencies are working on this issue and good progress has been made, including establishing four water treatment plants provided by the Government of Norway. However, sanitation and waste disposal remain major problems.

Adequate staff to continue provision of basic health care services is also important at this stage of recovery. Fortunately, there were relatively few casualties among health personnel, and teams have been mobilized from unaffected neighboring districts, contributing to the quick overall recovery of the services in response to the disaster. The response has been a joint effort by the public sector, the army, and individual philanthropists, together with staff from relief agencies.

Moderately affected facilities need to be reactivated through financing of minor repairs and the provision of medical equipment, clean water, and electrical generators. Where facilities have been severely affected, reconstruction—especially in the coastal region—should follow established health and safety standards and include features such as cyclone shelters.

Availability of buffer emergency medical supplies and emergency medical teams helped reduce immediate post-cyclone suffering. This must become standard practice across the country. Stocks need to be constantly replenished and staff trained to meet similar disaster situations.

Buffer stock should be stored at district level facilities so it can be delivered to disaster areas without delay. The emergency medical teams must also have access to transport facilities and information technology for rapid communications.

The Government has identified the following long-term disaster preparedness needs at a cost of BDT 970 million (US\$ 14 million):(i) extension to three stories of 70 *upazila* Health Complexes (estimated BDT 400 million); (ii) procurement of ten river ambulances (BDT 10 million) (US\$ 145,000); (iii) construction of new Union Health and Family Welfare Centers (BDT 420 million)); (iv) creation of a Health Sector Disaster Management Institute (BDT 100 million); and (v) construction of solar power systems (BDT 40 million).

Productive Sectors

Agriculture (Crops, Livestock, and Fisheries)

Summary

Cyclone Sidr caused significant damage to rural infrastructure and assets as well as losses of production valued at BDT 30.2 billion, (US\$ 438 million) of which 95% are production losses. A decline of rural household income and an increase in unemployment ensued as a result. For detailed tables see Annex 7.

Pre-Disaster Situation

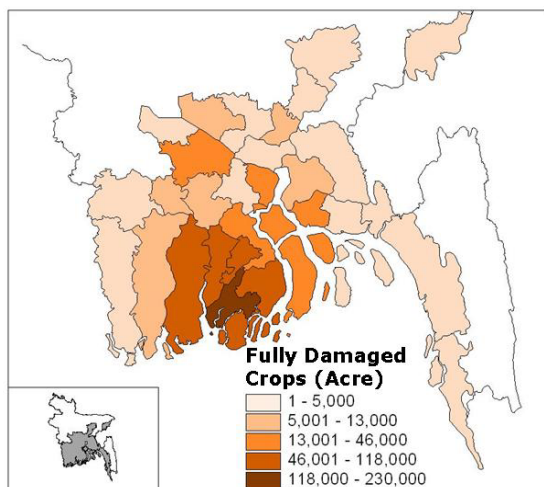
Agriculture is a key sector in Bangladesh. The main sources of livelihood for the rural population are agriculture and rural non-farm activities that directly or indirectly depend on agriculture. A large share of the rural population—about 75 percent—consists of landless laborers and marginal farmers with less than 0.2 ha of land. At the same time, agriculture accounts for about 22 percent of GDP.

Damage and Loss Assessment

The preliminary damage and loss assessment for crops, livestock, and fisheries is estimated to be BDT 30.2 billion (US\$ 437.6 million), of which BDT 1.5 billion (US\$ 21.3 million) is damage to assets and BDT 28.7 billion (US\$ 416.3 million) is production loss. As the agriculture sector consists primarily of private farmers and fishermen, almost all of the damage and loss has occurred in the private sector. Table 25 and Table 26 present the estimated damage and loss to the agricultural sector in BDT and US\$, respectively.

The macro and micro socio-economic impact of Cyclone Sidr is substantial and falls into four broad categories: (i) food supply (mainly rice); (ii) income and employment; (iii) availability of agricultural inputs; and (iv) prices of food and agricultural inputs.

Figure 22: Damaged Crops by District



Crops

Approximately, 2.2 million farming families have been affected by Sidr. The total damage and loss for the crops sub-sector is estimated at about BDT 28.4 billion (US\$ 412 million). The loss of production in all crops refers to an estimated 1.3 million metric tons, of which 63 percent (0.8 million metric tons) is *aman* rice.

Table 25: Estimated Damage and Loss for Agriculture: Crops, Livestock and Fisheries (BDT)

Sub-sector	Disaster Effects (Million BDT)			Ownership (Million BDT)			Effects on	
	Damage	Loss	Total	Public	Private	Total	BOP	Fiscal Aspects
Crops	—	28,400.1	28,400.07	—	28,400.1	28,400.1	Higher fertilizer and power tiller imports	Higher expenditure
Livestock	1,334.0	—	1,334.04	11.36	1,322.7	1,334.0	Increased imports of poultry feed	Higher expenditure
Fisheries	137.8	324.7	462.52	7.53	455.0	462.5	Lower shrimp exports	Higher expenditure
Total	1,471.86	28,724.8	30,196.6	18.89	30,177.7	30,196.6	Negative	Higher expenditure

Table 26: Estimated Damage and Loss for Agriculture: Crops, Livestock and Fisheries (US\$)

Sub-sector	Disaster Effects (Million US\$)			Ownership (Million US\$)			Effects on	
	Damage	Loss	Total	Public	Private	Total	BOP	Fiscal Aspects
Crops	—	411.6	411.6	—	411.6	411.6	Higher fertilizer and power tiller imports	Higher expenditure
Livestock	19.3	—	19.3	0.16	19.2	19.3	Increased imports of poultry feed	Higher expenditure
Fisheries	2.0	4.7	6.7	0.11	6.6	6.7	Lower shrimp exports	Higher expenditure
Total	21.33	416.3	437.6	0.27	437.37	437.6	Negative	Higher expenditure

Source: Data from DAE, DLS and DOF and World Bank staff estimates.

Livestock

Livestock is a very important sub-sector for the rural landless and for marginal and small farmers. Raising livestock is not only labor intensive, providing many employment opportunities, but also generates regular monthly income from the sale of milk, eggs, poultry, and goats. Most of the damage in the livestock sub-sector was caused by the tidal surge that drowned animals and birds and by falling trees

Almost 80 percent of the animals and 76 percent of the birds died in the four worst affected districts. There was also destruction of animal and poultry sheds (both cattle and poultry farms) and of feed (cattle and poultry), and devastation of fodder and pasture. There was also some destruction to public sector infrastructure (trees, animal sheds, and buildings). The estimated value of damage to the livestock subsector is BDT 1.3 billion (US\$ 19.33 million).

Figure 23: Cattle Shed



Fisheries

Fisheries are one of the fastest growing agricultural sub-sectors in Bangladesh. Most of the growth is attributed to fish and shrimp aquaculture. Shrimp, in particular, thrive in the brackish waters of the coastal districts that were affected by Sidr. The damage and loss that Sidr caused consists of damage to the fisheries infrastructure such as ponds, *dighis*, and *ghers*; damage to private fishing equipment such as boats and nets; damage to public infrastructure such as boundary walls, roofs, and electric lines in fisheries-related public buildings; and losses in catch or production. Damage and losses in the fisheries sub-sector, in the ten most affected districts, are estimated at BDT 463 million (US\$ 6.7 million).

Preliminary Recommendations and Needs

Following Sidr, the needs for affected areas fall into three broad categories: relief, recovery, and reconstruction. Relief work was undertaken by Government agencies, national and international NGOs, and development partners. This phase of the work has been more or less completed. Now there is a need to design the recovery and reconstruction programs and expedite their

implementation. During implementation, it is very important to focus on and give priority to the worst affected unions, *upazilas*, and districts, as well as on the worst affected poor households within these jurisdictions. Strategic programs to address cyclone-related problems fall into three groups: (i) rice imports to ensure food security; (ii) the agricultural recovery program; and (iii) the livelihood program. The estimated needs to finance these programs are summarized below.

Table 27: Estimated Program Needs to Promote Food Security, Recovery and Reconstruction

Program	Estimated Needs (US\$ million)		
	Short-Term	Medium-Term	Total
Rice imports to ensure food security	200	—	200
Agricultural Recovery Program (crops, livestock, and fisheries)	—	50	50
Livelihood Program (micro-credit, crop loans, micro-enterprise loans, cash grants, community infrastructure and training for the agricultural and rural non-farm sectors)	—	300	300
Total	200	350	550

Table 27 shows the total needs to be BDT 38 billion or US\$ 550 million: US\$ 200 million for financing rice imports and US\$ 350 million for financing the medium-term agricultural recovery program and the livelihood program. Given the urgency, it is extremely important to implement these programs with a particular focus on cyclone-affected areas.

Industry, Commerce, and Tourism

Summary

Production in these sectors came to a halt due to Cyclone Sidr. Roads were blocked, electricity supply stopped, premises and equipment were destroyed, and inventories were washed away. This affected industry and commerce as severely as it affected agriculture. Wholesale and retail traders were unable to work for days, transportation was hardly moving, and industrial establishments were generally closed for several weeks in the aftermath of the disaster.

This situation produced losses of output, income, and employment throughout the affected area, which was only partially compensated when some activities restarted at a higher pace of production than pre-cyclone, as a side effect of the disaster. Production of timber and sawn wood, for example, increased perceptibly because a large number of trees were felled by the storm.

Damage and losses to non-agriculture productive sectors is estimated to be BDT 3.6 billion (US\$ 52.5 million), of which 92 percent are production losses and 7 percent physical damage. Small industries were most affected with a total damage and loss of BDT 2.3 billion (US\$ 33.2 million).

Most businesses in the area are very small and labor-intensive. Restarting private business would reactivate the economy and put markets in motion again.

Pre-Disaster Situation

There are 122,000 non-agricultural establishments¹⁸ in the four worst affected districts, with 317,000 people engaged. Another 314,000 establishments are in the other eight districts in the cyclone-affected area. There are more than 27,000 industrial establishments, employing nearly 141,000 people in the main 12 districts affected. Total employment in private business in the 12 districts where the main effect of the cyclone was felt, then, is about 2.8 million people.

The economic census distinguishes two categories: micro-enterprises (with up to nine persons engaged) and macro establishments, with ten or more. The latter is in turn classified in three groups: small (10-49), medium (50-99) and large (100+). In practice, macro establishments in the cyclone-affected areas are mostly small, with no more than 49 people employed, with very few medium-sized and almost none large (except for a few in Khulna city). The average micro-enterprise in these twelve districts employs two people (a great many employ only one), whereas the average macro establishment employs 22.5 persons. In both cases, this may include wage workers as well as owners and family labor. The general average is 2.5 people per establishment. Total employment in establishments is about 1.1 million people. According to the 2001 population census, another 1.7 million are self-employed but not working in an establishment, that is, (i.e. a physical structure where the enterprise operates). Non-established self-employed workers include builders, carpenters, plumbers, van and rickshaw pullers, street hawkers, repairmen, and others.

¹⁸ 2001–03 Economic Census

Industry Damage and Loss Assessment

About 1,800 establishments (7 percent of total) were severely affected by the cyclone, with premises, inventory, or equipment destroyed sufficiently enough to prevent them from working for several weeks. Damage to industrial establishments' assets (infrastructure, equipment, and inventory) has been estimated on average at about BDT 27,600 (US\$ 400) per person engaged, after a number of studies by ILO and World Bank field visits. Assuming that the 1,822 affected establishments are of average size and employ an average of 5.2 persons, the total physical damage would have amounted to BDT 262 million (US\$ 3.8 million).

Besides sustaining damage to their assets, the vast majority of industrial firms had to stop working for a while due to a lack of electricity, the main source of power for small industry in the area. The time it took to restart these cases depended on the time it took to restore electricity. By mid-January, some 20 percent of industries were still stopped due to lack of energy, and most had suffered this problem for one to two months. According to a special survey undertaken by the World Bank, the average industrial firm (including those not significantly affected) stopped working for 41 days after the cyclone, losing a total output of BDT 251.9 million (\$3.65 million) and 1.2 million man days of work.

Table 28: Manufacturing Establishments in the Cyclone-Affected Area

District	Manufacturing establishments				
	Total Establishments	Persons engaged	Affected establishments	Man-days lost ¹⁹	Output loss (US\$)
Barguna	948	3,660	481	53,290	\$159,869
Patuakhali	1,638	8,203	16	99,902	\$299,706
Bagerhat	2,707	11,082	946	209,801	\$629,404
Pirojpur	1,613	6,886	88	80,714	\$242,143
Subtotal	6,906	29,831	1,531	443,707	\$1,331,122
Jhalokati	887	3,919	9	29,060	\$87,181
Satkhira	4,189	17,393	51	103,717	\$311,150
Khulna	4,517	38,632	45	285,449	\$856,348
Gopalganj	2,015	5,787	10	48,129	\$144,387
Madaripur	1,547	8,671	17	52,077	\$156,231
Shariatpur	1,518	6,433	32	46,051	\$138,154
Barisal	3,458	22,489	38	152,118	\$456,354
Bhola	2,078	7,754	89	57,707	\$173,122
Subtotal	20,209	111,078	291	774,309	\$2,322,927
TOTAL	27,115	140,909	1,822	1,218,016	\$3,654,049

Sources: Establishments and persons engaged from 2001-03 Economic census; Affected: Mission; Man-days of stoppage based on World Bank survey in cyclone affected areas.

¹⁹ Total man-days lost due to damage to the establishment, lack of electricity or other causes of reduction in activity.

The main kinds of business affected were:

- Sawmills
- Rice mills
- Ice factories
- Brick and tile factories
- Pottery factories

According to the World Bank survey among industrial establishments in the affected districts, only 5.4 percent of the establishments continued working, uninterrupted by the cyclone, while 94.6 percent stopped. Of these, 76.5 percent had resumed operations and 18.4 percent were still not working as of late January. The average time of interruption (including those that never stopped, and assuming 4.5 months of downtime for those that do not expect to resume work within three additional months) would be 41 days.

Self-employed industrial workers were only marginally affected. Some lost their tools or inventories. Their number was estimated based on field interviews, percentage of non-establishment non-farm self employment, and reported destruction of houses. The average duration of lack of employment (for those affected) is estimated to be 20 days, which amounts to a total of 31,965 work days lost at a cost of BDT 3.3 million (US\$ 47,948).

In addition to losses in production due to stoppage of operations in small-scale industrial enterprises, indirect estimates were made of losses in processing primary agriculture and fisheries products. This involved taking the volume of agriculture and fishery losses, deducting the fraction retained by producers for their own consumption, and comparing price levels at the producer and wholesale levels. These processing losses were estimated to be BDT 1.78 billion (US\$ 25.8 million). Thus, total losses for the industry sector were estimated at BDT 2.04 billion (US\$ 29.5 million).

Commerce Damage and Loss Assessment

The most severely hit districts do not have major establishments. Small and medium enterprises (SME) are geographically scattered, making data collection on loss of sector assets difficult.

Wholesale and retail trade establishments suffered destruction of premises and loss of inventory in surge-affected areas, and occasionally in other areas as well. The value of assets destroyed is already included in the estimates for the housing sector, as most establishments were located in the owners' homes. However, the duration of the stoppage was much shorter than for industrial establishments, according to ILO and World Bank assessments. In the surge-affected areas, the incidence of damage to commercial establishments was roughly proportional to the rate of house destruction, so the latter was used as a proxy for the purpose of estimation. In other areas, a small proportion was estimated based on field findings and informants.

By mid-December, a significant number of affected traders had not yet rebuilt their premises or restored their inventories. In certain areas of the worst-affected districts, most commerce businesses were still not operational. By mid-January, however, almost every retail trader had resumed business, even in severely affected areas. Premises had been rebuilt and inventories somewhat restored to permit operation, albeit on a reduced scale. The average trader in the twelve districts appears to have stopped for 2-3 days. Estimated loss of sales in the sector amounts to BDT 1.3 billion (US\$ 18 million).

Tourism Damage and Loss Assessment

In recent years, private tour operators, in cooperation with the Forest Department, have developed systematic and structured ecotourism tours in the Sunderbans. Some of the important tourist spots are Karamjal, Katka, Kochikhali, Dubla Island, Nikamal, Shekhertek temple, Mandarria, Notabeki, and Dobeki. The Sunderbans attract both local and foreign tourists—more than 0.1 million and around 1,500 per year, respectively. As private sector infrastructure has also been damaged by Sidr, eco-tourism will be negatively affected.



Figure 24: Bagerhat Beach

Sales of tourism packages to international visitors to the Sunderbans dropped immediately after Cyclone Sidr, affecting the present tourism season, which goes through May 2008. Interviews with representatives of the Association of Tour Operators revealed estimated losses for the season of BDT 65 million (US\$ 0.94 million), but fortunately, boats and other infrastructure had sustained no destruction.

Preliminary Recommendations and Needs

The needs for the affected areas in these sectors were identified together with the analysis to identify needs in the agriculture sector. A more detailed breakdown of these suggestions is in Annex 7. The needs for this area is estimated at US\$ 100 million, to cover some of the following activities: (i) replacement of equipment and well as restocking through grants, seed money and micro credit; (ii) the improvement of skills that are crucial to improve livelihood strategies.

Crosscutting Issues

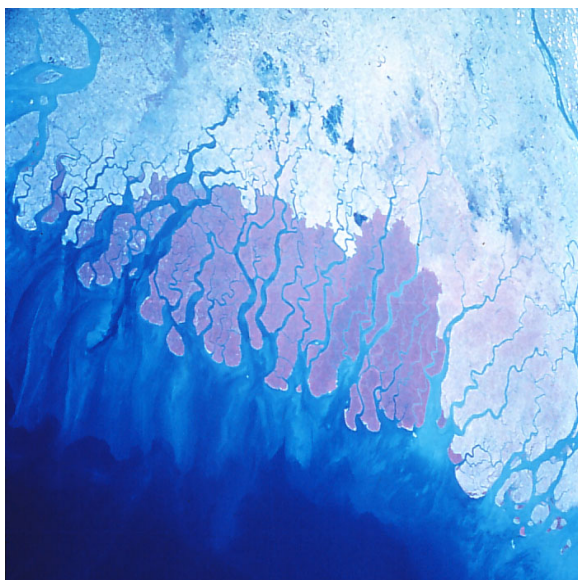
Environment

Summary

The importance of the Sunderban mangroves and coastal forests, as effective barriers to cyclones, became obvious during Cyclone Sidr. Destruction to inland assets and livelihoods losses could have been much more severe without their acting as barriers. Due to the lack of market information, a full economic assessment of the damages to these resources was not possible. However, of the total infrastructure destroyed (critical for monitoring and managing of these vital assets), replacement costs were assessed at about BDT 420 million (US\$ 6 million).

Pre-Disaster Situation

Figure 25: Satellite Image of the Sunderbans



The Sunderbans, comprising the southern part of the Satkhira, Khulna, and Bagerhat districts is the largest mangrove ecosystem of the world. The Sunderbans are known for its wide range of flora, fauna and aquatic life. Over 270 species of birds, 35 species of reptiles, and 42 species of mammals (including the famous royal Bengal tiger), and 400 species of fish are recorded. Three wildlife sanctuaries covering an area of 139,700 ha were declared a World Heritage Site in 1997. It extends 80 km north of the Bay of Bengal and is bound on the east by the Baleswar River and on the west by the border with India. The Sunderbans covers some total 590,000 hectares.

A coastal afforestation program has been in place since 1960, covering mainly newly accreted coastal land, the riverine coastal belt, and abandoned embankments. These plantations have played a significant role in reducing the impact of previous cyclones and floods. Their effectiveness as a barrier to cyclones depends on the width of the plantation, the number of stems per unit area, the size of the trees, the effect of branches and the roughness of the land. Coastal afforestation programs have covered about 159,000 ha. Moreover, social forestry programs introduced by the Forest Department (FD), in areas such as encroached and degraded forests, roadsides, char land, and other marginal lands, have increased green coverage and created employment opportunities. Through 2002, a total of 111,650 ha of lands had been brought under reforestation since 1990.

Damage and Loss Assessment

Figure 26: Tree Damage due to Cyclone Sidr



Inside the Sunderbans

Sidr struck the eastern part of the Sunderbans, especially Dublar Char, Kotka, Kochikhali, Hiron Point, Sharankhola, and the Chandpai area, causing severe destruction within 300 m of riverbanks. Satellite imagery reveals that the cyclone covered about 30% of the Sunderbans. The severe ecosystem disruption included uprooted, broken and twisted plants, and burnt foliage. The Forest Department estimated that about 30,000 acres of forest resources were severely affected and another 80,000 acres were partially affected.

In the partially affected areas, many branches were broken but the main trunks of the trees remained intact. The impact on dominant plant species—Sundri (*Heritiera fomes*), Gewa (*Exococaria agallocha*), and Keora (*Sonneratia apetala*)—was severe. A UNDP-sponsored report showed that Keora was the most affected plant species (80 percent) among all those affected in a total of 47,211 acres (Table 29). The FD estimated total forest resources damaged in the affected 110,000 ha are about BDT 10 billion (US\$ 145 million²⁰).

Table 29: Affected Areas of Major Plant Species

Plant Species	Species Area (Ha)	Affected Species Area (Ha)	Affected Species Area (%)
Sundri	75,654	17,400	23
Gewa	66,821	25,392	38
Keora	4,886	3,908	80
Others	1,109	510	46
Total	1,48,469	47,211	32

The disruption to the normal Sunderban ecosystem functions was extensive. Damaged and broken trees restricted the movement of animals, prevented regeneration capacity, and lead to scarcity of food. Fifty-seven ponds of varying size—the source of drinking water for local animals—were contaminated by saline water.

Infrastructure in the Sunderbans

The monitoring and surveillance facilities of the Forest Department have been severely destroyed, including many old, outdated infrastructure facilities and boats used by the Forest Department to patrol and monitor the area. All ninety-four administrative units were seriously affected with

²⁰ The accuracy of these numbers is not confirmed. Calculation is based on 500 trees severely affected at a unit replacement cost of BDT 400 and 200 trees partially affected at a unit replacement cost of BDT 250. since market values do not exist, these values are difficult to confirm.

nearly all of the offices and residential buildings in the eastern part of Sunderbans totally or partially destroyed. Twenty communication towers and RT sets were damaged acutely, seriously disrupting communications. Fifty boats were destroyed and nine others damaged, hampering the mobility of staff posted in remote areas. FD estimated the damage to infrastructure and watercrafts at about BDT 200 million (US\$ 2.9 million).

Outside the Sunderbans

The importance of coastal forests as a natural barrier to reduce wind velocities (protecting embankments and settlements) was evidenced. Many coastal forests were heavily affected by the uprooting of millions of timber and fruit trees, nurseries were destroyed, and hundreds of miles of roads and embankments with planted trees on the slopes were eroded. According to the Forest Department, 3,500 ha of coastal forest, 502 miles of strip plantations and 3.1 million nursery seedlings were affected in the coastal areas. The estimated value of damage, including affected infrastructure, is BDT 100 million (US\$ 1.4 million). In addition, the FD estimated the damage to areas under social forestry programs at BDT 120 million (US\$ 1.7 million). The physical damage includes 3362 miles of strip plantation, 78 ha of char land plantation and nursery seedlings.

Total damages, estimated by the FD, are given in Table 30 below:

Table 30: Damage of Cyclone Sidr in the Environment Sector

Serial #	Physical Damage	Estimated Damage (BDT Million)
Sundarban Reserve Forest		
1	Infrastructure and Watercrafts (Fully Destroyed)	141.18
	— Office and Residential Buildings 126 Nos.	90.00
	— Water Vessels 50 Nos.	19.89
	— Pier & Poltun 59 Nos.	14.63
	— Wireless, Tower, RT Set & Base Set 32 Nos.	16.66
2	Infrastructure and Watercrafts (Fully Destroyed)	58.83
	— Office and Residential Buildings 93 Nos.	12.70
	— Water Vessels 9 Nos.	6.09
	— Pier & Poltun 12 Nos.	0.68
	— Others	39.36
	Total Sundarban Reserve Forest =	200.00
Coastal Afforestation Region		
3	Damage to Forest Resources	83.03
	— Coastal Afforestation 35,000 hector areas	59.76
	— Strip Plantation 502 km	20.00
	— Nursery Seedlings 3.1 million Nos.	3.27
4	Infrastructure and Watercrafts	16.97
	— Office and Residential Buildings 138 Nos.	14.16
	— Water Vessels 18 Nos.	2.81
	Total Coastal Afforestation Region =	100.00
Social Forestation		
5	Damage to Forest Resources	110.47
	— Strip Plantation 3362 km	107.10
	— Char land Plantation 78 hector areas	0.80
	— Nursery Seedlings	2.57
6	Infrastructure	9.53
	— Office and Residential Buildings 172 Nos.	9.53
	Total Social Forestation =	120.00

Preliminary Recommendations and Needs

Immediate Priority

The Sunderbans must be a priority for rehabilitation and conservation, with a program carefully designed to cause the least disruption to the unique ecosystem. This has important implications for the mitigation of future cyclone impacts. The immediate strategy for the forest is not to allow any additional stress in the name of restoration to occur, which can exacerbate the damage situation. Although the Sunderbans are naturally restoring and rejuvenating, the restoration of freshwater ponds inside and outside the Sunderbans should be carried out immediately to complement this process. The estimated cost BDT 10 million (US\$ 0.15 million).

The Forest Department, which plays a key role in monitoring the Sunderbans and other forest resources, needs immediate support to restore strategically important field offices and monitoring stations to full operation again. Alternative arrangements for transportation and communication are an urgent need. The estimated cost for rehabilitation of the physical infrastructure and boats (including proper environmental assessments) is BDT 138 (US\$ 2 million).

Moreover, immediate plantation programs are needed in coastal areas other than the Sunderbans. These must be supported in part by public awareness activities, and will provide needed immediate employment opportunities to the affected community while also helping to promote future coastal afforestation. Nurseries also require immediate support for plant seedlings of indigenous and sustainable species. Experience from past social forestry efforts will be needed here. This is estimated to cost BDT 69 million (US\$ 1 million).

Medium-term Priority

Post-cyclone rehabilitation work should be considered an opportunity for better management, protection, and conservation of forest resources and biodiversity. Current forest sector institutional and management capacities need to be enhanced by developing and implementing a comprehensive plan for forest sector development that better links ecological with social benefits. Tracking this would provide an important opportunity for the government to engage with civil society organizations. The Forest Department needs support for capacity development, better equipment, monitoring, priority policy studies and guidelines, and appropriate regulatory revisions. These activities will improve the management of the globally significant Sunderbans; increase management capacity and knowledge of biodiversity resources; and strengthen cooperation between local communities and forest staff to better address areas of mutual interest. Among the medium-term priority activities, systematic studies should be carried out on the natural restoration process underway in the Sunderbans and the long-term environmental impacts of Sidr on the Sunderbans ecosystem. The findings will inform development of a complete restoration program. The effects of climate change must also be integrated into the long-term plans of the forestry sector. This is estimated to cost BDT 690 million (US\$ 10 million).

Long-term Priority

Cyclone Sidr and other experiences show that coastal afforestation protects embankments against cyclonic surge and monsoon waves—with the tremendous additional benefit of greatly reducing the impact of the storm surge. Programs to further green the coastal belt are needed for protection against future disasters and to provide income opportunities for local people through

co-management of the programs. This should include a carefully designed and targeted public involvement and education campaigns. Opportunities for carbon sequestration should be explored for additional resources. The Forest Department will require support to implement the program at an estimated cost of BDT 1.4 billion (US\$ 20 million²¹).

The Sunderbans Restoration Program should be undertaken based on the studies carried out in the medium-term. The integrated development of the Sunderbans will ensure a favorable environment for flora and fauna, as well as watershed protection and nature preserve management. An indicative cost of such a program is BDT 1.7 billion (US\$ 25 million).

²¹ The Government has prepared a proposal for green belt plantation from Satkhira to Teknaf with an estimated cost of BDT 5727 (US\$ 83 million). If the Sidr affected areas are roughly considered, the cost is about BDT 1380 (US\$ 20 million).



Section III: Economic and Social Impacts

Introduction

This section presents estimates of the economic and social impacts of Sidr-related damage and losses. These are measured at the macroeconomic level—including the performance of the country’s economy, the balance of payments, and the fiscal sector—and also at the personal or household level, where declines in income and livelihoods are estimated.

These disaster impacts are contextualized against the pre-cyclone state of the economy and level of social wellbeing. To estimate economic impact, the baseline data were comprised of the expected performance of the Bangladesh economy in fiscal year 2007–08. The analysis shows how the forecast will be affected by the Sidr-caused losses. For the case of social impact, numerous studies describing the situation prior to the occurrence of the disaster were used to develop a baseline for comparison to post-disaster conditions. The analysis shows how living conditions, including livelihoods, employment and income, will deteriorate due to cyclone losses.

Macroeconomic Impact

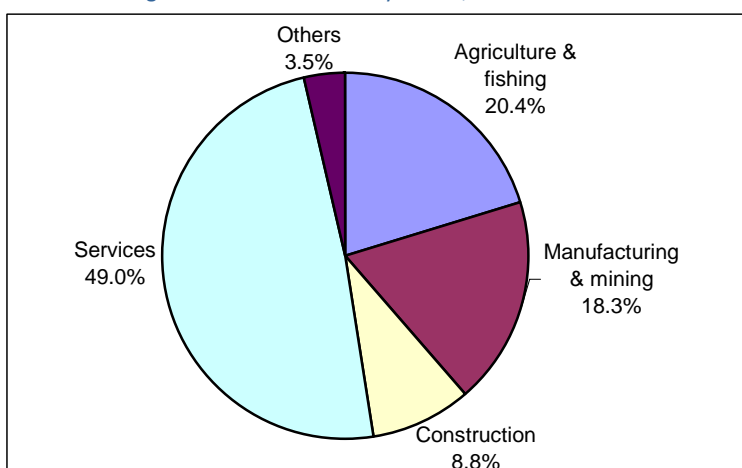
Pre-Disaster Economic Situation

Despite facing several constraints in development—low natural resource and skill base, high population density, severe vulnerability to floods and cyclones—Bangladesh has made steady economic progress in recent years. The national poverty rate declined by an average of 2 percent annually between 2000 and 2005 based on a strong and stable GDP growth that averaged over 6 percent growth annually during FY2003-07. This progress notwithstanding, Bangladesh remains a poor country, with a per capita GDP of US\$ 488 (2006-07) and a poverty rate of 40 percent (2005).

The economy grew by 6.6 percent in FY06, the highest rate in over two decades, and by 6.2 percent in FY07, despite prolonged political turmoil. Broad based growth has been fueled by robust demand in domestic and export markets. The manufacturing sector grew at 11.4 percent in FY07 and construction by 7.1 percent; garment exports grew by 11.6 percent (in nominal dollar terms).

A snapshot of the economy in FY07 shows that the services sector accounted for 49 percent of GDP, the agricultural sector for 20 percent, and manufacturing and mining for 18 percent (Figure 27).

Figure 27: Share of GDP by Sector, Fiscal Year 2007



Source: Bangladesh Bureau of Statistics

At the beginning of FY08, the economy was projected to grow at a healthy 7 percent, helped by an expected recovery in agriculture (the sector grew by around 3 percent in FY07), and continued growth in manufacturing and services. Buoyant garment exports and remittance flows, as well as the possibility of higher aid and private flows, were expected to sustain investment. A comfortable foreign exchange reserve position equivalent to 3.2 months of imports was sustained even after back-to-back floods in July-September 2007.

Amidst this generally positive economic environment, a few areas of concern had emerged even before Cyclone Sidr. One was inflation, aggravated by rising international prices of essential food items such as rice, wheat, and edible oil. Year-on-year consumer price index inflation reached a nine-year high of 10 percent in August-October, 2007. Analysts were also indicating a fall in business confidence as early as May and June 2007, based primarily on signals in the construction sector. The summer 2007 floods would have further slowed investment and growth and added to inflationary pressures by affecting production. Finally, the Government budget was under some stress attributable to post-flood recovery needs and rising international commodity prices.

Impact on Economic Growth

Based on this report's estimates, the aggregate estimated loss in value added in the current fiscal year (FY08) from the cyclone amounts to BDT 25.76 billion (US\$ 373.4 million) at current market prices.²² The loss in value added is estimated to be around 0.5 percent of the national GDP.

The impact of the cyclone is by far the most severe in the agricultural sector, at more than BDT 23 billion (US\$ 333 million), which accounts for 89 percent of the total loss in value added. Much smaller losses in value added are estimated for the fishing, manufacturing, commerce, tourism, and energy (electricity) sectors: around BDT 1 billion (US\$ 14.5 million) for manufacturing (all in the small scale sector), BDT 1.2 billion (US\$ 173.9 million) for commerce and in the range of BDT 250-300 million (US\$ 3.6 – 4.3 million) for the fishing and energy (electricity) sectors. With the output losses in agriculture, the share of the agriculture and fishing sector in GDP is expected to fall.

²² The aggregate loss in value is equal to the sum of value added losses in all sectors. For each sector, the gross economic (revenue or output) losses estimated for that sector (if any) are multiplied by input-output coefficients used in National Income Accounting to arrive at losses in "net" or value-added terms.

Table 31: Loss in Value Added by Sector

	Share in FY07 GDP (%)	Economic loss from cyclone (BDT millions)	Input-output (IO) coefficient	Estimated loss in value added (BDT millions)
Productive sectors				
Agriculture	15.8	28,400	0.812	23,049
Fishing	4.6	325	0.856	278
Manufacturing	18.4	2,035	0.498	1,014
Construction	8.8	0	0.425	0
Commerce	29.6	1,258	0.916	1,153
Tourism	0.7	65	0.236	15
Infrastructure				
Energy	1.5	359	0.708	254
Water supply	0.1	0	0.718	0
Transport	9.9	0	0.645	0
Social sectors				
Education	2.5	0	0.891	0
Health & nutrition	2.2	0	0.807	0
Cross-cutting				
Public Administration	2.7	0	0.596	0
Total in Million tk.		32,442		25,763
Total in Million US \$		470.2		373.4

Memo Item:

Projected FY 08 GDP Prior to the cyclone at current mkt prices (BDT millions)	5,322,000
(US\$ millions)	77,000

Loss in value-added as % of GDP (pre-cyclone projection for FY08) 0.49 %

Note: All numbers at current market prices; FY08 GDP Projection is from the GoB FY08 Budget. **Agriculture** includes forestry; I-O coefficient of crops & horticulture used as all losses are in crops. **Manufacturing** includes mining & quarrying; I-O coefficient of small scale sector used since all losses in that sector. **Commerce** includes Wholesale and Retail Trade; Real Estate, Renting and Business Activities; Financial Intermediations; Community, Social and Personal Services; I-O coefficient of wholesale and retail trade used. **Tourism** refers to Hotels and Restaurants. **Energy** includes electricity and gas; I-O coefficient of electricity used since all losses are in that sector. **Transport** includes Transport, Storage and Communication Public administration includes defense.

This section has so far focused exclusively on the cyclone's negative impact on GDP and growth in FY08, not taking into account economic losses that may persist into the future or the possibility of higher economic activity in certain sectors due to reconstruction activities. The assumption that all economic losses will be incurred in FY08 and none in subsequent years seems reasonable, given that nearly 90 percent of losses in value added are in agriculture, and consultations with the sectoral ministry have suggested that agricultural production should fully recover in FY09.

The impact of increased activity on GDP during the reconstruction stage is unclear at this point, and therefore not considered. For one, it is too early to estimate the rates of reconstruction, which depend on the availability of financing for reconstruction and new construction and on the installed capacity of the construction sector. In any event, the growth of the construction sector is likely to take place in the future (FY09 and beyond), rather than in the current fiscal year, and is therefore unlikely to have much impact on FY08 GDP. It was observed during the field visits that several new sawmills appeared after the cyclone, generating employment and lumber, which may

reflect a positive impact on lumber-related industries as fallen trees in affected areas are being utilized. However, it is impossible to estimate any positive impact on FY08 GDP from the information currently available.

Impact on Balance of Payments

The cyclone will increase the country's import bill and may also hurt exports in specific sectors. In addition to emergency food imports, it is estimated that there will be increases in import requirements in some sectors, such as electricity, due to repair and reconstruction of damaged infrastructure. It is estimated, as discussed in this report, that *aman* rice production loss due to the cyclone will be 0.8 million metric tons. This year's *boro* rice production, which will be harvested around April, is expected to compensate 0.3 million metric tons. Therefore, the additional rice import need, due to the cyclone, is estimated to be 0.5 million metric tons, at an estimated cost of BDT 13.8 billion (US\$ 200 million²³). The export side (especially shrimp exports, one of the largest export items) is likely to suffer, with some adverse impact on the Balance of Payments (BoP).

The BoP position, prior to the cyclone, was reasonably comfortable, despite some emerging stresses. Total export growth in July-November 2007 was 2.4 percent. The trade deficit widened to BDT 117.3 (US\$ 1.7 billion) in July-October 2007 compared to the BDT 46.9 billion (US\$ 680 million) deficit in July-October, 2006, as merchandise exports declined by 3 percent and import payments increased by 20 percent. Garment exports grew by 1.5 percent in the first five months of FY08, compared to 27.7 percent growth in the same period of last year, mainly due to fewer import orders received during the period of political instability in November-December 2006, and labor unrest in the readymade garments sector. The widening of the trade deficit, however, was offset by continued strong growth in remittances that continued after the cyclone: foreign exchange reserves remained above BDT 345 billion (US\$ 5 billion), equivalent to 3.3 months of import cover, through mid-January, thanks to strong remittance growth (20.3 percent in the first half of FY08).

The pressure arising from the emergency import of food, agricultural inputs, and construction materials is likely to be cushioned by the expected additional external assistance attributable to the cyclone-induced increase in remittances. All in all, the impact of the cyclone on BoP is unlikely to be substantial, particularly if the required external assistance on concessional terms materializes.

Impact on Fiscal Budget

The total public expenditure requirements for cyclone relief, recovery, and medium- to long-term rehabilitation are estimated to be BDT 143.5 billion (US\$ 2.06 billion).²⁴

On the revenue side, the cyclone is unlikely to have any discernible adverse impact. Revenue collection in the affected areas has been quite low traditionally. Most individuals in these areas fall into the zero-income tax category; the agricultural sector—where the overwhelming share of economic losses occurred—is not taxed, given the primary nature of the crops cultivated, and most manufacturing in these areas is small-scale and informal. Revenue mobilization has in fact improved this year after persistently falling short for several years.

²³ Assuming an average international price of rice at US\$ 400 cif per ton.

²⁴ Finance Division estimate January 15, 2008.

Estimates by the Government have indicated that out of the BDT 35.3 billion (US\$ 511 million) needed for cyclone relief and recovery in the current fiscal year, the FY08 budget will be able to provide BDT 9.5 billion (US\$ 138 million), while the remaining BDT 25.7 billion (US\$ 373 million) will need to be met by additional foreign assistance. To date, donor commitments have been around BDT 17.9 billion (US\$ 260 million) for cyclone-related expenditures.²⁵ Independent of these, the BDT (US\$ 100 million) budget support agreement with the World Bank was signed on 24 January 2008. Additional external assistance will also be necessary to meet medium- to long-term (beyond FY08) recovery needs. The Government has already spent substantial amounts on cyclone relief and recovery programs, including assistance to farmers for agricultural inputs, reconstruction and repair of damaged structures, infrastructure rehabilitation, death and medical benefits, and food and cash assistance to households.

The impact of the cyclone on expenditures has intensified the fiscal pressures already created by two other shocks: international oil and non-oil commodity price increases, and the 2007 floods. Inadequate pass-through of international fuel and urea prices to domestic consumers has created pressure for providing budget support to energy and chemical state owned enterprises. The floods have already required reallocations within the budget to meet relief and rehabilitation needs.

The combined impact of these three shocks means the FY08 central Government budget deficit is likely to overshoot the original target of 4.5 percent of GDP. The estimated deficit is about 5.4 percent of GDP, compared to 3.5 percent projected without the additional budgetary expenditures arising from the external shocks. Of this amount, cyclone-related additional expenditures account for around 0.5 percent of GDP. The challenge of containing the FY08 budget deficit within the post-flood target will be formidable, notwithstanding the recent growth in tax revenue collection by the National Board of Revenue.

The emergency needs created by Sidr have therefore placed severe pressure on the already overburdened FY08 budget. The Government has been compelled to redirect some of its limited budgetary resources towards post-cyclone rescue and relief activities. As there is little further scope for reallocation from existing expenditures without further cuts in critical areas like operation and maintenance budget, planned capital spending allocations, or recurrent expenditure activities, grants or concessionary financing from development partners will be critical in meeting the needs of the cyclone-affected areas. Alternatively, the Government will have to fall back on much more expensive domestic borrowing or monetary financing, which can add to inflationary pressures.

Possible Impact on Inflation

Inflation, already on the rise in recent years, has been exacerbated by the floods and the cyclone, reaching a nine year high of 10.2 percent (year-on-year) in August-November, 2007, driven mainly by food inflation. Rice, edible oil, and wheat were the major sources of food inflation in both rural and urban areas. Over the longer term, inflation has risen due to international commodity price increases and domestic monetary accommodation of these increases. These price movements were compounded by short-term domestic supply shocks, such as relatively poor crop harvests last year, and the drives against corruption, adulteration, and hoarding.

²⁵ As presented in the Local Consultative Group Meeting of January 8. However, there is not yet coherent information on how much Bangladesh has already received.

The damage to crops and transport infrastructure, caused by the cyclone, may intensify inflationary pressures by disrupting the supply of commodities. Once reconstruction efforts in the cyclone-affected areas are in full swing, there is the possibility of inflationary pressures intensifying due to rising wages and rising demand for specific items like construction materials. Rising inflation can in turn both drive up the cost of reconstruction and slow its pace.

Containing inflation would require a cautious monetary policy stance and fiscal prudence. Urgent policy attention is needed for the large financial losses of the SOEs, the financing of which fuels inflation. The banking system has BDT 140 billion (US\$ 2.0 billion) in surplus liquidity (equivalent to 3 percent of GDP), reflecting monetary hangover from past surges in money supply and dampened demand for money by the private sector in recent months.

Impact on Livelihoods and Income

Households Affected

Figure 28: Tents as Temporary Housing



About 2.3 million households were affected to some degree, of which about one million were seriously affected in their livelihood. This includes two million affected on their farms, though only 0.58 million of them depended mainly on their farm incomes. Many of the households have complex livelihoods, combining several overlapping activities, and thus some were simultaneously affected by losses in crops, livestock, fisheries, commerce, industry, or wage employment. For a more detailed analysis, see Annex 8.

The most vulnerable groups include landless laborers, female-headed households (the latter making up about 10 percent of households, many of them with several young children), and marginal farmers with very little land and no other sustainable source of income.

Households are using various coping mechanisms in reaction to cyclone damage. These households resort to coping strategies that include:

- Borrowing funds
- Relying on relief distributions and changing the normal diet
- Reducing the frequency and quality of meals
- Searching for “wild foods” from the forest, instead of normal market purchase
- Using savings to meet basic needs
- Begging

About two-thirds of households own agricultural land and slightly more than half of the employed population has an agricultural sector occupation, but only one-third of households have their own agricultural sector production as their main source of income. A quarter of all households get most of their income from wage labor (of which a majority is in the agricultural sector, including fisheries and forestry), 30 percent live mainly off small non-farm businesses and nine percent depend chiefly on rent, remittances, and other sources of income.

Some 10-12 percent of households are headed by divorced, widowed, or separated women. Most do not receive any support from their husbands, ex-husbands or other relatives, and have to fend for themselves. Most (except older widows) must raise and support several small children. Almost all of these women are landless, and work as casual wage workers or street hawkers for wages well below those of their male counterparts. Women laborers can be found in brick and tile factories, making textile and garment products in small enterprises or from their homes.

According to the WFP study on Rural Bangladesh socio-economic profiles about 15 percent of households in the coastal areas are non-vulnerable, about 30 percent are "on the edge", about 38 percent are vulnerable, and 17 percent are among the "most vulnerable" or "invisible poor."²⁶ This last group has been also described in other analyses as the "ultra-poor." The percentage of vulnerable and ultra-poor households in the coastal areas is above the national average.

Asset Damage

Damage to assets includes mainly the loss of fishing boats and gear, factory equipment, tools of self-employed workers, damage to fish ponds, loss of livestock, destruction of common assets such as roads and electric networks, destruction of cowsheds and other farm infrastructure, silting of land, destruction of shop inventories and business premises, and the loss of income-earning human capital in many of the households hit by loss of human life.

Crop Losses

Cyclone Sidr has severely affected more than one million hectares of cropland, washed away food storages and personal stockpiles, and destroyed fruit trees. The rice crop was the hardest hit among many affected central crops including pulses, vegetables (an important source of income and nutrition), and bananas.

Livestock

Large numbers of animals were killed in the cyclone, mainly by the tidal wave surge. Not only does this represent a major loss of assets, and loss of purchasing power for the affected families, but it also leads to an expected and protracted decline in the consumption of meat, milk, and eggs in the diets of affected people, plus further loss of income from the use or sale of such products. Livestock deaths were highest in Pirojpur, Borguna, Patuakhali, Bagerhat, and Jhalakathi.

Fishery Damage

Nearly 2,800 boats were reported lost, most of them small boats washed away by the surge. The cyclone has also affected the shrimp industry, which accounts for the country's second largest export.

Nonagricultural Business Damage

Private businesses lost infrastructure, equipment, and inventory in the cyclone. This included small retail shops in marketplaces across the affected areas, small factories (rice mills, sawmills, ice factories, potteries, etc.), trade shops (blacksmiths, barber shops, repair shops of various sorts), some wholesale trade stores, many tricycle vans and rickshaws, sewing machines, tools held in private homes for the self-employed, and many other kinds of equipment. Damages affected about 30,500 establishments and 75,000 jobs. In addition, about 27,000 self-employed workers without a fixed establishment lost tools and other assets. Destroyed assets had an estimated total value of BDT 262 million (US\$ 3.8 million), most in the industrial sector.

²⁶ WFP, Rural Bangladesh – Socio-Economic Profiles of WFP Operational Areas and Beneficiaries. Dhaka, WFP, October 2006. Available at <http://bangladesh.wfp.org>.

Loss of Output and Revenue in Nonagricultural Businesses

Private businesses had to interrupt or reduce activity for varying lengths of time due to the cyclone, extending in some cases to more than two months, due to destruction of assets, lack of electricity, or other reasons. The average industrial establishment interrupted operation for more than 40 days. Commerce and service enterprises stopped for much shorter periods, but were also affected. Total loss of revenue in industrial and commercial establishments due to reduced activity has been estimated at BDT 3.3billion (US\$ 47 million), most of it in the non-industrial sector.



Part B: Facing the Future: Recovery and Reconstruction and Risk Management Requirements

This second part of the report includes a forward-looking approach and describes what should be done to restore the economy and rebuild the assets destroyed by the cyclone, including a scheme for reduction of disaster vulnerability and risk management.

On the basis of the damage and loss assessment presented in Part A, financial needs to achieve full economic recovery – at the macroeconomic and individual household levels – and to rebuild the destroyed physical assets are estimated. Furthermore, needs for entering into vulnerability reduction and risk management are identified and quantified. Immediate or short term as well as medium and long-term requirements are estimated and presented.



Section IV: Early Recovery Requirements

Introduction

Reconstructing the infrastructure and recovering the economy of affected areas requires a multi-pronged approach that restores assets and protects the most vulnerable members of society against future calamities.

Experience shows that recovery efforts should start as soon as possible after a natural disaster, even though humanitarian assistance is still ongoing. This will mitigate the effect of dependency within the affected communities and ensure a more rapid return to normalcy. This also helps to reduce vulnerability to natural hazards by minimizing physical exposure and building community capacity to cope with and recover from disaster impacts.

The strategy outlined below is based upon a phased approach to recovery and reconstruction. The following section outlines a short-term recovery program to take care of the immediate needs arising from the humanitarian phase, while building a foundation for medium- to long-term recovery.

Early Recovery Strategy

The early recovery program is based on meeting immediate needs and will provide the first opportunity for the affected population to rebuild the homes, lives, and living environment devastated by Sidr. These needs, as a recent food security survey of the WFP points out are food, cash income, and clothing.

Table 32: Immediate Needs of Communities

Priority Needs	%
Food	95
Cash	68.3
Temporary Shelter	21.7
Clothing/blankets	60
Drinking water	13.3
Medical/health support	18.3
Sanitation	8.3
“Other”*	13.3
“Don’t know”	1.7

Source: UNDP Early Recovery report, 2008.

These immediate needs are followed by a second set of priorities to improve the housing and health of the population by provision of shelters, medication, and clean drinking water.

The early recovery strategy consists of three main lines of intervention, each having high relevance at a particular time after the disaster:

- Protection to ensure a quick response to those in immediate need for income;
- Community Infrastructure Repair to repair vital physical infrastructure while providing temporary employment opportunities; and
- Local Economic Recovery and Development to kick-start accelerated growth.

Protection ensures a quick response to assist large groups of people who have lost their possessions, homes, and livelihoods. Instruments include cash transfers, food and shelter

provision, medical assistance, water and sanitation interventions, etc., that have high relevance during the phase immediately after the humanitarian phase.

Community Infrastructure Repair programs repair economic and social infrastructure while providing intermediate job opportunities. This is of high relevance during early recovery while the intensity of interventions gradually increases over time. The assistance helps repair critical infrastructure while increasing the purchasing power of the affected population.

Economic Recovery activities start during early recovery and increase in scale once protection measures are downsized and phased out. The assistance helps re-establish normalcy in the productive lives of affected families and businesses, in the form of assets and working capital.

Throughout the strategy, special attention must be given to ethnic minorities, female-headed households, elderly people, persons with disabilities, and vulnerable children.

Component 1: Protection

Food Security

The two consecutive floods in July and August 2007 left ten million people and 13 percent of crops affected. The added impact of Cyclone Sidr on national and household food security is likely to be very serious. Over 80 percent of *aman* rice production (which has a single harvest season—November through January) and a large majority of sowing areas for pulses were damaged. Many other crops were ready or nearly ready for harvest at the time of the cyclone; a quarter of them have been destroyed. Soil condition in the area is not conducive to the planting of alternative crops, thus farmers' income sources have been severely curbed. Increased salinity caused by tidal surges during the storm, and soil deposition has further hampered agricultural productivity; destruction of the local variety of paddy may lead to seed scarcity in the coming seasons. In addition, the storm washed away private stockpiles and storages, killed thousands of animals (livelihood and protein source), and felled 1.4 million fruit trees, thus significantly curbing people's purchasing power and access to daily subsistence.

Initial priority will be given to foster special safety-net programs—Vulnerable Group Development (VGD) and Vulnerable Group Feeding (VGF)—to address food shortages among poor and vulnerable people in the 12 worst affected districts.

During food security interventions, these vulnerable groups must be given priority in receiving social safety net supports—an approach of 'positive discrimination.'

Early Recovery Interventions

- Continuing food relief assistance in the form of VGF (2.59 million cards), and GR (2.2 million people) up to June 2008;
- Establishing district level monitoring of food security system to ensure that no one suffers starvation and subsequent malnutrition;
- Quick Nutritional Surveillance to find out how many children and mothers are suffering in malnutrition;
- Ensuring supplementary nutrition to children and mothers with malnutrition and food supply to vulnerable groups; and
- Rice imports.

Shelter

Despite the high numbers of families that were able to rebuild their own shelters, about 200,000 families are still in need of transitional shelter assistance. Roughly one-third of those had their houses fully destroyed and need assistance in rebuilding their homes, while the remaining two-third only need assistance in repairing their partially damaged house.

The strategy will be to provide transitional shelters for those in need, while introducing new concepts to rebuild houses based on the 'build back better' concept, such as the "Core Shelter". This, broadly stated, is the construction of a small house of strong cyclone-resistant materials, to which storages spaces, verandas and extra rooms can be added in a latter stage. This progressive approach to shelter provision ensures that it acts as a stepping stone to strong, cyclone- and flood-resistant housing that will reduce beneficiary households' vulnerability to future storms.

Early Recovery Interventions

- Shelter repair assistance;
- Introduction of a Core Shelter Program;
- Construction of community appropriate cyclone shelters; and
- Neighborhood based safe center construction.

Water and Sanitation

Damaged tube wells have been repaired; therefore attention will focus on water-scarce areas by cleaning surface water sources that people rely on, improving sanitation in and around houses with extensive damage to pit latrines, and hygiene promotion. Provision of safe water will be needed for months to come in temporary schools, child-friendly spaces, communal facilities, and permanent cyclone shelters. In addition, restoration of sanitation facilities is required.

Early Recovery Interventions

- Construction of shallow/deep tube wells;
- In place where tube wells are not feasible, water treatment plants need to be installed;
- Water quality control and testing;
- Provision of household latrine kits;
- Construction of Pond Sand Filters (PSF)
- Training of community Water & Sanitation committees in operation;
- Maintenance, and management of water supply facilities; and
- Support installment of rain water harvesting at homes and shelters.

Education

The early recovery strategy, in an effort to 'build back better' will strengthen sector-wide coordination between Government institutions and development agencies to ensure that children's needs are addressed in a holistic and complementary manner and that vulnerable children's rights to and access to education receive priority.

Early Recovery Interventions

- Conduct a comprehensive assessment of needs teaching/learning materials and reconstruction for all types of schools of the affected districts;
- Supply of teaching/learning materials;
- Provision of water and sanitation facilities at education centers; and
- Sector coordination.

Health

Given the concern for the potential of water-borne diseases emergency medical support needs to be continued, in addition to the provision of drinking water. Some of the hospitals in the worst affected *upazilas* are partially damaged and are in need of immediate repair, as they are the only source of medical care service to those living in remote areas. The early recovery strategy further entails replacement of damaged health and medical equipment; provision of essential public health needs such as maternal health and other reproductive health services, newborn health services, immunization, strengthening communicable disease surveillance and health promotion are a priority. It is also necessary to provide medical support to the people injured during the cyclone to prevent the further deterioration of their health.

Early Recovery Interventions

- Capacity building in first aid, disaster response, disaster preparedness, health promotion, and collective and individual hygiene;
- Disease surveillance; and
- Procurement of medicines, safe delivery kits, medical equipment and generators.

Environment

From the overall picture of needs three key interventions have been identified as necessary to be implemented in the Early Recovery phase, before the end of 2008. Note the funding for Forestry Department infrastructure is highly recommended in this phase precisely due to its essential role in protection and maintenance of the Sundarbans. FD has the local knowledge to act as a perfect interlocutor for projects covering the Sundarbans; secondly, without their work it is likely existing environmental conditions will deteriorate.

Early Recovery Interventions

- Procurement of medicines, safe delivery kits, medical equipment and generators;
- Awareness raising campaign with the objective to prevent further damage to the vulnerable environment;
- Urgent activation of an effective GIS/RS based monitoring and evaluation system housed with the Forest Department; and
- Support to Environmental Recovery: environmental clean-up and rehabilitation, restoration of damaged environment and support for further protection, support for restoration of social forestry using local plant species.

Governance

Governance as a broader framework incorporates three crucial aspects: accountability, transparency, and participation. The early recovery strategy is to address the risks to good governance in planning, operation, and monitoring. A main crosscutting issue within this strategy is to address gender and diversity issues within the early recovery program to ensure participation of women and minorities.

Early Recovery Interventions

- Short-term Training and Awareness raising program regarding the overall comprehensive disaster management approach of the Government;
- Training of the Disaster Management Committees on Early Recovery issues, such as: data collection, data analysis, prioritization, governance, risk reduction, gender, social inclusion, participation and coordination;
- Training of Government Officials and staff of development partners in the Damage, Loss and Needs assessment methodology;
- Capacity development for early livelihood recovery planning;
- Strengthening of local level volunteer team to combat pre and post disaster emergency situation.

Component 2: Community Infrastructure Repair

Social and economic infrastructures have been damaged and must be repaired in order to facilitate recovery efforts. Repairs will be made through employment-intensive public works schemes that maximize the use of local labor and materials.

The key design features of the public works programs will be guided by basic principles derived from international best practices. The most important of these principles is that wages are not set above the prevailing market wage for unskilled labor, to ensure that those who have lost their livelihoods are able to work will “self-select” into the program. Other important aspects are the inclusion of vulnerable groups and the implementation of disaster-mitigating measures by adopting minimum design standards.

Early Recovery Interventions

- Community infrastructure recovery: road repair, cleaning of drainage canals, building of *killas*, rebuilding landing stations, repair of power stations and distribution lines, repair of embankments and tree planting;
- Repair of school buildings, community centers health facilities and forestry offices; and
- Construction of transitional schools for the fully damaged Government primary schools.

Component 3: Economic Recovery

In the short-term, money should be injected into the local economy through cash transfer mechanisms as well as labor-intensive public works schemes that kick-start the local economy, create jobs, and stimulate demand. In addition to generating self employment and encouraging socioeconomic recovery, there is a need for immediate measures to help people move out of dependency on relief aid and restore and improve previous livelihoods. Phased and progressive interventions, with a special focus on directly or indirectly targeting vulnerable categories of the cyclone-affected population, such as widows, youth, and the disabled, will be implemented.

Early Recovery Interventions

Agriculture

- Crop, livestock and fisheries restocking;
- Temporary income-generating schemes;
- Seed capital and grants in kind to farms, fishermen, industries, and services; and
- Interest-free or soft loans to farms.

Non-Farm

- Short-term skills training, upgrading of existing skills, and diversification of occupations in those trades which are in high demand during the recovery phases, such as carpentry, masonry, welding, and administration and logistics.

Summary of Early Recovery Requirements

Early Recovery cost estimations are based on the draft Early Recovery Action Plan, prepared by the Ministry of Food and Disaster Management²⁷. Budget requirements as identified in the Early Recovery Action Plan are included in both the early Recovery sections as well as the Medium to Long term section of the JDLNA Report, based on immediate needs, nature of activities and funding and implementation feasibility in the next 4–8 months.

Table 33: Summary of Early Recovery Interventions

Early Recovery	(BDT Million)	(US\$ Million)
Protection		
Food Security	17,526	254.0
Shelter	3,105	45.0
Water and Sanitation	345	5.0
Education	393	5.7
Health and Nutrition	152	2.2
Environmental protection	221	3.2
Governance (improve disaster preparedness)	110	1.6
Community infrastructure Recovery		
Economic and social infrastructure repairs	1,946	28.2
Income Recovery		
Agriculture	690	10.0
Non-Farm	345	5.0
Total	24,833	359.9

Note: based on findings of MoFDM figures and the assessment team

²⁷ "Cyclone SIDR, Early Recovery Action Plan, February 2009", prepared by the Ministry of Food and Disaster Management



Section V: Medium- and Long-Term Recovery and Reconstruction Requirements

Recovery and Reconstruction Strategy

Effective recovery and reconstruction over the medium- to long-term requires a comprehensive strategy that ensures communities and entities “reconstruct better” and drives sustainable economic recovery by ensuring exposure to climate risks is reduced and coping ability is enhanced.

Experience shows that recovery and reconstruction programs are more successful when physical reconstruction and employment generation are linked. This ensures community participation in housing and small infrastructure reconstruction, facilitates access to resources needed for livelihood restoration, and incorporates hazard risks and vulnerability concerns in reconstruction activities and future development plans. In fact, utilizing local resources, both physical and non-physical, is key to capacity building and long term sustainability of the affected regions.

Transparency, attention to governance, and proper targeting in allocating assistance to affected households and regions have also been identified as key factors that ensure sustainable results from recovery efforts. The following should be considered a starting point for further work in support of Government activities in this area, including the preparation of the second phase of the Comprehensive Disaster Management Program of MoFDM.

The medium- to long-term recovery and reconstruction program consists of two elements:

- Reconstruction and upgrading of damaged social and economic infrastructure;
- Recovery and improvement of agricultural and non-farm activities.

Component 1: Infrastructure Reconstruction

Medium- to long-term reconstruction of physical assets that were damaged by Cyclone Sidr will focus on private and public buildings (housing, educational institutions-cum-shelters, etc.) and infrastructure (embankments, rural roads, market places, etc.). The approach is to provide opportunities to help affected populations regain socioeconomic stability and to introduce and mainstream new standards and upgrading that will help protect them against future disasters.

The reconstruction program will build upon the early recovery infrastructure activities, developing these into more sustainable investments, while creating opportunities for the private sector to strengthen its capacity. It will also build on the EC-financed assessment of earthquake risks.

The expenditure on reconstruction of damaged assets will create job opportunities by utilizing local resources (both material and small and medium enterprises), build capacity among the affected populations, and improve accessibility, creating a multiplier effect on recovery in the local economy.

Introduction of quality control and improved construction standards for the construction will ensure increased resilience to face possible future natural hazards.

Medium- to Long-Term Recovery and Reconstruction Interventions

- Construction of housing for 20,000 households;
- Construction and upgrading of the transport network;
- Rehabilitation of electricity services;
- Rehabilitation of damaged or destroyed market places;
- Reconstruction of water supply services;

- Reconstruction of urban public infrastructure;
- Upgrading of health service infrastructure;
- Reconstruction of fully damaged schools to schools-cum-shelter;
- Reconstruction and upgrading of damaged embankments;
- Rehabilitation of the Sunderbans.

Component 2: Livelihood Recovery

Short-term measures that facilitate income recovery for individuals must be complemented by activities that promote community-wide economic recovery. Initiatives to consolidate the achievements of the first phases of the recovery should be considered, such as the promotion of an enabling environment for businesses. The revival of the local economy and the creation of livelihood opportunities should also be based on the development of micro- and small enterprises, support of microfinance services, establishment of local business advisory and development services, and promotion and support of local public–private partnerships for reconstruction. The existing business-supporting services will be extended to include informal sector operators, as micro-enterprises will develop and find their survival in that sector. The capacity of the Government will be further strengthened in the field of pre-disaster planning.

Medium- to Long-Term Recovery and Reconstruction Interventions

- Agricultural recovery and development programs for farmers and fishermen;
- Distribution of cash grants or grants in kind to the agricultural and non-farm sectors to replace tools, equipment, and stocks and rebuild workplaces;
- Provision of temporary employment through public works schemes;
- Provision of credit lines to replace and improve houses and household goods;
- Provision of credit lines to agricultural and non-farm sector to restore and upgrade productivity²⁸;
- Induce local economic recovery and development through provision of skills development and vocational training ;
- Develop capacity for disaster recovery planning, including comprehensive awareness and information campaigns.

²⁸ Interest on such credit should be lower than the market price so that borrowers of the SIDR-affected areas can ease the installments.

Summary of Medium- and Long-Term Recovery and Reconstruction Requirements

Table 34: Summary of Medium-Term Recovery and Reconstruction Interventions

Medium/Long Term Recovery and Reconstruction	Medium (1st Priority)		Long (2nd Priority)	
	(BDT million)	(US\$ million)	(BDT million)	(US\$ million)
Infrastructure Reconstruction				
Housing	1,380	20	0	0
Transport Infrastructure	2,760	40	4,485	65
Power	2,926	42.4	0	0
Water and Sanitation	4,761	69	3,450	50
Urban road and drainage canals	1,007	14.6	690	10
Embankments and Water Control Structures	4,554	66	2,760	40
Education	3,588	52	3,450	50
Health Care	573	8.3	0	
Environmental protection	690	10	373	5.4
Sub Total Reconstruction	22,239	322	15,208	220
Livelihood Recovery				
Agriculture sector	9,660	140	6,900	100
Rural non-farm sector	3,450	50	2,415	35
Financial assistance to recover housing and goods	5,865	85	0	0
Sub Total Recovery	18,975	275	9,315	135
Total	41,214	597	24,523	355
Total (BDT Million)	65,736			
Total (US\$ Million)	953			



Section VI: Disaster Risk Management Requirements

Country Risk Profile

Annual regular flooding has traditionally been beneficial in Bangladesh, while low frequency but high magnitude floods can have devastating impacts on livelihoods and the economy. Recent major floods occurred in 1978, 1988, 1998, 2004 and 2007²⁹. The country also remains one of the worst sufferers of cyclone casualties in the world. In addition, riverbank erosion affects many people and results in the loss of productive areas land annually. Droughts have also been a common occurrence over the years. Other major hazard risks to the country include earthquakes, tsunamis, high arsenic concentrations in the ground water, water logging, and salinity in the coastal areas.

Bangladesh is located in a seismically active and high risk region. However, despite an obvious need to do so, seismic risk awareness, mitigation, and reduction have not been mainstreamed into the country's core disaster management agenda and strategy. There is an equally great need for the country to urgently start devising and implementing major preparedness interventions and capacity building efforts.

Bangladesh is currently ranked as the most climate-vulnerable country in the world (World Bank, 2005). The Inter-Governmental Panel on Climate Change projects that climate change is likely to increase both the frequency and intensity of cyclones in the Bay of Bengal and alter the depth and spatial extent of flooding in the Ganges-Brahmaputra-Meghna Basin. This has important implications across all sectors (such as agriculture, housing, transport) and consequently on economic development and poverty. Added to these risks are the likely consequences of sea level rise, which could cause economic losses of an unprecedented magnitude in low-lying Bangladesh.

Country Strategic Approach and Institutional Arrangements for Disaster Management

Over time, the country's ability to manage disaster risks, in particular floods and cyclones, has evolved and improved, especially since the 1991 cyclone that claimed nearly 140,000 lives. This has been the result of a gradual shift from a response-based approach to a strategy that incorporates elements of greater emergency preparedness and risk mitigation. Bangladesh's Poverty Reduction Strategy Paper provides for strengthening disaster management and risk reduction, mainstreaming DRR into national policies and developmental processes, and enhancing community capacity for disaster preparedness and risk reduction.

The present national strategy for disaster management, although in an early phase of implementation, is based on three key elements including: (i) defining and redefining the risk environment, entailing systematic and improved hazard analysis and vulnerability and community risk assessments; (ii) managing the risk environment, including achieving a good balance of risk reduction options and mainstreaming risk reduction across sectors through policy and planning reform and capacity building; and (iii) responding to natural disasters in a timely fashion, including activating systems and mobilizing resources; utilizing vulnerability and risk databases for

²⁹ Most of the statistics quoted in the following sections have been excerpted from the Draft National Plan for Disaster Management, 2007-15.

emergency response planning; and enhancing effective communications and early warning systems.

Further, the Draft National Plan for Disaster Management (NPDM, 2005–15), is aligned with the objectives and priorities for action identified under various international conventions, such as the Hyogo Framework for Action (HFA) 2005-15, the United Nations Framework Convention on Climate Change (UNFCCC), and particularly, the SAARC Framework for Action (SFA) 2006-15. The NPDM has already been approved by a wide stakeholder group comprising of Government and non-governmental organizations and academic institutions, and by the IMDMCC, and now awaits cabinet consideration and approval. The NPDM is centered around the following strategic priorities and goals: (i) strengthening the present disaster management system; (ii) mainstreaming disaster risk reduction; (iii) strengthening institutional mechanisms for disaster management; (iv) empowering at-risk communities; (v) expanding risk reduction programming across all sectors and all hazards; (vi) strengthening emergency response systems; and (vii) developing and strengthening networks for disaster management.

The National Disaster Management Council (NDMC), headed by the Prime Minister, is the highest-level forum for the formulation and review of disaster management policies. The Inter-Ministerial Disaster Management Coordination Committee (IMDMCC) is in charge of implementing disaster management policies and decisions of the NDMC, assisted by the National Disaster Management Advisory Committee (NDMAC). The Ministry of Food and Disaster Management (MoFDM) is the apex institution responsible for coordinating national disaster management interventions across all agencies. Details on the structure of the MoFDM, and the various sub-national disaster management committees are provided in the Annex.

The Comprehensive Disaster Management Program (CDMP), under the auspices of the MoFDM, is undertaking a number of interventions aimed at strengthening and improving disaster management and risk mitigation capacities at various levels, and in promoting and implementing the national strategic priorities and plans set out by the Government. It is funded by DFID, UNDP, and the EC. The program has started to make significant contributions in the areas of capacity building, professionalizing disaster management, partnership development, advocacy for mainstreaming disaster risk reduction across sectors, community empowerment for disaster risk reduction, and strengthening response management. The CDMP has met with particular success in implementing Community Risk Assessments (CRAs), community-level Risk Reduction Action Plans (RRAPs), and small-scale risk mitigation interventions funded through the Local Disaster Risk Reduction Fund (LDRRF) in seven pilot districts.

Needs Assessment for Disaster Response

Management in the Light of Recent Lessons

The key lessons learned and needs identified from the recent Cyclone Sidr response include the following: (i) improving, training and strengthening the Cyclone Preparedness Program (CPP) Volunteers Force and streamlining its management; (ii) further strengthening and institutionalizing disaster preparedness, especially among the various sub-national disaster management committees; (iii) mobilizing adequate response resources for improving provision of basic facilities and relief provisions in cyclone shelters, and providing search and rescue equipment to local Government teams and other partners; (iv) mainstreaming disaster risk reduction and mitigation across sectors and down to the lower levels of governance; (v) taking stock of deficiencies in key

cyclone risk mitigation infrastructure such as cyclone shelters, access to cyclone shelters, and coastal and river embankments; (vi) strengthening local communication systems through the provision of modern, disruption-free communication equipment to key disaster management focal points, and; (vii) community training in interpretation of early warning signals and in following evacuation protocols and requirements, through sustained public information and behavioral change/sensitization campaigns.

Proposed Risk Mitigation Strategic Framework and Action Plan - Moving from Risk to Resilience

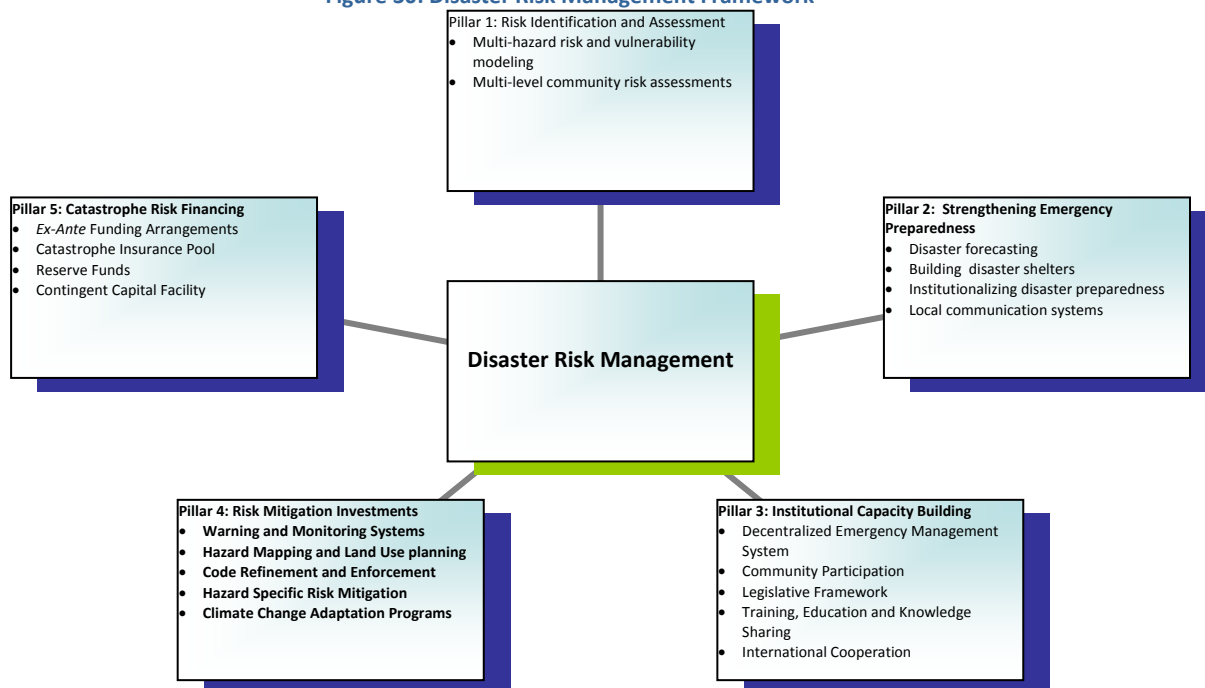
Figure 29: Cyclone Shelter



The proposed disaster risk reduction framework combines the broad strategic priorities and goals contained in the NPDM (2007-15), as well as contemporary strategic elements for disaster risk mitigation in the international arena. These can essentially be distributed across the following five strategic pillars: (i) risk identification and assessment; (ii) strengthening and enhancing emergency preparedness; (iii) institutional capacity building; (iv) risk mitigation investments; and (v) introducing catastrophe risk financing in the longer term (Figure 30). The underlying principles of this framework are that both loss of life and the economic impact of disasters can be reduced through advance planning and investment. Further, the strategic framework and action plan should be both affordable and delivery-efficient.

Pillar 1: Risk Identification and Assessment

Bangladesh has already done a substantial amount of work assessing the risks due to major disasters, particularly for recurrent floods and cyclones. A series of studies was carried out in the 1990s backed with thorough analysis to manage floods: the Flood Action Program (FAP). These studies consist of 27 detailed studies spanning several volumes of reports. Similarly, there have been many assessments, studies, and strategies developed for managing cyclones, the coastal zone, and general risk reduction. However, some natural disasters, such as earthquakes, have rarely been considered in these assessments. Moreover, given the potential for long-term climate change concomitant with changes to existing climate variability, it is crucial to update the risk assessments for various regions and zones of the country and prepare detailed hazard risks maps for each district, *upazila*, and union in the country.

Figure 30: Disaster Risk Management Framework³⁰

Detailed, national level multi-hazard risk and vulnerability assessment and modeling

During the last 150 years, several major earthquakes with a magnitude greater than seven on the Richter scale have affected Bangladesh, two of which (with their epicenters within the country) caused considerable damage. Recent studies indicate that at least one 8.1 to 8.3 magnitude earthquake is overdue along the plate boundaries within Bangladesh. Such an event would have catastrophic effects in the country's major, densely populated cities. However, earthquake risks are little known among policymakers and the public, and implementation of earthquake mitigation measures has not yet taken root. While there is sufficient knowledge of flood management in order to identify risks and generate hazard maps for each union or village in the country, more work is needed to assess earthquake risks.

Based on existing studies and new data acquisition, a national level multi-hazard risk and vulnerability assessment and modeling should be undertaken. This work can help integrate disparate local studies and identify key knowledge gaps. The proposed assessment should develop national level and administratively disaggregated modules and models for: (i) spatial and temporal mapping of all hazards and development of probabilistic future models; (ii) asset and population exposure; (iii) vulnerability of different asset types; and (iv) loss analysis for estimating monetary losses for each division of the geographical area covered. The understanding of potential economic losses will help the country review physical, human, and financial exposures; in determining levels of acceptable risks and those to be mitigated; and in updating emergency plans and procedures and developing appropriate capacity building programs.

³⁰ Based on World Bank Disaster Risk Management Series No. 9 "Preventable Losses - Saving Lives and Property"

Supporting community risk assessments at the district, *upazila* and union levels

This component would entail supporting the CDMP approach and efforts towards the development of CRA and RRAP at the union level, aggregating into *upazila* level and further into district level CRA and RRAP. Structural and nonstructural priorities determined through this 'bottom-up' approach, and centrally compiled and recommended by the Disaster Management Committee (DMC) at various levels, could then help identify, prioritize, and implement appropriate risk reduction interventions at various administrative levels. Such interventions could possibly be financed through instruments such as the LDRRF, further expanded through Government and multi-donor sources.

Pillar 2: Strengthening and Enhancing Emergency Preparedness**Disaster forecasting and warning**

The disaster warning systems have to be improved to provide a more effective coordinated response. In this context, the Flood Forecasting and Warning Center (FFWC) under the Ministry of Water Resources, should be given a prominent role, technology-upgraded, and capacity-enhanced (for example, by use of satellite imagery to improve flood forecasting). Similarly, the forecasting system for cyclones, which is managed by the Metrological Department under the Ministry of Defense, needs strengthening, and its work coordinated with the MoFDM and FFWC. Moreover, the CPP needs upgrading, by providing equipment, staff and training; it also needs improved linkage with local Governments. The communication system also has to be improved for flood warning and combined with the cyclone warning system to improve dissemination of early warnings and information to communities. This could include, in particular, further strengthening of the local communication system the network of the Department of Mass Communication (DMC), a grassroots level Department of the Ministry of Information. The disaster information management system (being developed under CDMP) would have to be expanded to the district and *upazila* levels.

Construction of new, and rehabilitation of existing, disaster shelters

Over time, multipurpose cyclone shelters have been constructed in 15 of 19 coastal districts in Bangladesh. There are about 2,133 purpose-built shelters and perhaps 200 refuge sites (*killas*) for livestock during cyclones and storm surges.³¹ The existing shelter capacity, however, is grossly inadequate compared to the requirements. There is also need for disaster shelters in frequently flooded areas and possibly shelters for earthquakes and other natural calamities. Where appropriate, shelters should be multipurpose buildings (for example, in education facilities) also connected to *killas*. The shelters should have water supply (or storage facilities for water), sanitation facilities, and storage for food and supplies needed for survival immediately after a disaster³². They should be connected with the communication network for speedy evacuation and delivery of relief supplies during the disaster. As a matter of policy, all public buildings constructed in the high-risk zones should be multi-purpose and of shelter grade.

³¹ Estimates available for functional Cyclone shelters range widely. The DMB estimated in 1991 that there about 2033, however, LGED estimate is 1,868. The CEGIS 2004 estimate is that there are about 1,639 shelters in the high risk zone.

³² This could include construction of bonds with raised banks nearby the shelters to keep provisions of water supply safe from tidal surges.

While studies to update the requirements are being prepared, the Government should begin a program of constructing at least 2,000 additional shelters in the high-risk zones and upgrading at least 1,000 existing shelters (by adding *killas*, communication, and other facilities, and removing deficiencies observed in use of the existing shelters). Given the capacity for implementation and possible financial outlays, it would be reasonable to construct about 100 new shelters and upgrade 200 annually over the next five years.

Further strengthening and institutionalizing disaster preparedness

This will entail the following activities: (i) supporting and building the capacity of the various sub-national disaster management committees to develop and implement disaster management plans at various levels, and mobilizing adequate response resources; (ii) development of evacuation protocols and plans to guide local populations; and (iii) provision of search and rescue equipment to *upazila* DMCs, and if necessary, provision of transport for selected most in-need *upazilas*.

Strengthening local communication systems and sustained public awareness and sensitization campaigns

Existing telecommunications facilities need to be better protected and supplemented by modern, disruption-free communication equipment to key disaster management focal points at the district, *upazila*, and union levels. Further, communities need to be trained in evacuation protocols and requirements through sustained above-the-line (such as electronic media) and below-the-line (such as behavioral change and sensitization campaigns) mass communication tools.

Pillar 3: Institutional Capacity Building

The country's capacity to manage risk at the different levels of Government needs improvement. Disaster risk reduction has to be made part of the investment programs of line Ministries/Agencies. This process has to be driven by the MoFDM as the apex agency in leading such efforts. Though its role is crucial, there are several areas in which MoFDM lacks capacity. Despite CDMP support there remain several issues that need to be addressed in order for MoFDM to become an effective institution to deal with disasters in the future. The current focus of the ministry seems to be on relief work, and to some extent reconstruction. Disaster preparedness and management, however, demand a different set of activities. Most importantly, a key role that MoFDM should play is coordinating with other Government ministries, agencies, and local Governments before, during, and after the disaster. Primarily, the roles of various MoFDM directorates and agencies (in particular DMB and Disaster Relief and Rehabilitation), and their working relationship with the other line ministries and district/local administration need to be defined clearly. Furthermore, DMB and Disaster Relief and Rehabilitation need to be staffed with professionals trained in disaster management. The following set of activities is proposed under this component:

Establishing a Bangladesh Institute for Disaster Management Training

This institute should be aimed at creating a national training and research capacity in disaster risk management. This could be established within one of the major universities, and be responsible for developing curriculum and devising and conducting comprehensive training programs.

Professionalizing the current disaster management institutions

This component could include supporting existing CDMP activities toward the training and capacity building of DMB and other key disaster management related institutions. The Government should also, in the longer term, consider the creation of a disaster management cadre. In the short-term, the Government may consider inducting disaster management experts and consultants in DMB and other institutions as required.

Building DMB capacity for damage, loss and needs assessments

This component will entail the strengthening of the DMB to quickly provide reliable JDLNA that can serve when needed to allow the DMB to quickly carry out assessments on a regular basis, not only for extreme flood disasters. Moreover, establishing and strengthening a multi-hazard vulnerability mapping, information, and database unit within the DMB will help manage disparate sources of information.

Mainstreaming disaster risk reduction and mitigation across sectors

This component will support existing CDMP efforts toward cross-sector mainstreaming of Disaster Risk Reduction (DRR), also identified as a priority under the NPDM. Present CDMP activities to this effect primarily include partnership development, including advocacy for mainstreaming disaster risk reduction and for expanding risk reduction across a broader range of hazards.

Fostering national level public–private partnership forums

This component will support the creation and strengthening of multi-sector national platforms for the development of integrated disaster risk reduction mechanisms—a key priority for action adopted under the HFA. Such mechanisms will need to be multi-sector and interdisciplinary, with public, private and civil society participation involving all concerned entities within the country. Such forums could prove instrumental in realizing the potential of public–private partnerships in DRR for wider resource mobilization and for deepening partnerships with stakeholders working on the socio-economic dimensions of DRR.

Pillar 4: Risk Mitigation Investments for Reducing Exposure to Natural Hazards

Absolute protection for all areas against all climate hazards is neither feasible nor economically defensible. Economic considerations argue for an emphasis toward the protection of higher-value assets such as urban areas, production centers, and infrastructure, with greater importance given to building coping capacity in other areas. Building resilience would involve a combination of interventions that include “hard” and “soft” engineering solutions, zoning and planning, and an innovative use of economic instruments to protect assets and direct incentives toward investment in climate-resilient forms of economic activity.

Riverbank Protection Improvement Program (RBIP)

Riverbank protection is the main strategy available to Bangladesh for reducing flood risks and erosion for and managing land and water resources. The country has a long history of embankment construction along all its major rivers. RBIP, coupled with an enhanced flood management approach for long-term sustainability, would call for large investments. To be cost effective, it must be phased and accompanied by policy commitments and by a financial and institutional architecture designed to assure adequate operational maintenance. The first phase

could start with improvements along the Brahmaputra Right bank Embankment (BRE). The protection has to be provided by constructing hard points where necessary (as identified by the FAP studies) for fixing river bank alignment. The hard points should be connected with a properly constructed embankment and combined with a road to make this substantial investment more productive and to ensure continued maintenance in the future. The first phase could also support preparation and design of priority investments in subsequent phases, together with a comprehensive asset management plan, which would also involve local Governments and communities. Given current planning, absorption, and implementation capacities, the first phase should require about US\$300 million and would include improvement in protection around major cities along BRE. The investment program is summarized in Table 35.

Coastal Embankment Improvement Program (CEIP)

There is clear evidence that embankments, though inadequate in some places, provided an effective buffer during the tidal surge due to Cyclone Sidr. Damages and losses are much lower—and lives were saved—where effective embankments were present. Some embankments did not fail even when they were overtopped by the surge. The existing network is large—more than 6,000 km of coastal embankments and over 130 polders—many of them constructed more than 30 years ago. However, their effectiveness has been impaired by poor maintenance and inadequate management. With repeated storms, coastal embankments have weakened and need restoration and upgrading.

A systematic approach is needed to upgrade the coastal embankments to provide protection against future storm surges. Designs should protect against an appropriate return period and should be based on sound local risk and vulnerability assessments. An effective asset management plan will be critical. In addition, for some structures the crest level of the embankment should be raised, and slopes and construction material improved. Moreover, the embankment improvement program has to be accompanied with a forestation program, particularly on the sea side. Forestation has been shown to significantly reduce storm surge damage. Where appropriate, these need to be multi-purpose infrastructure items. The total cost of CEIP is estimated at around US\$ 1 billion. The first phase should start with investment of about US\$300 million over the next five years, giving priority to areas with high population density and economic activity.

Program for upgrading the standards of construction for roads

The road network, particularly rural roads, serves as a lifeline during floods and needs to be upgraded to proper levels, with proper provision for drainage. Piecemeal repair and restoration of roads after each flood or cyclone is neither cost effective nor suitable for a country facing increasing climate risks. The standards for the road network need to be upgraded and made mandatory for all roads constructed in the future. A survey of vulnerabilities and a comprehensive program is required to upgrade these structures. This will help reduce future damage and save lives. Roads should also be made multipurpose where possible.

Forestation in the coastal belt and rehabilitation of Sunderbans

Historically, the Sunderbans have provided protection against cyclone damage, as was demonstrated clearly during Cyclone Sidr. Even scattered and unplanned forestation on the seaside of the embankments was of great help in breaking the velocity of the storm surges. The forestation and rehabilitation of the Sunderbans could comprise the following programs: (i)

forestation along the embankments, integrated with the improvement program; (ii) in the long run, a program of forestation along the coastal belt to reduce vulnerability to storms and surges (for example, ‘Green Belt’ programs); (iii) rehabilitation of the Sunderbans, plantation where necessary, and improvement in the protection systems and infrastructure; and (iv) restoration of the Gorai river system.

Capacity building for risk mitigation investments

To ensure the sustainability of the risk mitigation investments, proper institutional arrangements must exist with a capacity to plan, design, and implement. These activities must take into account the increased volatility of the environment because of climate change. Technical assistance and training will be provided to ensure capacity building.

Figure 31: Embankments at the Coast



Pillar 5: Catastrophe Risk Financing and Transfer

A well-designed risk financing program enables a disaster-prone country to avoid major economic disruptions following natural disasters by meeting its post-disaster funding needs without resorting to major budget reallocations, additional taxation, or external borrowing. Risk financing instruments are even more relevant given the increased vulnerabilities and uncertainties due to climate change.

The budget of Bangladesh does not include adequate contingency arrangements for disaster risk reduction and/or recovery. The general practice is that a “reserve” category is established in the budget for various contingencies, and these funds are used in the aftermath of a disaster. The budget allocations have typically been insufficient, requiring substantial supplemental donor assistance, and operation and maintenance budgets frequently suffer due to funds having been used in disaster response. To meet its post-disaster funding needs, the Government can resort to a combination of ex-post sources of funding and ex-ante funding arrangements. Ex-ante funding arrangements include reserve funds, contingent capital facilities, and risk transfer instruments (insurance and reinsurance). Disaster response financing would have two main elements:

Disaster Response Fund (DRF)

The DRF would provide funding for early recovery, obviating the need to tap operation and maintenance budgets. This fund can be supplemented through a combination of grants, credits,

or loans, and standby arrangements with Global Facility for Disaster Reduction and Recovery (GFDRR). Donors could contribute to the established mechanism of GFDRR, with some amount available upfront and the remaining on a callable basis. A certain amount of the funds can be directly provided for budget support. The balance would finance specific recovery investments. The estimated level of DRF should be around US\$300 million, based on the 2007 flood and cyclone immediate recovery needs and the operation and maintenance funds that were redirected for disaster management.

Catastrophe risk financing of rare events

The possibility should be explored of buying risk coverage from the international capital market, including re-insurers, in case of catastrophic and rare events. This would inject liquidity immediately after the disaster and enhance coping capacity, as well as providing hazard-contingent budget support. Depending on the peril, the insurance arrangements would follow parametric or index-based triggers. For Bangladesh, the coverage should include weather-related events (flood, earthquake, cyclone, etc.). The premium could be financed through IDA credit.

Climate Change Multi-Donor Trust Fund

There is also a clear and present need for supporting the climate change risk mitigation agenda contained within the NPDM (2007-15), including (i) capacitating the Climate Change Cell within DoE; (ii) developing scenario and prediction models; (iii) strengthening knowledge on climate change and climate variability impacts; (iv) identifying climate change adaptation options through action research; (v) incorporating climate variability impact information in DRR programs and strategies; and (vi) implementing capacity-building programs to improve multi-stakeholder understanding of climate change impacts.

The international awareness of climate change has led to a significant increase in interest in supporting Bangladesh, given the numbers of people likely to be significantly affected. The urgent need for research and capacity building, and for rapid action to advance climate change adaptation activities, is well recognized. However, given the unique nature of the climate change issue (despite the significant experiences with managing 'normal' disasters in Bangladesh), there is still little of clarity about what needs to be done and how. In order to avoid what could potentially be a large number of uncoordinated projects and programs over the next several years, the international donor community in Bangladesh is exploring options for a more harmonized approach. A multi-donor trust fund—allowing for both technical assistance and grant or loan funds for the additional costs of adaptation—would attract both bilateral and global funds, as well as funds from other sources such as the private sector. A single fund made available to a range of sectors and stakeholders could provide coherent support for identified priorities, with appropriate management structures to ensure sound development outcomes, technical feasibility, and coordination.

Summary of Risk Management Requirements

Table 35: Preliminary Investment Program for Disaster Risk Reduction (US\$ million)

Program	2008-2012	2013-2017	2018-2022	Total
A. Risk Identification and Assessment	10	3	3	16
B. Strengthening Emergency Preparedness				
B1. Improving forecasting and warning systems, and disaster planning and preparedness	10	5	5	20
B2. Disaster Shelter Program				
B2.1. Construction of New Shelters	150	210	240	600
B2.2. Upgrading existing shelters	80			80
Sub-total	240	215	245	700
C. Institutional Capacity building	10	2	2	14
D. Risk Mitigation Investments				
D1. River Bank Protection Improvement Program	300	500	500	1,300
D2. Coastal Embankment Improvement Program	300	400	200	900
D3. Upgraded road network in particular in rural areas	100	100	100	300
D4. Forestation of Coastal Belt	30	40	30	100
D5. Sundarbans restoration and improvement	30	20	—	50
D6. Gorai River Restoration Program	100	100	—	200
D7. Capacity building for risk mitigation investments	20	10	10	40
Sub-total	880	1170	840	2890
E. Disaster Risk Financing				
E1. Disaster Response Fund	300	—	—	—
E2. Multi-Donor Climate Change Fund	80	—	—	—
Sub-Total	380	—	—	380
Total	1,520	1,390	1,090	4,000

Note: The cost estimates provided in the table are indicative, and are based on WB Staff estimates, derived through various sources including GoB estimates, consultations with various development partners, and current costs of activities funded under various ongoing programs, such as the CDMP.

Annexes

Annex 1 - Housing

The analysis of housing damage and loss is largely based on statistics collected by the MoFDM as presented in the Interim report: “Super Cyclone Sidr 2007, Emergency Response and Action Plans”, 27 December 2007. This report estimated the total loss to the housing sector as BDT 57.9 billion (US\$ 839 million), which includes both partial and total damage to housing. The preliminary needs assessment for the housing sector identified an estimated cost of BDT 14 billion (US\$ 200 million).

The calculations for losses to the housing sector took into account both the level of vulnerability of the household (which, in turn, require greater assistance in the rebuilding process), as well as the variability in quality of housing. This data was then further divided by district to give a comprehensive assessment of the total damage to the housing sector, as well as the estimated needs (see Table 36, Table 37, and Table 38).

Vulnerability: Across the country, an average of 5 percent of all households is classified as vulnerable, which includes female-headed households, the elderly, widowers, and the disabled. While there is certainly variation in the number of vulnerable households across districts, the national average of 5 percent was used for all affected districts.

Housing Reconstruction: Calculations to derive both the total loss to the housing sector, as well as the estimated needs were based on a series of assumptions. These included the following: (i) reconstruction of a (15 x 15 ft) house with CI sheet roof and CI sheet fence was calculated at BDT 20,000, and (ii) repairs to a partially damaged (15 x 15 ft) house with CI sheet roof and CI sheet fence would require an average BDT 10,000.

Housing Quality: These calculations were based on a further assumption, that all vulnerable households live in Kutcha housing. For non-vulnerable households, an estimated cost of BDT 44,000 was used, based on taking 30 percent of the estimated cost of a Semi-Pucca (at BDT 1,000,000) and 70 percent of the estimated cost of Kutcha (at 20,000 BDT). Costs for partially damaged houses were estimated at approximately 50 percent of the total cost.

Additional damage costs: Damage and losses of household contents was estimated to be 50 percent of the building damage. Salvage of building materials was estimated to be 25 percent of the building damage (primarily CGI and wood beams). The net effect of these assumptions is a 25 percent increase to bare building costs for the total damage estimate per household.

Losses: Since the rental and formal sheltering sectors are small, the estimation of costs is considered negligible. The net effect of these sectors has been captured in economic losses for the housing sector, since most losses appear to be restricted, in large part, to direct damage.

Needs Assessment: The DMB (14 Jan) estimates that 66 percent of fully damaged and 83 percent of partly damaged houses can be rebuilt without assistance. However, the assistance required to rebuild housing will need to reflect improved quality in construction to mitigate future risk.

Table 36: Housing Damage by District—Part I

District	Total Population 2007 est. (No.)	Total Households (No.)	Total Vulnerable Households (FHH, Widow) [No.]	Fully Damaged Households (No.)	Partially Damaged Households (No.)	Fully Damaged Vulnerable Households (No.)	Partially Damaged Vulnerable Households (No.)	Fully Damaged Non-vulnerable Households (No.)	Partially Damaged Non-Vulnerable Households (No.)
Bagerhat	1,796,876	321,640	16,082	118,899	130,675	5,945	6,534	112,954	124,141
Barguna	984,323	180,060	9,003	95,412	96,245	4,771	4,812	90,641	91,433
Barisal	2,732,922	475,680	23,784	41,470	92,242	2,074	4,612	39,397	87,630
Bhola	1,975,616	328,540	16,427	15,389	20,300	769	1,015	14,620	19,285
Gopalgang	1,351,717	217,440	10,872	24,133	85,000	1,207	4,250	22,926	80,750
Jhalokathhi	805,308	145,700	7,285	69,685	76,108	3,484	3,805	66,201	72,303
Khulna	2,759,606	494,800	24,740	17,323	67,011	866	3,351	16,457	63,660
Madaripur	1,329,765	231,920	11,596	4,991	7,509	250	375	4,741	7,134
Patuakhali	1,694,506	280,980	14,049	53,291	132,369	2,665	6,618	50,626	125,751
Pirojpur	1,288,839	233,160	11,658	63,896	80,315	3,195	4,016	60,701	76,299
Satkhira	2,163,057	390,080	19,504	5,293	12,245	265	612	5,028	11,633
Shariatpur	1,255,468	213,240	10,662	27,993	54,325	1,400	2,716	26,593	51,609
subtotal 12 distr.	20,138,003	3,513,240	175,662	537,775	854,344	26,889	42,717	510,886	811,627

District	Total Population 2007 est. (No.)	Total Households (No.)	Total Vulnerable Households (FHH, Widow) [No.]	Fully Damaged Households (No.)	Partially Damaged Households (No.)	Fully Damaged Vulnerable Households (No.)	Partially Damaged Vulnerable Households (No.)	Fully Damaged Non-vulnerable Households (No.)	Partially Damaged Non-Vulnerable Households (No.)
Chandpur	2,634,626	422,740	21,137	10,342	15,443	517	772	9,825	14,671
Chittagong	7,670,082	1,228,880	61,444	603	5,181	30	259	573	4,922
Comilla	5,330,846	822,480	41,124	806	3,412	40	171	766	3,241
Cox's Bazar	2,057,502	294,460	14,723	40	1,499	2	75	38	1,424
Dhaka	9,701,012	1,788,520	89,426	15	3,036	1	152	14	2,884
Faridpur	2,037,505	345,340	17,267	1,000	37,635	50	1,882	950	35,753
Feni	1,438,845	213,040	10,652	45	300	2	15	43	285
Jessore	2,867,003	521,360	26,068	295	405	15	20	280	385
Kishorganj	3,010,147	528,520	26,426	55	2,628	3	131	52	2,497
Laxmipur	1,728,285	287,880	14,394	1,479	6,652	74	333	1,405	6,319
Manikganj	1,490,693	276,540	13,827	750	1,370	38	69	713	1,302
Moulvibazar	1,870,354	291,620	14,581	60	89	3	4	57	85
Munshiganj	1,501,008	251,280	12,564	2,804	5,548	140	277	2,664	5,271
Narail	810,199	140,020	7,001	3,629	6,177	181	309	3,448	5,868
Narayanganj	2,521,780	444,320	22,216	476	5,156	24	258	452	4,898
Narsingdi	2,199,341	382,440	19,122	24	5,280	1	264	23	5,016
Noakhali	2,989,603	460,240	23,012	980	2,200	49	110	931	2,090
Rajbari	1,104,211	189,440	9,472	3,789	755	189	38	3,600	717
Total	73,101,045	12,402,360	620,118	564,967	957,110	28,248	47,855	536,719	909,255

Sources: Population: 2001 Census, projected to 2007 using 1991–2001 growth rates

Households: Ministry of Food and Disaster Management, Emergency Response and Action Plans, 2007

Table 37: Housing Damage by District—Part II

District	Housing Cost for Fully Damaged Households of Vulnerable People (BDT/HH 20000) (Mio. BDT)	Housing Cost for Partially Damaged Households of Vulnerable People (BDT/HH 10000) (Mio. BDT)	Total Cost Housing Cost for Vulnerable Households (Mio. BDT)	Housing Cost for Fully Damaged Households of Non-Vulnerable People (BDT/HH 44,000) (Mio. BDT)	Housing Cost for Partially Damaged Households of Non-Vulnerable People (Mio. BDT)	Total Cost Housing Cost for Non-Vulnerable Households (Mio. BDT)	Total Housing Costs (Mio. BDT)
Bagerhat	118.9	65.3	184.2	4,970.0	2,959.0	7,928.9	8,113.2
Barguna	95.4	48.1	143.5	3,988.2	2,179	6,167.6	6,311.1
Barisal	41.5	46.1	87.6	1,733.4	2,089	3,822.1	3,909.7
Bhola	15.4	10.2	25.5	643.3	460	1,102.9	1,128.5
Gopalgang	24.1	42.5	66.6	1,008.8	1,925	2,933.5	3,000.1
Jhalokathhi	69.7	38.1	107.7	2,912.8	1,723	4,636.2	4,743.9
Khulna	17.3	33.5	50.8	724.1	1,517	2,241.5	2,292.3
Madaripur	5.0	3.8	8.7	208.6	170	378.7	387.4
Patuakhali	53.3	66.2	119.5	2,227.6	2,997	5,224.9	5,344.4
Pirojpur	63.9	40.2	104.1	2,670.9	1,819	4,489.5	4,593.5
Satkhira	5.3	6.1	11.4	221.2	277	498.5	509.9
Shariatpur	28.0	27.2	55.2	1,170.1	1,230	2,400.2	2,455.4
subtotal 12 distr.	537.8	427.2	964.9	22,479.0	19,345	41,824.5	42,789.4

District	Housing Cost for Fully Damaged Households of Vulnerable People (BDT/HH 20000) (Mio. BDT)	Housing Cost for Partially Damaged Households of Vulnerable People (BDT/HH 10000) (Mio. BDT)	Total Cost Housing Cost for Vulnerable Households (Mio. BDT)	Housing Cost for Fully Damaged Households of Non-Vulnerable People (BDT/HH 44,000) (Mio. BDT)	Housing Cost for Partially Damaged Households of Non-Vulnerable People (Mio. BDT)	Total Cost Housing Cost for Non-Vulnerable Households (Mio. BDT)	Total Housing Costs (Mio. BDT)
Chandpur	10.3	7.7	18.1	432.3	350	782.0	800.0
Chittagong	0.6	2.6	3.2	25.2	117	142.5	145.7
Comilla	0.8	1.7	2.5	33.7	77	111.0	113.5
Cox's Bazar	0.04	0.7	0.8	1.7	34	35.6	36.4
Dhaka	0.02	1.5	1.5	0.6	69	69.4	70.9
Faridpur	1.0	18.8	19.8	41.8	852	894.0	913.8
Feni	0.05	0.2	0.2	1.9	7	8.7	8.9
Jessore	0.3	0.2	0.5	12.3	9	21.5	22.0
Kishorganj	0.06	1.3	1.4	2.3	60	61.8	63.2
Laxmipur	1.5	3.3	4.8	61.8	151	212.4	217.3
Manikganj	0.8	0.7	1.4	31.4	31	62.4	63.8
Moulvibazar	0.06	0.0	0.1	2.5	2	4.5	4.6
Munshiganj	2.8	2.8	5.6	117.2	126	242.8	248.4
Narail	3.6	3.1	6.7	151.7	140	291.6	298.3
Narayanganj	0.5	2.6	3.1	19.9	117	136.6	139.7
Narsingdi	0.02	2.6	2.7	1.0	120	120.6	123.2
Noakhali	1.0	1.1	2.1	41.0	50	90.8	92.9
Rajbari	3.79	0.4	4.2	158.4	17	175.5	179.6
Total	565.0	478.6	1,043.5	23,615.6	21,672	45,288.1	46,331.6

Table 38: Housing Damage by District—Part III

District	Total Housing Damage (Mio. BDT)	Value of Lost Household Goods (Mio. BDT)	Salvageable Building Material (Mio. BDT)	Overall (Total Housing Damage + Value of Lost Housing Goods - Salvageable Material) (Mio. BDT)
Bagerhat	8,113.2	4,056.6	2,028.3	10,141.5
Barguna	6,311.1	3,155.5	1,577.8	7,888.9
Barisal	3,909.7	1,954.9	977.4	4,887.2
Bhola	1,128.5	564.2	282.1	1,410.6
Gopalgang	3,000.1	1,500.1	750.0	3,750.1
Jhalokathhi	4,743.9	2,372.0	1,186.0	5,929.9
Khulna	2,292.3	1,146.2	573.1	2,865.4
Madaripur	387.4	193.7	96.9	484.3
Patuakhali	5,344.4	2,672.2	1,336.1	6,680.4
Pirojpur	4,593.5	2,296.8	1,148.4	5,741.9
Satkhira	509.9	255.0	127.5	637.4
Shariatpur	2,455.4	1,227.7	613.8	3,069.2
subtotal 12 distr.	42,789.4	21,394.7	10,697.3	53,486.7
Chandpur	800.0	400.0	200.0	1,000.1
Chittagong	145.7	72.9	36.4	182.1
Comilla	113.5	56.7	28.4	141.8
Cox's Bazar	36.4	18.2	9.1	45.5
Dhaka	70.9	35.5	17.7	88.6
Faridpur	913.8	456.9	228.5	1,142.3
Feni	8.9	4.4	2.2	11.1
Jessore	22.0	11.0	5.5	27.5
Kishorganj	63.2	31.6	15.8	79.0
Laxmipur	217.3	108.6	54.3	271.6
Manikganj	63.8	31.9	16.0	79.8
Moulvibazar	4.6	2.3	1.2	5.8
Munshiganj	248.4	124.2	62.1	310.5
Narail	298.3	149.1	74.6	372.8
Narayanganj	139.7	69.9	34.9	174.6
Narsingdi	123.2	61.6	30.8	154.0
Noakhali	92.9	46.4	23.2	116.1
Rajbari	179.6	89.8	44.9	224.6
Total	46,331.6	23,165.8	11,582.9	57,915

Annex 2 - Transport

The transport suffered both direct and indirect damage and losses to the following sectors: inland water transport, roads (both primary and secondary) and rural infrastructure (including roads, bridges, culverts and other infrastructure). The total direct damages to the transport sector are estimated at BDT 8 billion (US\$ 115 million). Indirect damages, including loss of use and reduced economic return was more difficult to estimate (given data constraints), and was calculated at BDT 1.7 billion (US\$ 25 million), or about 22 percent of the value of damage. Losses and damages to the transport sector varied by sub-sector (inland water transport, roads, and rural infrastructure), as well as by district. A further breakdown of these components by district is presented below.

Inland Water Transport: Damages to Inland water transport included equipment damage to pontoons, buoys, beacon lights, and poles. The damages by type of equipment are given in Table 39. The Inland Water Transport Authority will use its own tugboat and salvage vessel, to carry out the repair of damaged infrastructure and replacement of lost safety equipment.

Table 39: Water Transport Equipment Damage

Type of Equipment	Total	Damaged Equipment		
		Sunk	Dislocated	Lost
Pontoon	45	12	100	
Bouy	90		25	
Beacon Light	328			
Steel/concrete pole	970			80
Bamboo Pole	5000			2,500

The total cost of damage for inland water transport is estimated at BDT 72.052 million. There was significant variation in the costs of damage estimated, with Barisal district sustaining the bulk of the water equipment damages (BDT 17.9 million), followed by Patuakhali (BDT 8.2 million) and Bagerhat (BDT 6.9 million) The costs of damage by district are given in Table 40.

Table 40: Cost of Water Transport Equipment Damage

District	Cost (BDT million)
Barisal	17.909
Jhalkati	5.342
Pirojpur	3.886
Bhola	1.080
Patuakhali	8.213
Barguna	4.026
Khulna	6.950
Bagerhat	5.340
Sathkhira	0.250
Dhaka	1.160
Munshigonj	1.650
Naraygonj	0.995
Manikgonj	0.190
Madaripur	1.983
Shariatpur	1.000
Gopalganj	1.513

Rajbari	0.020
Kishorganj	0.850
Chittagong	2.023
Cox's Bazar	0.200
Chandpur	4.932
B-Baria	1.000
Noakhali	0.700
Lakshmipur	0.840
Total	72.052

Roads: The breakdown of road and bridge damage by district is given in Table 41.

Table 41: Road and Bridge Damage

District	Population (2007)	No. of affected People	Damaged Roads (km)		Damaged Bridges/ Culverts
			Full	Partial	
Barisal	2,732,922	846,076			
Jhalokathhi	2,867,003	763,211	495	1,313	20
Pirojpur	1,288,839	1,011,359	383	1,259	33
Borguna	3,495,145	843,669	614	1,294	1,634
Bhola	1,975,616	147,718	25	87	
Patuakhali	1,694,506	611,125		838	
Khulna	2,759,606	525,616	11	67	
Satkhira	2,163,057	212,133	50	25	
Bagerhat	1,796,876	1,221,788	60	1,174	
Gopalgang	2,356,994	257,354	46		
Madaripur	1,329,765	595,000			
Shariatpur	1,255,468	423,023			
Faridpur	2,037,505	154,540			
Rajbari	1,104,211	3,775			
Dhaka	9,701,012	15,180			
Narayanganj	2,521,780	57,998			
Munshiganj	1,501,008	102,322		23	
Narsingdi	2,199,341	306,538			
Chittagong	7,670,082	15,295	30	70	
Cox'sBazar	2,057,502	8,555		21	
Noakhali	2,989,603	217,300		150	
Feni	1,438,845	156			
Laxmipur	1,286,838	55,695			
Chandpur	2,634,626	175,579		40	
Comilla	5,330,846	70,527			
Jessore	2,867,003	223,608			
Narail	810,199	35,024			
Moulvibazar	686,066	755			
Kishorganj	3,010,147	18,140			
Manikganj	1,490,693	4,200			
Total	77,053,101	8,923,259	1,714	6,361	1,687

Note: Shading indicates 12 most affected districts

The average cost per km of carpeted road is around BDT 2 Million, and average cost per km to repair carpeted road is around BDT 1 Million. Costs to build other roads are more than BDT 0.40 million for each km of road, and to repair roads is BDT 0.16 million per km³³. The breakdown of estimated repair costs for partially and fully damaged roads is given in Table 42.

Table 42: Cost of Road and Bridge Damage

Type of	Repair Cost (BDT million)			% Total Cost
	km	unit cost	total	
ROADS				
Fully damaged				
paved (km)	1,258	2	2516	32%
unpaved (km)	456	0.4	182.4	2%
Partially damaged				
assume all unpaved	6,361	0.16	1,017.76	13%
BRIDGES/CULVERTS				
No. Damaged	1,687	2.5	4,217.5	53%
Total cost of Road and Bridge/Culvert Damage		(BDT million)	7,934	
		(US\$ million)	115	

Losses:

Estimating the secondary losses of road transport resulting from loss of use is more problematic, since data on traffic, locations and road outages are unavailable. One approach to estimating these secondary losses is to use the normal economic rate of return (ERR) for road improvements in Bangladesh (approximately 20 percent³⁴) to evaluate the economic return (assumed to be equivalent to the reduced losses) given the improvements. The return for one year would then be 20 percent of the damage, and the return for the project life (assumed 50 years, at a 5 percent discount rate) would be 120 percent of the estimated total damage. Another approach is to estimate a fraction of the national roads damaged, apply that to the national traffic volume to estimate disrupted traffic volume, and use unit operating costs for vehicular traffic. Based on these two approaches, the economic loss arising from damage to roads, bridges, culverts, and ferries can be estimated at BDT 1.7 billion (US\$25 million). Table 43 shows the calculations for an estimated road loss figure.

³³ Ministry for Food and Disaster Management (2007) *Super Cyclone Sidr 2007*, Emergency Response and Action Plans – Interim Report, 27 December 2007

³⁴ Project Appraisal Document on a Proposed Credit of SDR 138 million to the People's Republic of Bangladesh for the Rural Transport Improvement Project, May 22, 2003, Report No. 25853-BD, The World Bank, Energy and Infrastructure Unit, Bangladesh Country Management Unit

Table 43: Road Loss Estimation

Losses			
Approach 1: ERR for roads is 20%			
	BDT (million)	US\$ (million)	
Return for one year	1,587	23.0	
Return for 50 year project life (disc. rate 5%):	9,520	138.0	
Approach 2: pro-rate transport network by damage and use unit operating costs			
(see tables below for initial data)			
	national	damaged	%
Paved roads (km)	23,000	1258	5.5%
Unpaved roads (km)	217,000	6,817	3.1%
Passenger flow/year (billions pass-km):	56	2.39	
Freight flow/year (billions ton-km):	9	0.40	
Assumptions:	No.	% passenger traffic	
Assume passengers/light vehicle:	5	10%	
Assume passengers/large bus:	50	90%	
Assumed tons/heavy truck:	20		
then:	km	unit cost US\$/km	total cost/yr US\$ Million
Light vehicle billions km:	0.05	0.40	19
Large bus billions km:	0.04	1.10	47
Heavy truck billions km:	0.02	1.50	30
Total			97
Assume majority of traffic on paved roads which are first priority for restoration, and are restored within 3 months --> 0.25 yrs. therefore loss:			
			US\$ 25 million

Primary Roads (under the Roads and Highways Department): Out of the 30 districts affected by the cyclone, damage to roads, bridges, and culverts is concentrated in 11 districts. A total of about 1,258 km of primary road network has been damaged either fully or partially, and the cost of reconstruction is estimated at BDT 278 million. The cost breakdown by for the 12 most effected districts is given in Table 44.

Table 44: Costs of Road Damage by District

District	Road Length (km) *	Cost (BDT million)
Bagerhat	229.97	453.1
Khulna	66.00	82.1
Barisal	124.50	166.7
Patuakhali	206.50	286.0
Bhola	154.00	292.8
Barguna	152.80	243.2
Jhalkhati	9.00	51.6
Pirojpur	29.00	51.6
Faridpur	88.49	163.5
Sariatpur	53.00	160.6
Gopalganj	145.00	181.4
Ferry Rehabilitation		654.5
Total	1,258	2,777.1

* including bridge rehabilitation

Rural Infrastructure damage (under LGED)

Damage to rural infrastructure occurred in 17 of 30 districts, and the total cost of damage is estimated at BDT 3277.4 million. About 1,989 km of paved road, 1,670 km of unpaved road, 7,880 m of bridge/culvert, 83 rural markets, 2 helipads, 6 rural jetties and 22 Union Parishad buildings were fully or partially damaged. The costs by district are shown in Table 45.

Table 45: Damage of Rural Infrastructure under LGED by District

District	Road (km)		Bridge/ Culvert (m)	Bridge Approach (m)	Other Infrastructure	Approximate Rehabilitation cost (BDT million)
	Paved	Unpaved				
Munshigonj	4	23	—	200	—	8.30
Gopalganj	15	20	150	350	—	25.50.
Shariatpur	5	25	—	470	—	12.20
Madaripur	—	—	—	—	Growth Centre—1 no.	0.50
Khulna	85.85	28.49	—	—	Ferry ghat—6 nos.	23.7.3
Satkhira	13.75	18	40	400	—	22.55
Bagerhat	336	586	1,140	—	—	1,128.00
Jessore	49.33	—	—	—	—	40.00
Noakhali	8	22	12	20	—	11.4.0
Laxmipur	12	30	40	70	—	18.70
Chandpur	10	20	25	50	—	13.50
Barisal	253	134	1529	51	Growth Centre—11 nos. P Bhaban—9 nos. Helipad—2 nos.	102.20
Patuakhali	239.08	231.5	877	—	Growth Centre—17 nos. UP Bhaban—7 nos.	293.15
Jhalakathi	120.95	51.52	854.91	—	Growth Centre—8 nos. UP Bhaban—1 nos.	75.05
Barguna	361.59	202.66	1,797.4	480	Growth Centre—16 nos. UP Bhaban—5 nos.	488.47
Bhola	80	46	—	700	Growth Centre—10 nos.	114.60
Pirojpur	394.2	232	1,413	—	Growth Centre— 26 nos.	899.60
Total	1,987.75	1,670.17	7,878.3	2,791	Growth Center—83 nos UP Bhaban—22 nos. Helipad—2 nos. Feri ghat—6 nos.	3,277.44

Annex 3 –Power and Telecommunications

A. Power:

Calculations of electricity sales losses arising from the disaster were made on the basis of the value of the electricity not sold in the country on the first day after the cyclone, plus the estimated revenue losses in the most affected area served by West Zone Power Distribution Company Limited (WZPDCL) and the Rural Electrification Board (REB). For revenue losses, baseline data were used on the number of total users and their normal electricity consumption and values, combined with data on the number of affected residential, commercial, industrial, and other energy users and their estimated period of reconstruction. The total amount of damage and losses in the electrical sector was estimated at BDT 935 million (US\$ 13.4 million). Of the total, BDT 576 million refer to the value of damage to physical assets (61 percent of the total) and BDT 359 million represent the losses in revenues (Table 15).

Table 46: Damage and Losses in the Power Sector

Item	Disaster effects, BDT million		
	Damage	Losses	Total
Transmission system			
Power Grid Company of Bangladesh (PGCB)	19.49	—	19.49
Distribution			
West Zone Power Distribution Company Ltd (WZPDCL)	45.30	—	45.30
Rural Electrification Board (REB)	511.00	—	511.00
Entire country sales for 1 day	—	197.7	197.00
Distribution losses in most affected areas	—	161.2	161.20
Total sector (BDT million)	575.79	358.90	934.69
Total sector (US\$ million)	\$ 8.2	\$ 5.1	\$ 13.4

Sources: Damage values supplied by electrical utility enterprises.

B. Telecommunications

Mobile telecommunications was not significantly affected, and operators in the country only listed 7 percent of their facilities as non-operational as a result of the storm. Table 47 gives a breakdown of these losses by Mobile operators.

Table 47: Mobile Operators Status as of November 22, 2007 (No. of BTS Down)

Districts	Grameenphone			Aktel			Banglalink			Citycell			Teletalk			Warid		
	Total BTS	Down BTS	UP BTS	Total BTS	Down BTS	UP BTS	Total BTS	Down BTS	BTS UP	Total BTS	Down BTS	BTS UP	Total BTS	Down BTS	BTS UP	Total BTS	Down BTS	BTS UP
Patuakhali	55	4	51	17	6	11	13	0	13	8	6	2	7	1	6	0	0	0
Barguna	32	4	28	10	4	6	9	0	9	5	3	2	4	1	3	9	4	5
Jhalokati	28	4	24	10	3	7	7	0	7	4	2	2	4	0	4	7	1	6
Faridpur	76	3	73	24	0	24	20	0	20	9	0	9	10	0	10	25	2	23
Pirojpur	47	4	43	12	2	10	10	1	9	6	2	4	7	3	4	9	5	4
Bhola	42	0	42	12	3	9	10	0	10	6	0	6	6	1	5	3	0	3
Khulna	39	0	39	36	0	36	69	0	69	14	0	14	29	0	29	40	0	40
Satkhira	58	0	58	13	0	13	19	0	19	7	1	6	8	0	8	12	0	12
Bagerhat	62	1	61	16	4	12	20	0	20	9	2	7	8	0	8	15	6	9
Gopalganj	47	2	45	11	0	11	15	0	15	5	0	5	6	0	6	13	0	13
Barisal	105	8	97	41	5	36	41	0	41	17	7	10	13	2	11	18	3	15
Madaripur	56	1	55	17	0	17	10	0	10	0	0	0	6	4	2	9	1	8
Shairatpur	43	0	43	15	0	15	12	0	12	0	0	0	4	0	4	3	0	3
Lakshmipur	79	0	79	56	4	52	14	0	14	6	0	6	4	0	4	8	1	7
Total	769	31	738	290	31	259	269	1	268	96	23	73	116	12	104	171	23	148
	Total BTS			BTS down			BTS UP											
	1711			121 (7%)			1590											

Note: Mobile Operators SIDR affected 14 Districts sites. Table shows BTS Status as on 22-11-2007 (at 11:00 am).

Annex 4 - Water Supply and Sanitation

Total damage and losses to the water supply and sanitation sector were estimated at BDT 2.03 billion (US\$2.2 million), and was located predominantly (over 85 percent of the reported damage) in rural areas that were affected by the tidal surge that accompanied the cyclone. Water supply and sanitation in Bangladesh is provided predominantly by private households, where groundwater, extracted by hand or motorized pumps, is the most common source of drinking water. This is true even for cities, since public water supply networks provide service to only small number of city inhabitants. Data for the damage and loss as well as needs assessments were provided by DPHE.

Damage and Loss Assessment

Although Cyclone Sidr affected broad areas of the country (64 Upazilas of 12 coastal districts in southern Bangladesh), Government estimates indicate that the overall damage to water supply and sanitation sector has been relatively modest. According to DPHE estimates, less than 10 percent (12,984 water sources) out of 221,039 water sources (tube wells, rain water harvesters, pond sand filters, etc.) that existed before the cyclone in the affected area were affected. The majority of these (11,135), in addition to 3,508 of the 6,082 affected domestic ponds were repaired by DPHE during the emergency response.

Water points and household latrines damaged or destroyed by the cyclone are primarily affected by increased salinity intrusion and flooding (in the case of latrines) that accompanied the storm's tidal surges. Tube wells have been submerged by saline water and many surface water sources have been contaminated by saline intrusion, random debris, and biodegradable materials. Increased salinity in the water supply has been reported in about two-thirds of the coastal areas, while pre-existing arsenic continues to contaminate shallow aquifers in an estimated 23 of the 31 cyclone risk districts (extending beyond the 12 coastal districts directly affected by Cyclone Sidr).

A majority of the reported damages to the WSS infrastructure occurred in rural, as opposed to urban areas, because rural settlements were closer to the open water bodies that channeled the tidal surges. According to DPHE estimates, the total direct losses of WSS infrastructure for both urban and rural areas amount to US\$2.27 million, of which rural damages amount to US\$2.02 million (or 89 percent). It is estimated that 11,612 tube wells, 1,372 pond sand filters, 1,173 ponds (for domestic use other than drinking water), 55,279 latrines, and 64 VS Sheds, among other WSS infrastructure, were damaged by the cyclone in the rural areas. Table 48 shows the damage to WSS infrastructure in rural areas, and Table 49 shows a similar breakdown of damages for the urban sector.

Table 48: Damage to Water Supply and Sanitation by Sub-Sector Component—Rural Areas

Sub-sector Component	Effects (US\$ million)			Ownership	
	Damage	Loss	Total	Public	Private
Residential/Non-residential Infrastructure	0.08	0.00	0.08	0.08	0.00
Tubewells	0.09	0.00	0.09	0.09	0.00
Pond Sand Filter	0.15	0.00	0.15	0.15	0.00
Pond	0.31	0.00	0.31	0.00	0.31
Latrine	1.28	0.00	1.28	0.00	1.28
VS Shed	0.04	0.00	0.04	0.04	0.00
Latrine Products at VS Shed	0.00	0.00	0.00	0.00	0.00
Rain Water Harvesting	0.00	0.00	0.00	0.00	0.00
Security Wall	0.07	0.00	0.07	0.07	0.00
Plants	0.00	0.00	0.00	0.00	0.00
Total	2.02	0.00	2.02	0.43	1.59

Table 49 shows the overall damage to WSS infrastructure in urban areas.

Table 49: Damage to Water Supply and Sanitation of affected Districts by Sub-Sector Component—Urban Areas

Sub-sector Component	Effects (US\$ million)			Ownership	
	Damage	Loss	Total	Public	Private
Pump House	0.02	0.00	0.02	0.02	0.00
Pipeline	0.12	0.00	0.12	0.12	0.00
Electrical/Mechanical	0.04	0.00	0.04	0.04	0.00
Reservoir	0.01	0.00	0.01	0.00	0.01
Treatment Plant	0.02	0.00	0.02	0.00	0.02
Latrine/Drain	0.01	0.00	0.01	0.01	0.00
Boundary Wall	0.03	0.00	0.03	0.03	0.00
Total	0.25	0.00	0.25	0.22	0.03

Damage to the urban municipalities (pourashavas) was relatively minor compared to that in the rural areas and was concentrated in two small cities. The worst affected urban municipality was Pirojpur, where direct physical losses (damages) was estimated at US\$140,000, followed by Patuakhali municipality, with total damages estimated at US\$90,000 (see Table 51). While the rural areas sustained the bulk of the damages, there was also considerable variation in damages and losses by district within rural districts. Bagerhat was reported to be the worst affected district in terms of water supply and sanitation, with damages totaling an estimated US\$680,000, followed by Pirojpur (US\$220,000), Barisal (US\$150,000), and Barguna (US\$130,000). The disaggregated damage to water supply and sanitation facilities in rural areas of the affected districts is summarized in Table 50.

Table 50: Estimate of Damage and Loss repair Cost Rural Sector (Direct Losses)

S/N	DPHE Circle	Name of District	Residential/Non-residential infrastructure		Tube Wells		Pond San Filter		Pond		Latrine		VS Shed		Latrine Products at VS Shed		Rain Water Harvesting		Security Wall		Plants		Others	Total Financial Loss		
			Physical	Financial	Physical	Financial	Physical	Financial	Physical	Financial	Physical	Financial	Physical	Financial	Physical		Physical	Financial	Physical	Financial	Physical	Financial				
															Slab	Ring										
1	Khulna	Khulna			468	3.28	304	22.8	469	14.07	1912	30.59	3	1.8						240	2.4				74.94	
		Bagerhat	4	6	1094	1.09	491	36.83	1814	54.42	22000	352	5	5				25	0.25	900	10				465.59	
		Satkhira			330	0.66	159	11.93	296	8.88	175	2.8									12.4				24.27	
		Sub-total			6	1892	5.03	954	71.55	2579	77.37	24087	385.39	8	6.8			0	0.25		12.4		0	0		564.8
2	Barisal	Barisal	LS	0.85	860	3.39					5631	90.1	13	3	125	170	0.31			427	3.85	67	0.9		102.4	
		Jalokhati		1.5	1959	8.9	92	6.9	92	2.76	1680	26.88	2	0.5	65	78	0.16			450	3.25	400	0.5		51.35	
		Pirojpur		10.3	1458	1.07	285	21.38	2836	85.08	1505	24.08	12	2.5	87	145	0.24			LS	9.7	146	1.4		155.75	
		Bhola		4.11	757	1.19		0		0	1300	20.8	2	0.55						LS	4.5	6	0.1		31.25	
		Patukhali		6.85	2275	14.75		0		0	1750	28	7	1.5	110	355	0.44			LS	5	5	0.2		56.74	
		Barguna		19.37	1343	23.49	41	3.08	475	14.25	1060	16.96	10	4	537	896	1.46			LS	4.2	110	2.75		89.56	
Sub-total			42.98	8652	52.79	418	31.36	3403	102.09	12926	206.82	46	12.05	924	1644	2.61	0	0	0	30.5	734	5.85	0		487.05	
3	Faridpur	Shariatpur	1	1.5	576	2			684	20.52	1540	24.64	5	5						800	6.5			1	61.16	
		Madaripur			209	0.73			409	12.27	1467	23.47	3	2.67												39.14
		Gopalgang	LS	1.77	283	0.9			80	2.4	15259	244.14	2	1.75												251.05
Sub-total			3.27	1068	3.63	0	0	1173	35.19	18266	292.25	10	9.42	0	0	0	0	0	0	6.5	0	0	1		351.36	
Total Direct Loss				52.25	11612	61.54	1372	102.9	7155	214.65	55279	884.46	64	28.27	924	1644	2.61	0	0.25	0	49.4	734	5.85	1		1403.18
2. Total Indirect Loss (attached-b)																										461
3. Total Loss:																										18664.18

Note: Financials are BDT in lakh

Table 51: Estimate of Damage and Loss repair Cost Urban Sector

S/N	DPHE Circle	Name of District	Pump House		Pipeline		Electrical/Mechanical		Reservoirs		Treatment Plant		Latrine/Drain		Boundary Wall		Others	Total Financial Loss
			Physical	Financial 1/	Physical	Financial	Physical	Financial	Physical	Financial	Physical	Financial	Physical	Financial	Physical	Financial		
1	Khulna	Khulna Bagerhat Satkhira																0
Sub-total										0	0		0					0
2	Barisal	Barisal Jalokhati			Pipelines and fittings	7.75												0
		Pirojpur	Pump house & delivery equipment	10	4, 6, & 10 inc dia	27.5	Transformer/ generator/ electric line	11.75	1 nos	5.25	1 nos	13			500 m	16	16.25	99.75
		Bhola			5 Pourashavas	1.45							5 Pourashavas	4				5.45
		Patukhali	1 Porashava	4	3 Pourashava	45	3 Pourashava	15							1 Pourashava	3		67
		Barguna																0
Sub-total				14	0	0	0	26.75	5.25	13	0	4	0	4	0	19	16.25	172.2
3	Faridpur	Shariatpur Madaripur Gopalgang	1															0
Sub-total			LS		0	0	0	0					0	0	0	0	0	0
Total Direct Loss				14	0	81.7	0	26.75	5.25	13	0	4	0	4	19	16.25		172.2
2. Total Indirect Loss (attached-b)																		461
3. Total Loss:																		1864.18

Note: 1/ Financials are BDT in lakh

Reconstruction and Recovery Needs

Although Bangladesh faces cyclones almost every year, these storms usually do not cause the severe damage to WSS infrastructure on the same level that Cyclone Sidr caused. To mitigate recurrent storm damage (from cyclones and floods) and the potential spread of waterborne diseases, a long-term program is required that includes a focus on safe water supply and sanitation facilities. Taking Sidr-affected districts as an initial focus area, a needs assessment has been outlined by DPHE considering two aspects: (i) restoring water supply to pre-cyclone conditions and development of services, and (ii) emergency preparedness to address future natural disasters. Recovery needs estimated by DPHE (2008) can be summarized as follows:

Table 52: Proposed Program for Rehabilitation and Emergency Preparedness Cost Estimates

Items	Quantity	Unit Cost (BDT million)	Amount	
			BDT million	In US\$ million
Ponds with raised bank including the cost for land acquisition and excavation/re-excavation	100	2.5	250	3.57
Re-excavation of ponds with bank protection	1,000	1	1,000	14.29
Rehabilitation of PSF	1,000	0.01	10	0.14
Pond Sand Filters (PSF)	800	0.1	80	1.14
Dewatering of Pond	500	0.02	7.5	0.11
Installation of new latrine	300,000	0.002	600	8.57
Water carrier/tanker	100	4	400	5.71
Generator	50	1.5	75	1.07
Production well in cyclone shelters	1,000	2	2,000	28.57
Raised Concrete Latrines (community)	1,000	1.5	1,500	21.43
Feasibility study including Geo-hydrological investigation, socio-economic survey, GIS map etc.	LS	LS	250	3.57
Drilling Rig	5	50	250	3.57
Piped water system in Upazilla HQ/urban center	55	20	1,100	15.71
Establishment of water quality testing and monitoring	10 labs	50	500	7.14
Capacity building of the service provider and community	64 unit	10	640	9.14
Total			8,662.5	123.73

Source: DPHE, 2008.

Social and Environmental Aspects

Destruction to WSS infrastructure has implications both for livelihoods strategies, as well as health and nutrition. While more detail is provided in Annex 7, of note here is the cross-cutting need to repair sanitation facilities, especially in schools, and for the estimated 1.3 million people who lost their homes. Lack of clean sanitation facilities and drinking water is linked to increased risk of outbreaks of diarrhea and other hygiene-related diseases

Implementation Arrangements

The reconstruction needs will touch upon important reforms underway to decentralize water management in Bangladesh. Currently, DPHE is responsible for implementing nearly all WSS infrastructure investments for both rural areas and cities (excluding Dhaka and Chittagong). While DPHE maintains a crucial staff of technical experts in offices throughout the country, its centralized decision-making structure has led to many inappropriate or unsustainable infrastructure solutions in union parishads, pourashavas, and city corporations. While financing can be easily provided to DPHE through the national budget because it is a central government agency, the execution of this financing is often delayed, and decisions are made without clear consultative mechanisms with the local bodies that are expected to operate and maintain the constructed infrastructure.

In response to these inefficiencies, the Government of Bangladesh has adopted policies and programs for greater decentralization in infrastructure implementation, and for an organizational reform of DPHE as a facilitative and advisory body to support local governments and urban municipalities. Any medium-term reconstruction program should be oriented towards a more decentralized infrastructure investment and implementation approach, while simultaneously giving DPHE an appropriate role in accordance with established GoB policies and strategies (see National Policy for Safe Water Supply and Sanitation 1998, National Water Management Plan 2004, Water and Sanitation Sector Development Program 2005).

Annex 5- Urban and Municipal Infrastructure

Calculations for the damage and loss, as well as needs assessments were provided by the Local Government Engineering Department (LGED). According to their estimates, urban and municipal infrastructure was affected in 50 municipalities (pourashavas) in the 15 affected districts. These districts are further broken down by the extent of damages; districts were classified as either severely or moderately damaged. Table 53 shows the breakdown of damage by classification, district and assessment of damages.

Of the 28 towns in the districts classified as moderately affected (Barisal, Bhola, Gopalganj, Madaripur, and Shariatpur), seven pourashavas of Madaripur and Shariatpur were also affected by the 2007 monsoon floods. Fifteen towns that were classified as marginally affected by Cyclone Sidr in the districts of Jessore, Satkhira, Chandpur, Comilla, and Cox's Bazar are also included in this summary.

According to the LGED's summary of damages, the total level of cyclone-damaged infrastructure in these towns include: 825.34 km of municipal roads and 16,880 meters of drainage in the 14 municipalities classified as severely affected, and 392.82 km of damaged roads and 7541.35 m of drainage damaged in the four severely affected districts of Bagerhat, Barguna, Patuakhali, and Pirojpur. Table 53 breaks these damages down by district and pourshava. In addition to the damages reported to the municipal infrastructure in each of these towns and included in the LGED summary, there have been damages to private housing and business structures. The concomitant losses to livelihood, trade, and industry in these urban areas have not yet been estimated by the government or pourashavas.

Table 53: Urban and Municipal Infrastructure Damage

Extent of Damage	Sl. No	Name of District	Sl. No	Name of Pourashava	Road (km)	Drain (m)	Others	Cost (BDT Million)
Severe	1	Patuakhali	1	Patuakhali	18.63	3,960.00	6.00	62.45
			2	Kalapara	7.832	482.00	5.00	12.95
			3	Galachipa	6.8	457.00	1.00	9.68
			4	Baufal	6.2	73.65	6.00	19.11
	2	Jessore	5	Jessore	34.696			40.55
			6	Benapol	8.2			19.28
			7	Chowgacha	13			3.18
			8	Monirampur	6.2			17.50
			9	Kashebpur	4.7	28.20	2.00	12.41
			10	Jhikargacha	6.24	4,500.00		8.68
3	Satkhira	11	Satkhira	39.995	37.30		85.64	
		12	Kalaroa					
Moderate	4	Barisal	13	Mehindigonj	27.5	87.00		47.20
			14	Muladi	29.05			25.00
			15	Gournadi	20.40			36.30
			16	Bakergonj	43.00	80.00		36.20
			17	Banaripara		1,204.00	38.00	22.39
	5	Chandpur	18	Changarchar	0.72			5.00
			19	Hajigang		6.00	1.00	1.00
20			Kachua	1.40	950.00		5.30	
6	Comilla	21	Chandpur			44.00	2.80	
		22	Laksam			2.00	1.20	

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Extent of Damage	Sl. No	Name of District	Sl. No	Name of Pourashava	Road (km)	Drain (m)	Others	Cost (BDT Million)		
Moderate	7	Bhola	23	Bhola	20.08	45.00	202.00	69.20		
			24	Lalmohan	10.26			12.00		
			25	Borhanuddin	5.24			7.40		
			26	Daulatkhan	4.18			10.50		
			27	Charfassion	2.5			55.00	7.50	
	8	Cox's Bazar	28	Cox's Bazar	33.4	9.00	77.70			
			29	Chakaria	20.25		23.20			
Severe	9	Barguna	30	Betagi	29.17	282.20	14.00	44.82		
			31	Pathorghata	37.65	210.00		89.05		
			32	Barguna	69.06	125.00		4,410.00	228.27	
			33	Amtali	35.45	1,025.00		46.48		
Moderate	10	Madaripur	34	Kalkini	2.5	134.00	2.00	22.50		
			35	Madaripur	16.555	4.50		33.16		
			36	Shibchar	44.69	78.00		55.50		
Moderate	11	Shariatpur	37	Damudya	4.15	20.00		17.72		
			38	Janjira	3.1			2.50		
			39	Bhedargonj	6.85			4.00		
			40	Naria	9.75			3.10		
Moderate	12	Gopalganj	41	Sahriatpur	7.935	67.00	2.00	16.30		
			42	Gopalganj	1.885			0.31		
			43	Kotalipara	4.00			1,814.00	6.43	
Severe	13	Priojpu	44	Tungipara	4.00	465.60	85.00	4.80		
			45	Priojpur	46.4			178.02		
			46	Mathbaria	18.81			216.70	56.76	
Severe	14	Bagerhat	47	Swarupkati	19.31	272.18	62.00	41.48		
			48	Morrelgonj	42.91			192.00	6.00	38.15
			49	Mongla	38.549			71.86		
	15	Khulna	50	Bagerhat	16.146			53.85		
				Dacope (Chalna)						
Total					825	16,880	4,912	1,696.4		

Annex 6- Education

Educational facilities sustained partial and full damages, estimated at a total of BDT 5.1 billion (US\$ 74 million). The damages were broken down by district and by type of educational facility. Districts affected most severely by the cyclone also sustained the most damages to educational facilities. Table 55 provides a damage assessment of primary schools by district. Table 54 provides a detailed breakdown of the damage and loss estimates by type of educational facility.

Total loss from providing interim facilities during reconstruction is estimated at BDT 414 million (US\$ 6 million). The Government has already provided funding of BDT 745 million (US\$ 10.8 million³⁵) for repair of the 3,705 partially damaged schools, and it is reported that 95 percent of school repairs have been completed. Additional textbooks from the Government's stock were provided to affected students, further reducing loss assessments.

Total needs for the education sector are estimated at BDT 7.6 billion (US\$ 110 million). This figure includes the reconstruction of educational facilities to higher standards, to further mitigate risk in the future. The breakdown of these costs by educational facility is provided in Table 54

³⁵ Based on unit cost BDT 200,000 (US\$ 2,900) per school.

Table 54: Estimated Educational Institution Damage and Loss

	(BDT Million)			(US\$ Million)		
	Damage	Losses	Needs	Damage	Losses	Needs
Primary Education						
Reconstruction fully damaged schools ¹	3,502	—	7,004	50.8	—	101.5
Reconstruction of partially damaged school ²	734	—	734	10.6	—	10.6
Stationary needs for primary education for severely affected areas	10	—	—	0.1	—	—
Construction of make-shift/transition primary school	415	415	—	6.0	6.0	—
Secondary Education						
Reconstruction Secondary schools (fully and partially damaged)	41	—	41	0.6	—	0.6
Subsidy for books and stationary ³	—	—	—	—	—	—
Primary—Informal						
Reconstruction and repair of pre-primary nonformal learning centers	4	—	4	0.1	—	0.1
Learning materials	1	—	—	0.02	—	—
Reconstruction and repair of primary nonformal learning centers	7	—	24	0.1	—	0.3
Learning materials	3	—	—	0.05	—	—
Secondary—Informal						
Reconstruction and repair of adolescent nonformal learning centers	1	—	1	0.02	—	0.02
Learning materials	0	—	—	0.01	—	—
Adult Literacy—Informal						
Reconstruction and repair of adult literacy nonformal learning centers	1	—	1	0.01	—	0.01
Learning materials	0	—	—	0.01	—	—
Reconstruction and repair of post-literacy nonformal learning centers	5	—	5	0.1	—	0.1
Learning materials	2	—	—	0.0	—	—
TOTAL	4,728	415	7,814	68.5	6.0	113

1. GPS, RNGPS and Community Schools (fully damaged). Note that Need is twice damage due to destroyed schools being built to serve added purpose of emergency cyclone shelter (which is estimated to double cost).

2. GPS, RNGPS and Community Schools (partially damaged)

3. Number of students receiving subsidy yet to be determined

Table 55: Number of Formal Primary Schools Damaged by the Recent Cyclone SIDR (2007)

District	Upazilla	Fully Damaged				Partially Damaged			
		Gov.	Registered	Community	Total	Gov.	Registered	Community	Total
Barisal	Agaoiljhara	0	0	0	0	31	5	2	38
	Uzirpur	8	2	0	10	59	32	0	91
	Gournadi	0	1	0	1	30	7	1	38
	Barisal sadar	2	6	1	9	67	17	2	86
	Bakerganj	23	11	1	35	40	17	4	61
	Banaripara	4	2	0	6	62	32	1	95
	Babuganj	0	0	0	0	32	18	2	52
	Muladi	0	0	0	0	54	21	1	76
	Mehediganj	9	6	1	16	22	10	0	32
	Hijla	12	2	0	14	43	18	2	63
Sub total in Barisal		58	30	3	91	440	177	15	632
Perojpur	Kowkhali	2	2	0	4	50	7	0	57
	Nazirpur	9	12	0	21	54	26	4	84
	Perojpur sadar	0	0	0	0	55	18	0	73
	Bhandaria	17	0	1	18	42	11	4	57
	Modhbaria	48	19	0	67	4	10	0	14
	Nesarabad	33	4	1	38	50	18	3	71
Zianagar	1	0	0	1	26	19	0	45	
Sub total in Perojpur		110	37	2	149	281	109	11	401
Jhalokanthi	Kathalia	0	0	0	0	42	6	6	54
	Jhalokanthi sadar	0	0	0	0	64	11	1	76
	Nolciti	3	0	0	3	100	46	3	149
	Rajapur	0	0	0	0	47	7	7	61
Sub total in Jhalokanthi		3	0	0	3	253	70	17	340
Borguna	Amtoli	21	26	0	47	62	66	15	143
	Pantharghata	13	1	2	16	7	26	10	43
	Borguna sadar	26	19	11	56	53	54	1	108
	Bamna	27	6	1	34	0	0	0	0
	Begati	39	37	1	77	29	7	5	41
Sub total in Borguna		126	89	15	230	151	153	31	335
Patuakhali	Kalapara	11	6	4	21	41	33	1	75
	Golachipa	1	2	0	3	55	53	0	108
	Dashmina	0	0	0	0	24	53	9	86
	Patuakhali Sadar	28	0	0	28	54	20	7	81
	Bowful	18	7	3	28	66	49	3	118

District	Upazilla	Fully Damaged				Partially Damaged			
		Gov.	Registered	Community	Total	Gov.	Registered	Community	Total
	Mirzaganj	17	1	0	18	25	27	8	60
	Dumki	0	0	0	0	17	5	0	22
Sub total in Patuakhali		75	16	7	98	282	240	28	550
Bhola	Charfashion	0	0	0	0	37	48	8	93
	Tajumuddin	12	3	0	15	0	0	0	0
	Doulatkhan	0	0	0	0	29	8	0	37
	Borhanuddin	2	2	0	4	30	26	1	57
	Bhola Sadar	7	4	0	11	20	22	2	44
	Monpura	0	0	0	0	8	20	0	28
	Lalmohan	0	0	0	0	17	7	2	26
Sub total in Bhola		21	9	0	30	141	131	13	285

Division	Khulna	Fully Damaged				Partially Damaged			
		Gov.	Registered	Community	Total	Gov.	Registered	Community	Total
Narail	Kalia	0	1	0	1	2	0	0	2
	Lohagora	0	0	0	0	2	1	0	3
Sub total in Narail		0	1	0	1	4	1	0	5
Shatkhira	Ashashuni	0	0	0	0	2	3	3	8
	Kaliganj	0	0	0	0	1	1	0	2
	Tala	0	0	0	0	4	2	0	6
	Shyamnagar	0	0	0	0	6	4	0	10
Sub total in Shatkhira		0	0	0	0	13	10	3	26
Khulna	Koyra	0	0	0	0	5	10	5	20
	Sadar	0	0	0	0	10	3	0	13
	Dumuria	0	0	0	0	1	0	1	2
	Terkhada	0	0	0	0	8	3	0	11
	Dakop	1	1	0	2	13	5	0	18
	Diglia	0	0	0	0	3	0	0	3
	Paikgacha	0	0	0	0	3	9	0	12
	Fultola	0	0	0	0	1	0	0	1
	Botiaghata	0	0	0	0	1	1	0	2
	Rupsa	0	0	0	0	1	1	0	2
Sub total in Khulna		1	1	0	2	46	32	6	84
Bagerhat	Kachua	1	2	0	3	17	8	0	25
	Chiltamari	0	1	0	1	22	8	0	30
	Fakirhat	0	0	0	0	18	2	0	20
	Sadar	0	0	0	0	28	14	0	42
	Mollarhat	0	0	0	0	6	11	0	17
	Mongla	1	0	0	1	17	11	2	30
	Morolganj	41	1	0	42	39	65	2	106
	Rampal	2	1	0	3	24	7	0	31
	Sharankhola	8	5	5	18	16	44	2	62
Sub total in Bagerhat		53	10	5	68	187	170	6	363
Sub-total in Khulna Division		54	12	5	71	250	213	15	478

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Division	Chittagong	Fully Damaged				Partially Damaged			
		Gov.	Registered	Community	Total	Gov.	Registered	Community	Total
Chandpur	Sadar	2	0	1	3	24	1	2	27
	Kachua	10	0	0	10	10	2	0	12
	Hajiganj	0	0	0	0	38	3	2	43
	Haimchar	21	1	1	23	8	0	0	8
	Shaharasthi	0	0	0	0	14	1	0	15
	Faridganj	0	0	0	0	19	0	1	20
	Motlab	0	0	0	0	12	7	0	19
	Motlab Uttar	0	0	0	0	7	1	5	13
Sub-total in Chandpur		33	1	2	36	132	15	10	157
Laxmipur	Ramgoti	0	0	0	0	17	8	4	29
	Raipur	0	0	0	0	2	1	0	3
	Sadar	0	0	0	0	50	12	6	68
Sub-total in Laxmipur		0	0	0	0	69	21	10	100
Chittagong	Sandwip	0	0	0	0	5	0	0	5
Sub-total in Chittagong		0	0	0	0	5	0	0	5
Sub-total in Chittagong Division		33	1	2	36	206	36	20	262
Division	Dhaka								
Kishoreganj	Astagram	0	0	1	1	0	0	0	0
Sub-total in Kishoreganj		0	0	1	1	0	0	0	0
Narshingdi	Raipur	0	0	0	0	7	0	0	7
Sub-total in Narshingdi		0	0	0	0	7	0	0	7
Manikganj	Shibalaya	0	0	0	0	1	0	0	1
Sub-total in Manikganj		0	0	0	0	1	0	0	1
Narayanganj	Narayanganj	0	0	0	0	3	0	0	3
	sadar								
	Bandar	0	0	0	0	2	0	0	2
	Rupganj	0	0	0	0	2	0	0	2
Sub-total in Narayanganj		0	0	0	0	7	0	0	7
Madaripur	Kalkini	7	1	4	12	32	3	9	44
	Shibchar	9	1	0	10	8	2	0	10
	Sadar	0	0	0	0	16	3	2	21
Sub-total in Madaripur		16	2	4	22	56	8	11	75
Shariatpur	Goshairhat	1	2	0	3	11	0	0	11
	Jajira	7	1	0	8	5	0	0	5

	Dumudda	0	0	0	0	20	4	0	24
	Naria	5	2	0	7	14	0	0	14
	Bhedarganj	7	4	0	11	14	0	1	15
	Shariatpur Sadar	8	0	2	10	33	10	10	53
	Sub-total in Shariatpur	28	9	2	39	97	14	11	122
Gopalganj	Kotalipara	4	2	3	9	72	29	17	118
	Kashiani	1	0	0	1	19	0	1	20
	Gopalganj Sadar	2	2	0	4	16	1	0	17
	Tungipara	0	0	0	0	22	6	0	28
	Mokshedpur	0	0	0	0	25	2	0	27
	Sub-total in Gopalganj	7	4	3	14	154	38	18	210
	Total in Dhaka Division	51	15	10	76	322	60	40	422
	Grand Total	531	209	44	784	2326	1189	190	3705

Annex 7- Agriculture (Crops, Livestock, and Fisheries)

Cyclone Sidr caused significant damages to rural infrastructure and economic assets, a loss of agricultural (crops, livestock, and fisheries) production, a loss in rural household income, and an increase in unemployment in the rural areas. The impact of Cyclone Sidr is magnified for the people Bangladesh because poverty there is primarily a rural phenomenon. About 85 percent of the poor in Bangladesh live in the rural areas. Furthermore, about 75 percent of the population in Bangladesh lives in rural areas that was seriously affected by the cyclone.

Agriculture remains an important sector in Bangladesh. The main sources of livelihood for the rural population are agriculture and rural non-farm sectors that directly or indirectly depend on agriculture. Agriculture is dominated by small and marginal farmers; a large share of the rural population consists of landless laborers with no land (29 percent) or with up to 0.02 ha land (5 percent); marginal farmers with less than 0.2 ha of land (19 percent); and small farmers with 0.2 ha to 1.0 ha land (34 percent). These households depend on agriculture and the rural non-farm sectors for income and employment. At the same time, agriculture accounts for about 22 percent of GDP. The rural non-farm sector, accounts for another 35 percent, and is driven primarily by agriculture through forward and backward linkages.

Cyclone Sidr affected 30 districts (out of a total of 64 districts in the country): 4 severely, 9 badly, and 17 moderately. The coastal districts of Bangladesh have many large rivers that drain into the Bay of Bengal. Most of the damage from Cyclone Sidr was caused by the tidal surge (15 to 20 feet high) in the coastal areas as well as upstream in the extensive river system. The tidal surge acted more like mini-tsunamis affecting the coastal areas and 3- to 5-km areas on both sides of the rivers. The secondary damage was caused by high wind speed (up to 240 km/ hour) and falling trees.

As a result, the damage and loss caused by Cyclone Sidr varies a great deal from one union to another and from one upazila to another, even within the same district. In designing and implementing a relief, recovery, and reconstruction strategy, it is important, therefore, to map the affected areas and target the potential beneficiaries carefully for any preparedness and response programs. Otherwise, the truly needy may not be able to benefit from such programs.

Damage and Loss Assessment

The preliminary damage and loss assessment, for the crops, livestock, and fisheries, is reported in Table 25 and Table 26 (in BDT million as well as in US\$ million, respectively). The total damage and loss have been estimated to be US\$437.64 million, of which US\$21.33 million is damage and US\$416.31 million is production loss. Because the agriculture sector consists primarily of private farmers and fishers, with few exceptions, almost all the damage and loss occurred in the private sector.

Crops: Approximately 2.2 million farm families were affected by Cyclone Sidr. The extent of damage and loss depends on the location of each family, but almost all of the damage and loss is classified as potential production loss. The total damage and loss for the crops sub-sector is estimated to be about US\$412 million, although Cyclone Sidr induced an increase in salinity, and sand/sediment deposition also had an adverse impact on crop production and agricultural land that is not accounted for in this figure. Furthermore, the quality of the standing crop as well as the stalk (used as fodder) was also affected adversely.

The intrusion of brackish water, the tidal surge, and high-speed winds damaged the standing crops in the fields, mainly aman rice (sown, transplanted local, and transplanted HYV), vegetables, pulses, mustard, wheat, betel leaves, and fruit trees (banana, papaya, betel nut, and coconut). Given the high level of salinity and limited area under irrigation, the main crop in the coastal areas is aman rice crop. In addition, seed bed was also affected for boro rice. At the time of the cyclone, crops were standing in about 2.6 million ha in the affected districts, of which 4 percent was totally damaged and 53 percent was partially damaged.

The potential production loss of all crops is estimated to be 1.3 million MT (MT), of which 63 percent (0.8 million MT) was aman rice; 14 percent (0.2 million) were vegetables, and the remaining 23 percent (0.3 million) were other crops (see Table 22 for details). Almost all of the production loss was on the fields of private farmers, many of them small and marginal. The cyclone also affected the quality of grain, produce, and fodder.

As far as geographical distribution is concerned, 86 percent of all the potential production loss was in 13 districts (see Table 61). Within these 13 districts, almost 50 percent of the production loss was in the worst affected 4 districts and the other 50 percent was in the badly affected 9 districts. In other words, out of a total of 30 affected districts, the potential production loss is 42 percent in the worst affected districts, 44 percent in the badly affected districts, and 14 percent in the moderately affected districts.

Livestock: Livestock is an important sub-sector for the rural landless and marginal and small farmers. Raising livestock is not only a labor-intensive activity but it also generates regular monthly income from the sale of milk, eggs, poultry, and goats. Most of the damage to the livestock sub-sector was caused by the tidal surge (hence drowning of animals and birds) and falling trees.

The total number of animal and bird deaths that are attributed to the cyclone, in the 17 most affected districts, are as shown below.

Table 56: Number of Animals lost

Animal/ Bird	Number
Cow	37,391
Buffalo	7,211
Goat	59,804
Sheep	3,517
Subtotal (animals)	107,923
Chicken	2,219,328
Duck	353,691
Subtotal (birds)	2,573,019

Almost 80 percent of the animals and 76 percent of the birds died in the worst affected four districts.

In addition to the dead animals and birds, there was damage to animal and poultry sheds (both cattle and poultry farms) and loss of feed (cattle and poultry), fodder, and pasture. There was also some damage to public sector infrastructure (trees, animal sheds, and buildings). The estimated damage to the livestock sub-sector is summarized in

Table 57: Damage to Livestock Infrastructure.

Table 57: Damage to Livestock Infrastructure

Item	US\$ Million
A. Public Sector	0.16
B. Private Sector	19.17
Cattle Farms	0.29
Poultry Farms	0.72
Cattle/Poultry Feed	4.90
Dead Animals/Birds	13.26
Total	19.33

Within the 17 affected districts (see Table 61 for details), 81 percent of the total private sector damage to the livestock sub-sector was concentrated in the 4 worst affected districts. These four districts accounted for 32 percent of affected cattle farms, 61 percent of affected poultry farms, 74 percent of cattle and poultry feed, and 86 percent of the dead animals and birds.

Fisheries: The fisheries sub-sector is one of the fastest growing agriculture sub-sectors in Bangladesh. Most of the growth is attributed to fish and shrimp aquaculture. The cyclone-affected coastal districts are important for aquaculture, particularly for shrimp (bagda) aquaculture because of the presence of brackish water. Approximately 75 percent of all shrimp in Bangladesh is produced in Cyclone Sidr-affected coastal areas. The damage and loss from Cyclone Sidr consists of damage to fisheries infrastructure (such as ponds, dighis, and ghers), damage to private fishing equipment (such as boats and nets), and damage to public infrastructure (such as boundary walls, roofs, and electric lines in fisheries-related public buildings).

The damage and loss to the fisheries sub-sector, in most affected 10 districts, is summarized below.

Table 58: Damage to Fishery Infrastructure

Item	Million US\$
A. Public Sector	0.11
B. Private Sector	6.60
Washed Fish	2.56
Washed Shrimp	2.02
Washed Fingerlings	0.13
Boats and Nets	1.89
Total	6.71

It has also been reported that the total damage and loss to the fisheries subsector may even be higher. The breakdown for higher damage and loss by categories is as follows: washed fish: US\$3.32 million; washed shrimp: US\$2.32 million; washed fry/fingerlings: US\$0.15 million; affected fishing equipment (boats and nets): US\$3.30 million; private infrastructure: US\$0.75 million; public infrastructure: US\$0.19 million; and total: US\$10.03 million.

As far as washed-out fish, shrimp and fry/fingerlings are concerned, while these are losses to individual households, it is likely that catch in the open-water-capture fisheries will increase, thereby resulting in reduced losses to the economy as a whole. However, production of fish and shrimp from aquaculture will decline unless the ponds, dighis, and ghers are properly repaired and restocked quickly.

Socioeconomic Impact

The socioeconomic (macro and micro) impact of the Supercyclone Sidr is substantial and falls into four broad categories: (i) food supply (mainly rice); (ii) income and employment; (iii) availability of agricultural inputs; and (iv) prices of food and agricultural inputs. There has also been an indirect impact on the balance of payments (BOP) from increased agricultural imports (rice, pulses, vegetable oil, rice seed, and fertilizer) as well as reduced agricultural exports (mainly frozen shrimp). The estimated BOP impact is US\$325 to US\$375 million.

Food Supply: The aman rice production in the affected districts is estimated to be lower by 0.8 million MT. This is on top of estimated 0.8 million MT reduction in the aman rice production that was caused by 2007 floods. This is almost 15 percent of normal aman rice production, or about 6 percent of total rice production. The reduction in rice production is likely to affect rice availability and food security unless the rice deficit is filled through rice imports by the GoB and the private sector. In addition to staple rice, there has been reduction in the production of winter vegetables and other food commodities such as pulses and vegetable oil. The adverse impact on the livestock and fisheries production will not only reduce food supply but will also have a detrimental affect on nutrition for the affected households.

Income and Employment: All of the crop production loss is in the private sector. As a result, a large number of affected small and marginal farmers do not have the capacity to bear production loss from the cyclone (particularly after the production loss caused by 2007 floods). Unless the GoB puts in place an effective agricultural recovery program, livelihood program, and a social safety net, household income for the cyclone affected rural families is likely to decline. Because of adverse impact on the industry, commerce and the rural non-farm sector, employment opportunities for the landless and marginal and small farmers will also decline, at least until the necessary recovery and reconstruction begins.

Availability of Agricultural Inputs: As a result of the cyclone, many households lost stored feed, seed, fertilizer, and other agricultural inputs. Many fishermen lost their fishing boats and nets. Most of these farmers and fishers do not have the capacity to purchase these vital but relatively scarce agricultural inputs. This is likely to further affect the production of crops, livestock, and fisheries, unless the GoB implements an appropriate agricultural recovery program quickly to address this problem.

Prices of food and Agricultural Inputs: Reduction in rice production is likely to adversely affect both access to food by the poor households and retail prices of rice. To some extent, this would also be true for vegetables, other food crops, livestock products (milk, eggs, and meat), and fish. An increase in food prices is likely to have devastating consequences for the urban poor, the rural landless, and the small and marginal farmers who have lost aman rice, other crops, livestock, and or fish. As far as agricultural input prices are concerned, the GoB is committed to maintaining stable prices through subsidies. Even then, given the scarcity of critical agricultural inputs, farmers are likely to pay higher prices at the local level.

Recovery and Reconstruction Needs

Following Cyclone Sidr, the needs for the affected area fall into three broad categories: relief, recovery, and reconstruction (the three R'). The relief work was undertaken by the GoB agencies, nongovernmental orgaizaations (NGOs) (both national and international), and the development

partners. This phase of the work has more or less been completed. Now there is a need to design the recovery and reconstruction programs and expedite their implementation. During implementation, it is important to focus on and give priority to the worst affected unions, *upazilas*, and districts as well as the worst affected poor households within these jurisdictions.

Strategic Programs: The strategic programs to address the cyclone-related problems fall into three groups: rice imports to ensure food security, the agricultural recovery program, and the livelihood program. Each of these programs is briefly discussed below.

Short-Term Rice Imports. Total rice production is estimated to decline by about 1.6 million MT; 0.8 million MT due to 2007 cyclone Sidr and 0.8 million MT due to 2007 floods. Part of this deficit is likely to be bridged by a better than average boro rice crop. The private sector has been importing rice as well. However, in order to ensure food security and maintain stable rice prices, the GoB needs to import about 0.5 million MT additional quantity of rice. The likely cost for importing 0.5 million MT rice is at least US\$200 million.

Medium-Term Agricultural Recovery Program. As indicated earlier, the agricultural sector remains the main source of income, employment, and livelihood opportunities in rural Bangladesh. Ensuring fast recovery of the agricultural sector (crops, livestock, and fisheries) and the rural economy is therefore critical to reduce poverty and promote economic growth. At the same time, the agricultural recovery program must also promote disaster management, that is, preparedness and mitigation. The agricultural recovery program should focus on the four worst affected and nine badly affected districts. The proposed agricultural recovery program is based on the proposals developed by the Ministry of Agriculture and the Ministry of Fisheries and Livestock as well as the recommendations made by the Food and Agriculture Organization (FAO) (based on its own assessment at the GoB request).

Crop Sub-sector

The medium-term recovery program for the crop sub-sector (about US\$25million) consists of the following activities:

- (i) Support for horticulture: Provision of fruit tree saplings; provision of banana suckers; rehabilitation of beetle leaf orchards; and provision of vegetable seeds.
- (ii) Support for rice and other crops: Provision of aman rice package (seed and fertilizer); and provision of seeds for other food and cash crops suitable for cultivation in the coastal areas. To promote crop varieties that are tolerant to salinity is very important.
- (iii) Support for farm machinery: Provision of farm machinery to Integrated Crop Management (ICM) clubs (power tillers, pedal threshers, low-lift irrigation pumps, sprayers, dryers, weighing scales, moisture meters, and so forth); provision of seed and grain storage drums to individual farmer families; and training of ICM clubs.

Livestock Sub-sector

The medium-term recovery program for the livestock sub-sector (about US\$15 million) consists of the following activities:

- (i) Emergency feed, fodder, and medicine: Provision of feed, medicine and vaccines, and fodder production demonstrations.
- (ii) Restocking poultry, goats, sheep, cows, and buffalo: Training in poultry breeding and bio-security; restocking of poultry; training in sheep and goat rearing and management; restocking of sheep and goats; training in cow and buffalo rearing and management; restocking of cows and buffalo; semen and artificial insemination for cows.
- (iii) Support to cold chain system: Provision of milk-cooling equipment and training in milk management and quality control.
- (iv) Support for livestock shelters: Mobile poultry cages and animal sheds. This will be complemented by the construction of animal cyclone shelters (killa).

Fisheries Sub-sector.

The medium-term recovery program for the fisheries sub-sector (about US\$10 million) consists of the following activities:

Support for aquaculture:

- (i) Rehabilitation and restocking of fish ponds and shrimp ghers (for golda and bagda shrimp) as well as fish sanctuaries.
- (ii) Support for capture fisheries: Provision of non-mechanized boats, fishing gear, and safety equipment to small fisher groups; provision of mechanized boats, fishing gear, and safety equipment to large fisher groups; training of fisher groups in group dynamics, management, safety at sea, marketing, and processing; and supply of lifesaving equipment.

Medium-Term Livelihood Program

The medium-term agricultural recovery program will cover a subset of farmers and fishers. Since the average farm size is very small and a large share of rural population is landless, there is a need to design and implement a medium-term livelihood program that would provide increased income and employment opportunities in the rural areas. These livelihood programs should be open to all the rural population, that is, both the agricultural and nonagricultural activities. Specifically, the livelihood program should include micro-credit, cash grants, crop loans, micro-enterprise loans, rehabilitation of community infrastructure, and skill development through targeted training. Since many NGO are also active in promoting livelihood programs, it is very impotent to coordinate these programs with NGOs active in the cyclone-affected areas in order to reduce overlap and duplication. It is also very important to coordinate the proposed livelihood program with the proposed agricultural recovery program.

The proposed livelihood program would cover about 2 million rural households in the affected 13 districts; 50 percent in the worst affected 4 districts and 50 percent in the badly affected 9 districts. In terms of agrarian structure and hence implications for livelihood activities, this consists of 22 percent landless (no land or less than 0.02 ha land); 34 percent marginal farmers (0.02 to 0.2 ha); 31 percent small farmers (0.2 to 1.0 ha); 11 percent medium farmers (1.0 to 3.0 ha); and 2 percent large farmers (over 3.0 ha). The average farm size in the four worst affected districts is 0.6 ha. The proposed livelihood interventions would support both the agricultural (farmers dealing with crops and livestock and fishers

dealing with aquaculture and capture fisheries) and rural non-farm households and activities. The estimated cost of the proposed livelihood program is about US\$300 million.

The detailed breakdown for estimating livelihood program cost is provided below.

1. Agricultural sector (US\$200 million):
 - a. Crop sub-sector (1 million households @ US\$100/household): \$ 100 million;
 - b. Livestock sub-sector (0.2 million households @ US\$200/household): US\$40 million
 - c. Fisheries sub-sector:
2. Aquaculture (0.1 million households @ US\$400/household): US\$40 million;
 - a. Capture fisheries (0.2 million households @ US\$100/household): US\$20 million
3. Rural non-farm sector (US\$100 million):
 - a. Landless rural poor (0.4 million households @ US\$150/household): US\$60 million
 - b. Micro-enterprises (0.1 million households @ US\$400/household): US\$40 million

In terms of instruments of intervention, the proposed livelihood program can be supported through:

(i) micro-credit; (ii) crop loans; (iii) micro-enterprise loans; (iv) cash grants to ultra poor; (v) rehabilitation of community infrastructure (similar to public works program to create jobs); and (vi) training for skills development. The repayment schedule of credit must be flexible and linked with the likely time frame for income flow, for example, crop harvest.

Summary of the Proposed Program Needs

The estimated needs to finance the proposed food security, recovery, and reconstruction programs are summarized in Table 52. The total needs are US\$550 million, of which US\$200 million for financing rice imports and US\$350 million for financing the medium-term agricultural recovery program and the livelihood program. In terms of importance, the suggested programs need to be implemented as soon as possible so that the affected households in the cyclone Sidr area are able to benefit. Table 59 outlines these needs.

Table 59: Estimated Needs to Promote Food Security, Recovery, and Reconstruction

Sl. No.	Program	Estimated Needs (US\$ Million)		
		Short Term	Medium Term	Total
1	Rice imports to ensure food security	200*	—	200*
2	Agricultural Recovery Program (crops, livestock, and fisheries)	—	50	50
3	Livelihood Program (micro-credit, crop loans, micro-enterprise loans, cash grants, community infrastructure and training for the agricultural and rural non-farm sectors)	—	300	300
Total		200	350	550

Institutional Implications

The rice imports can be handled by the GoB (actually, the GoB is already in the process of importing 0.5 million MT of rice). Part of the imported rice can be used to build the strategic rice reserves and part can be sold in the open market, for example, through open market sales (OMS), using the existing framework. Given the urgency, it is extremely important to implement the agricultural recovery program in the cyclone-affected areas. Since the capacity of DAE, DLS, and DOF remains weak, it is very important that the proposed program be implemented jointly by FAO, DAE, DLS, DOF, and NGOs. FAO, which has prepared an agricultural recovery program at the GoB request, should be brought in to coordinate implementation of the proposed program. Finally, the livelihood program should be implemented by PKSF through its Partner Organizations (POs). PKSF has extensive experience in managing the livelihood programs in the flood- and cyclone-affected areas as well as beneficiaries.

Critical Needs to Reconstruct Rural Infrastructure

In addition to the three programs outlined above, there is also a need to rehabilitate and reconstruct appropriate rural infrastructure, since it will not only complement the above programs but will also increase the likely impact as well as returns to investment. Reconstruction of rural infrastructure is likely to improve access to market, access to employment opportunities, and transport facilities and reduce the risk and impact of such disasters in the future. The critical rural infrastructure needs are rehabilitation of cyclone shelters (along with animal shelters), embankments, coastal green belt, roads and power distribution, and water and sanitation facilities.

Table 60: Estimated Crop Loss due to the Cyclone SIDR

Crop	Total standing crops (ha)	Affected land area (ha)	Totally Damaged land area (ha)	Partially damaged land area (ha)	Damage to crops on partially damaged land area (%)	Transforming partially damaged into totally damaged land area (ha)	Total damaged land area (ha)	Possible loss in potential production (mt)	Estimated value of lost crop production (MDT Million)	Number of affected farmer families
Sown Aman	110,805	34,356	2,528	31,828	22	7,058	9,936	11,196	257.51	
Broadcast Aman (HYV)	1,188,587	511,753	15,328	496,425	24	116,721	134,261	362,853	8,345.62	
Transplanted Aman (local)	910,475	710,288	30,810	679,478	35	234,486	266,819	430,909	9,910.91	
Boro Seed bed	21,401	4,940	944	3,966	29	1,131	2,105	—	92.62	
Vegetables	76,041	44,542	8,114	36,428	30	10,807	19,464	177,955	2,135.46	
Pulse crops/Lentils	157,675	110,949	29,057	81,892	48	37,161	67,218	41,630	2,581.06	
Mustard	74,718	40,271	7,199	33,072	35	10,736	18,235	21,744	652.32	
Wheat	2,373	1,602	352	1,250	40	498	850	1,717	42.93	2,224,464
Betel Leaves	8,298	7,081	1,236	5,845	41	2,378	3,614	25,416	635.4	
Betel Nut	5,275	5,275	150	5,125	80	4,100	4,250	—	-	
Coconut	2,102	2,102	68	2,034	20	407	475	—	-	
Banana	21,265	9,420	2,019	7,401	49	3,657	5,676	93,383	1,400.7	
Papaya	3,207	2,334	787	1,547	35	545	1,332	24,488	244.88	
Others	49,379	27,965	8,335	19,630	44	8,665	19,651	84,025	2,100.63	
Total	2,631,601	1,512,878	106,927	1,405,921	38	438,350	553,886	1,275,316	28,400.07	2,224,464

Source: Department of Agricultural Extension (DAE) and World Bank staff estimates.

Notes: 1. Likely loss in potential production for rice is 804958 metric ton (11196+362853+430909).

2. Value is estimated by using the following prices: rice: BDT23000/mt; boro rice seed bed: BDT 44000/ha; vegetables BDT 12000/mt; pulses: BDT 62000/mt; mustard:BDT 30000/mt; wheat: BDT 25000/mt; betel leaves: BDT 25000/mt; banana: BDT 15000/mt; papaya: BDT 10000/mt; Others: BDT 25000/mt.

Table 61: Estimated Crop Loss in Most Affected District by the Cyclone SIDR

Sl. No.	Affected District	Total standing crops (ha)	Affected land area (ha)	Totally damaged land area (ha)	Partially damaged land area (ha)	Damage to crops on partially damaged land area (%)	Transforming partially damaged into totally damaged land area (ha)	Total damaged land area (ha)	Possible loss in Potential Production (mt)	Estimated value of lost crop production (BDT Million)	Number of affected farmer families
1	Barguna	125,702	125,702	15,000	110,702	83	92,297	107,297	173,311	3,986	152,850
2	Bagherhat	127,084	108,147	12,000	96,147	37	35,392	47,392	103,789	2,387	107,119
3	Patuakhali	209,958	207,708	17,428	190,280	42	79,114	96,542	189,756	4,364	233,795
4	Perojpur	86,898	86,898	11,522	75,376	34	25,480	37,002	68,851	1,584	278,307
Sub-total		549,642	528,455	55,950	472,505	49	232,283	288,233	535,707	12,321	772,071
% of Total		41.33	48.34	56.78	47.50	114.25	58.94	58.51	49.07	49.07	41.9607
5	Barishal	160,747	129,225	8,500	120,725	39	47,052	55,552	145,391	3,344	240,967
6	Bhola	180,663	176,753	4,920	171,833	25	42,322	47,242	112,868	2,596	163,540
7	Jhalokhati	53,537	47,483	4,500	42,983	37	15,781	20,281	70,111	1,613	107,277
8	Sathkhira	115,595	43,468	2,000	41,468	21	8,522	10,522	29,067	669	78,543
9	Khulna	113,307	96,467	5,218	91,249	25	22,557	27,775	93,227	2,144	125,253
10	Madaripur	43,536	13,486	3,587	9,899	40	3,962	7,549	23,932	550	71,183
11	Gopalganj	27,306	15,197	3,546	11,651	35	4,080	7,626	20,463	471	57,646
12	Shariatpur	29,372	25,888	8,314	17,574	47	8,330	16,644	47,162	1,085	65,005
13	Faridpur	56,123	16,872	2,000	14,872	62	9,190	11,190	13,782	317	158,501
Sub-total		780,186	564,839	42,585	522,254	37	161,796	204,381	556,003	12,788	1,067,915
% of Total		58.67	51.66	43.22	52.50	85.75	41.06	41.49	50.93	50.93	58.04
Total		1,329,828	1,093,294	98,535	994,759	43	394,079	492,614	1,091,710	25,109	1,839,986

Source: Department of Agricultural Extension (DAE) and World Bank staff estimates.

Table 62: Livestock Sector Damage: Dead Animals and Birds due to the Cyclone SIDR

Sl. No.	Affected District	Number of Dead Animals				Number of Dead Birds			
		Cow	Buffalo	Goat	Sheep	Total	Chicken	Duck	Total
1	Borguna	13,245	347	16,805	102	30,499	588,712	69,547	658,259
2	Bagherhat	3,663	235	6,610	38	10,546	107,258	27,946	135,204
3	Potua khali	13,662	5,615	18,069	1,570	38,916	249,708	27,660	277,368
4	Pirojpur	2,568	144	4,117	33	6,862	779,738	111,103	890,841
Sub-total		33,138	6,341	45,601	1,743	86,823	1,725,416	236,256	1,961,672
% of Total		88.63	87.94	76.25	49.56	80.45	77.74	66.80	76.24
5	Barishal	707	306	590	4	1,607	80,366	31,675	112,041
6	Bhola	329	393	492	46	1,260	22,745	16,585	39,330
7	Jhalokhati	522	77	2,554	32	3,185	91,384	3,550	94,934
8	Sathkhira	6	1	30	40	77	1,228	16,660	17,888
9	Khulna	1,961	18	3,916	237	6,132	25,486	18,577	44,063
10	Madaripur	121	—	215	—	336	65,400	—	65,400
11	Gopalganj	276	—	368	38	682	97,910	20	97,930
12	Shariatpur	91	—	102	—	193	13,031	2,000	15,031
13	Faridpur	52	36	36	—	124	6,424	28,050	34,474
14	Munshigonj	187	11	5,900	1,200	7,298	89,618	318	89,936
15	Chittagongj	—	28	—	162	190	320	—	320
16	Feni	—	—	—	15	15	—	—	—
17	Jessore	1	—	—	—	1	—	—	—
Sub-total		4,253	870	14,203	1,774	21,100	493,912	117,435	611,347
% of Total		11.37	12.06	23.75	50.44	19.55	22.26	33.20	23.76
Total		37,391	7,211	59,804	3,517	107,923	2,219,328	353,691	2,573,019

Source: Department of Livestock Services (DLS) and World Bank staff estimates.

Table 63: Livestock Sector Damage due to the Cyclone SIDR

Sl. No.	Affected District	Public Sector Damage (NDT Million)	Private Sector Damage (BDT Million)				Sub-total	Total (Public and Private)
			Affected Farms	Cattle Farms	Affected Poultry Farms	Cattle and Poultry Feed		
1	Borguna	1.00	0.38	9.27	114.20	243.92	367.76	368.76
2	Bagherhat	2.70	0.57	3.35	21.10	103.28	128.30	131.00
3	Potua khali	0.06	4.70	9.27	50.96	255.49	320.41	320.47
4	Pirojpur	—	0.68	8.53	64.44	183.01	256.65	256.65
Sub-total		3.76	6.32	30.42	250.70	785.70	1,073.13	1,076.89
% of Total		33.10	31.87	61.06	74.17	85.86	81.13	80.72
5	Barishal	0.50	0.03	3.40	—	17.82	21.25	21.75
6	Bhola	—	0.02	0.67	6.12	13.96	20.77	20.77
7	Jhalokhati	6.60	0.15	2.12	0.30	26.61	29.18	35.78
8	Sathkhira	0.50	0.03	0.02	28.20	7.81	36.06	36.56
9	Khulna	—	0.05	0.62	0.92	6.83	8.42	8.42
10	Madaripur	—	3.00	4.90	16.98	14.11	38.99	38.99
11	Gopalganj	—	—	3.72	1.06	18.31	23.09	23.09
12	Shariatpur	—	0.18	0.60	—	3.07	3.85	3.85
13	Faridpur	—	0.30	0.22	2.14	2.99	5.65	5.65
14	Munshigonj	—	9.75	3.13	29.44	17.83	60.15	60.15
15	Chittagong	—	—	—	2.14	—	2.14	2.14
16	Feni	—	—	—	—	—	—	—
17	Jessore	—	—	—	—	0.02	0.02	0.02
Sub-total		7.60	13.50	19.40	87.30	129.35	249.55	257.15
% of Total		66.90	68.13	38.94	25.83	14.14	18.87	19.28
Total		11.36	19.82	49.82	338.00	915.05	1,322.68	1,334.04

Source: Department of Livestock Services (DLS) and World Bank staff estimates.

Notes:

1. Damage is estimated by using the following prices: cow and buffalo: BDT 12,000; sheep and goat: BDT. 1200; duck: BDT. 80; chicken: BDT 92; cattle farm: BDT 15,000; poultry farm: BDT 10,000; feed: BDT 20,000/metric ton; tree: BDT 20,000.
2. Public sector damage deals with damage to GoB assets such as trees, animal sheds and buildings.

Table 64: Fisheries Sector Damage and Loss due to the Cyclone SIDR

Sl. No	Affected District	Affected ponds/ dighis/ ghers		Amount/ Number of fish/ shrimp/ fingerlings washed away			Value of the fish/ shrimp/fingerlings washed away (BDT Million)			Damage to Private Fishing Equipment		Amount of total Private loss and damage (BDT Million)	Damage to Public Infrastructure		Total Damage and Loss (BDT Million)
		No.	Area (acre)	Fish (mt)	Shrimp/ Prawn (mt)	Fingerlings (BDT Million)	Fish	Shrimp/ Prawn	Fingerlings	Type	Value (BDT Million)		Type	Value (BDT Million)	
1	Borguna	50,684	50,684	2,339	58	—	93.57	11.66	—	Boats: 219	71.92	177.15	—	—	177.15
2	Bagherhat	9,752	24,903	354	371	—	14.16	74.17	—	—	—	88.33	Boundary / Roof/ Elect. Lines	0.01	88.34
3	Patuakhali	26,160	5,159	466	211	10.8	17.16	42.37	5.38	Boats: 555	4.96	69.87	Boundary / Roof/ Elect. Lines	0.15	70.02
4	Pirojpur	18,440	2,206	1,497	28	2.15	19.64	3.6	0.98	Boats: 588 Nets: 1,718	36.01	60.23	Boundary / Roof	1.61	61.84
Sub-total		105,036	82,952	4,656	668	12.95	144.53	131.8	6.36	Boat: 1,362 Nets: 1,718	112.89	395.58	—	1.77	397.35
% of Total		92.20	95.24	86.00	94.48	76.18	81.69	94.54	76.08	Boats: 73.42 Nets: 99.83	86.65	86.94	—	23.47	85.91
5	Barishal	—	—	—	—	—	—	—	—	—	—	—	Boundary / Roof/ Elect. Lines	0.75	0.75
6	Bhola	1,693	502	267	4	3.23	10.7	0.74	1.61	Boats: 05	6.78	19.83	Embank.t	3.67	23.50
7	Jhalokathi	6,640	2,449	450	5	0.62	19.98	1.09	0.31	Boats: 152	9.99	31.37	Boundary / Roof/ Elect. Lines	1.30	32.66
8	Satkhira	185	569	1	2	—	0.05	0.34	—	—	—	0.39	—	—	0.39
9	Khulna	316	506	9	27	—	0.37	5.4	—	Boats: 36 Nets: 3	0.63	6.40	Roof/ Boundary / Dams	0.04	6.44
10	Gopalganj	44	118	31	1	0.20	1.30	0.04	0.08	—	—	1.42	—	—	1.42
Sub-total		8,878	4,144	758	39	4.05	32.4	7.61	2	Boat: 493 Nets: 3	17.40	59.41	—	5.76	65.17
% of Total		7.79	4.76	14.00	5.52	23.82	18.31	5.46	23.92	Boat: 26.58 Nets: 0.17	13.35	13.06	—	76.53	14.09
Total		113,914	87,096	5,414	707	17	176.93	139.41	8.36	Boats: 1,855 Nets: 1,721	130.29	454.99	—	7.53	462.52

Source: Department of Fisheries (DOF) and World Bank staff estimates.

Annex 8- Livelihoods

Livelihoods in the Disaster Area

Total population in the twelve main districts affected by the cyclone is estimated at 18.7 million in 3.5 million households. The estimated population of the four worst affected districts in 2007 is 5.3 million people in 1.02 million households. The analysis of livelihoods will be restricted to these districts, although some marginal effects of the cyclone were also felt in other districts (see page 4).

Table 65: Population and Households in Affected Areas (2007)

District	Households	Population
Worst affected		
Barguna	180,060	903,592
Patuakhali	280,980	1,607,706
Bagerhat	321,640	1,637,133
Pirojpur	233,160	1,145,864
Subtotal	1,015,840	5,294,294
Less affected		
Jhalokati	145,700	714,597
Satkhira	390,080	2,078,210
Khulna	494,800	2,676,252
Gopalganj	217,440	1,244,475
Madaripur	231,920	1,203,661
Shariatpur	213,240	1,183,094
Barisal	475,680	2,465,854
Bhola	328,540	1,882,295
Subtotal	2,497,400	13,448,438
Total	3,513,240	18,742,733

Sources: Population: 2001 Census, projected to 2007 using 1991–2001 growth rates

Households: Ministry of Food and Disaster Management, Emergency Response and Action Plans, 2007

About two-thirds of households own agricultural land and more than half of the employed population has an agricultural sector occupation but only one-third of households have their own agricultural sector production as their main source of income. A quarter of all households get most of their income from wage labor (a majority of these in the agricultural sector), 30 percent live mainly off small non-farm businesses, and 9 percent depend on rent, remittances and other sources of income. Field evidence suggests that exclusive dependence on subsistence agriculture or wage labor is associated with greater poverty, while access to nonagricultural activities is associated with livelihood diversification, better coping mechanisms, and lower poverty levels. It is worth noting that farmland ownership is widespread but (i) one-third of the population is landless, and (ii) most land holdings are extremely small (more than a third are under 0.2 ha), requiring other occupations to make ends meet.

Table 66: Households by Normal Source of Income (%)

	Total 12 districts	Subtotal 4 districts	Bagerhat	Pirojpur	Barguna	Patuakhali	Subtotal 8 districts	Jhalokati	Satkhira	Khulna	Gopalganj	Madaripur	Shariatpur	Barisal	Bhola
Farmers	29	32	38	34	27	30	27	28	28	18	36	34	32	25	29
Fishermen	4	4	4	4	6	3	4	1	5	4	2	1	2	3	9
Subtotal agric producers	33	36	43	38	33	33	31	29	33	23	37	35	34	28	37
Agricultural wage labor	21	19	20	19	20	18	22	17	29	12	24	26	27	20	26
Subtotal agriculture	54	55	63	57	54	50	53	46	63	35	62	61	62	48	64
Other wage labor	5	6	4	5	7	6	4	5	4	6	2	3	3	4	5
Subtotal wage labor	26	25	24	24	27	24	27	22	34	18	27	28	30	24	31
Industry, construction	3	3	2	3	2	3	3	3	3	6	2	3	2	4	2
Commerce, transport, services	29	27	22	25	29	31	30	34	24	43	28	25	23	34	21
Subtotal non agricultural business	32	30	25	28	31	34	34	37	27	49	30	28	25	37	23
Rent, remittance, other	9	9	8	9	8	10	9	11	6	10	6	8	10	10	8
Total	100	100	100	100	99	100	100	100	100	100	100	100	100	100	100
Memo: Agric sector employment	56	57	61	59	53	54	55	51	61	38	67	65	67	51	58

Source: Bangladesh 2001 Population Census, Table C07. (For agricultural employment: Table C05).

Geographical Differences and Livelihood Zones

The four most affected districts: These districts are located on or near the seashore (see page 4) with intersecting rivers connecting the Bay of Bengal. Naturally, they are most vulnerable to natural disasters, such as cyclones, hurricanes, tidal waves, and so forth, and have already suffered from them many times.

Within these districts, farming is dominated by paddy, which represents about 95 percent of all cropped area. The *aman* rice variety is the one most widely sown there. It grows from July to November, and it was near harvest when the cyclone hit, severely affecting the crop. About 35-40 percent of households lack any access to agricultural land; among the rest, another 30 percent farm only a marginal amount of land (between 200 and 2,000 square meters), and only a minority have access to more than one ha of land (with 1 percent of farms above 3 ha).

Most farms own also artificial ponds for growing fish (especially carp) as well as prawn and shrimp. The harvest of prawn and shrimp had been completed up to 60-80 percent before the cyclone, but there were losses of carp and some shrimp, and heavy losses of fingerlings. Open water fishing is undertaken mostly along rivers and sea shores in small boats. The boats vary in size from small, fit for 2-4 workers, to large, fit for about 10-12 workers. The latter may be able to fish somewhat further into the sea. Fish resources in rivers and near sea shores are already approaching depletion, threatening the sustainability of this activity. Moving to bigger boats and further away from the coast is the logical move to ensure sustainability.

Most of the bigger boats are manned by owners plus hired workers, all partaking in the catch (owners take extra shares to reflect their bigger stakes in the enterprise).

Many other occupations exist in the area, including making and repairing boats and nets as well as ancillary activities for farming such as rice-husking mills. Forestry extraction and saw mills are very important activities. Some ice factories provide refrigeration for fish preservation and for households. Some areas specialize in certain industries and handicrafts, such as the cluster of pottery industries in Purijpur Sadar, the main sub-district in Purijpur district.

Other affected areas: To the north of the four most affected districts there is a marshy zone with a completely different configuration. Water incursions from big rivers and the sea inundate the area between July and December, carrying fish which remain trapped in the marshes and are easily harvested. Rice of the *boro* variety is sown after the flood, in December-January, to be harvested in April-May, and was thus mostly unaffected by the cyclone. In this area (main districts Gopalganj, Madaripur, Shariatpur) an important production of vegetables exists, including commercially oriented farms supplying onions and other produce to the market.

Farms are also very small in this area, with average farm sizes below one ha, more than one-third landless households, and a significant proportion of farms in the marginal category (below 0.2 ha). Fish ponds also exist but are less abundant and less developed than in coastal areas.

Gender: About 10-12 percent of households are headed by divorced, widowed, or separated women. Most do not receive any support from their husbands, ex-husbands, or other relatives, and have to fend by themselves. Most (except older widows) must raise and support several small children. Almost all these women are landless and work as informal casual wage workers or street hawkers, for wages well below those of their male counterparts. Women laborers can be found in brick and tile factories, making textile and garment products in small enterprises or from their homes, or even pulling rickshaws.

According to the WFP study on rural Bangladesh socio-economic profiles about 15 percent of households in the coastal areas are non-vulnerable, about 30 percent are "on the edge," about 38 percent are vulnerable, and 17 percent are among the "most vulnerable" or "invisible poor".³⁶ This last group has been also described in other analyses as the "ultra poor." The percentage of vulnerable and ultra poor households in the coastal areas is above the national average. The vulnerable and ultra poor groups, according to that study, have very meager assets (worth less than 500 BDT).

Impact of the Cyclone on Livelihoods

Livelihoods were affected by damage to income-generating assets, and by loss of employment and income.

Asset damage: Damage to assets includes mainly the loss of fishing boats and gear, factory equipment, tools of self-employed workers, damage to fish ponds, loss of livestock, destruction of common assets such as roads and electric networks, destruction of cow sheds and other farm infrastructure, silting of land, loss of shop inventories, destruction of shop or business premises, and the loss of income-earning human capital in many of the households hit by loss of human life.

Cropland: Cyclone Sidr damaged more than 1.6 million acres of cropland, washed away food storages and personal stockpiles, and destroyed fruit trees. Thousands of animals used for meat and milk were killed. The rice crop was worst affected, along with other central crops including pulses, vegetables (an important source of income and nutrition), and bananas.

Over 80 percent of *aman* production (which has a single harvest season - November through January) and 100 percent of the sowing area for pulses were damaged.³⁷ Many other crops were ready or nearly ready for harvest at the time of the cyclone, and a quarter of these have been destroyed.³⁸ Soil condition in the area is not conducive to the planting of alternative crops, so diversification of cropping cycles is limited. Increased salinity caused by tidal surges and soil deposition have further hampered agricultural productivity in the area; destruction of the local variety of paddy is feared to lead to seed scarcity in the coming season.

Fisheries: Fishers are among the poorest in the coastal zone. They are often marginalized and landless, with little or no education, poor access to health services, and living in substandard houses without basic amenities. Those who live on marginal lands and embankments have limited alternative employment opportunities. Fisheries have been severely damaged by the cyclone, and a large number of fishermen who were eking out a marginal existence have now lost all their fishing gear and houses. Many have died or are reported missing.

About 45 percent of the fishers living in the coastal areas reside in the cyclone-affected districts.³⁹ The total number of artisanal fishing vessels is uncertain, but the Department of Fisheries estimates that there should have been 10,000 boats in the area when the cyclone hit, plus those that had migrated to the area for the winter fishery. Nearly 2,800 boats were reported lost. The most affected categories of vessels are non-motorized fishing boats, 30–30 ft and the smaller range of motorized boats, 35-40 ft. No damage has been reported to the trawler fleet. Based on

³⁶ WFP, Rural Bangladesh – Socio-Economic Profiles of WFP Operational Areas and Beneficiaries. Dhaka, WFP, October 2006. Available at <http://bangladesh.wfp.org>

³⁷ Rapid Environmental Assessment in the Sidr Affected Areas: A Joint Assessment by FD, DoE, CEGIS, SPARRSO and UNDP. January 15th, 2008.

³⁸ Cyclone Sidr: United Nations Rapid Initial Assessment Report (focus on 9 worst affected districts). November 22, 2007

³⁹ FAO: Bangladesh Emergency Livelihood Protection and Rehabilitation Program Appraisal Document; January 2008.

these observations it can be concluded that the small-scale and poorer fishers have been most severely impacted by the cyclone.

The cyclone also ravaged the shrimp industry, which accounts for the country's second largest exports. Shrimp farming is heavily concentrated in Khulna division and about 75 percent of all shrimp production occurs in the cyclone-affected districts. Mongla, Satkhira, and Bagerhat, which produce 70 percent of Bangladesh's shrimp, were hit by Cyclone Sidr.⁴⁰ An FAO appraisal mission visited eight districts and made spot checks in fishing settlements, fish landing and processing centers and fish ponds and shrimp enclosures. The outcome of the field visits were cross-checked with estimates of damage done by Department of Fisheries (Table 67).

Table 67: Damages to Fisheries and Shrimp Enclosures

Sector	Losses
Capture Fisheries	
Fishing boats	2,761 (fully destroyed) 1,219 (partial damage)
Gear	2,467
Aquaculture	
Shrimp enclosures	54,000
Fish Ponds	208,000
Production loss (MT)	
Shrimp	10,609
Fish	56,564

Table 68: Percentage Damage to Aquaculture (field observations)

Group of Upazila	Fish Ponds	Shrimp enclosures
Severely affected	85%	60%
Moderately affected	75%	40%

The FAO mission estimated that 80 percent of the *Bagda*, 60 percent of *Golda* shrimp, and 10 percent of fish (mainly carp) had been already harvested at the time of the cyclone. Thus the impact of the cyclone was mainly on carp and secondarily on *Golda* shrimp. Besides, trees falling into the water under the impact of the wind caused de-oxygenation, making ponds unusable until the water quality is restored. A large number of fingerlings were lost in several locations.

Livestock: A large number of animals were killed in the cyclone, mainly by the tidal wave surge. Not only does this represent a major loss of assets, and loss of purchasing power for the affected families, but it also leads to a decline in the consumption of meat, milk, and fish in the diets of affected people. Livestock losses were the highest in Pirojpur, Borguna, Patuakhali, Bagerhat, and Jhalakathi. Chicken, ducks, goats, and sheep were the most affected species. Mostly, communities with limited livelihood assets raise these species as an additional livelihood resource next to fishing. The physical assessment by the FAO team revealed that most of the small ruminant and poultry along riverbanks and sea embankments were washed away almost entirely.

A total of 20,611 acres of grazing land was badly damaged through silt and salinity in Pirojpur, Borguna, Patuakhali, and Bagerhat. A total of 424 small-scale dairy farms were destroyed, of which 313 were reported in Patuakhali alone. The worst affected are small-scale household chicken and duck farms in Borguna and Patuakhali, owned mainly by landless households and managed by women. Many livestock offices were badly damaged by falling trees. Injury and weakness are

⁴⁰ Unicef: Bangladesh Cyclone Sidr Situation Report – EXTERNAL; November 17, 2007

evident among remaining livestock, which are vulnerable to disease outbreak. Fodder is a major issue in most of the affected areas as grass and crop residues have become inedible.

The value of lost agricultural assets has been estimated as follows:

1. Livestock losses: 1254.04 million BDT (equivalent to US\$ 18.18 million)
2. Damage to fisheries infrastructure and equipment: 137.83 million BDT (or about US\$ 2 million)

Nonagricultural private assets: Private businesses lost infrastructure, equipment and inventory in the cyclone. This included small retail shops in marketplaces across the affected areas, small factories (rice mills, saw mills, ice factories, potteries, and so forth), trade shops (blacksmiths, barber shops, repair shops of various sorts, and so on), some wholesale trade stores, many tricycle vans and rickshaws, sewing machines, tools held in private homes for the self-employed, and many other kinds of equipment.

Valuing these losses is quite difficult. Spot checks in the field by the International Labour Organization (ILO) reveal a tendency toward an average of US\$ 300 per employed person in the case of established traders and factories, and an average of about US\$ 100 for self-employed workers such as van or rickshaw workers, sewing machine operators, and other self-employed workers.

The estimated number of persons affected by the loss of private productive assets and the estimated value of those assets is shown in Table 69.

Table 69: Estimated Loss of Assets in Nonagricultural Businesses

	Damaged establishments	Jobs lost in damaged establish.	Other self employ assets lost	Establishment asset losses (US\$)	Self employed assets losses (US\$)
Barguna	9,926	22,217	8,091	6,665,178	809,101
Patuakhali	364	951	321	285,237	32,095
Bagerhat	13,956	36,900	12,877	11,069,910	1,287,703
Pirojpur	1,427	3,990	1,403	1,196,940	140,259
Subtotal	25,673	64,058	22,692	19,217,265	2,269,157
Jhalokati	165	391	173	117,426	17,303
Satkhira	619	1,381	494	414,181	49,360
Khulna	663	1,838	1,139	551,340	113,854
Gopalganj	135	279	124	83,729	12,376
Madaripur	298	662	241	198,634	24,102
Shariatpur	552	1,249	391	374,554	39,058
Barisal	659	1,780	681	534,009	68,072
Bhola	1,726	3,722	1,183	1,116,599	118,284
Subtotal	4,817	11,302	4,424	3,390,472	442,410
TOTAL	30,489	75,359	27,116	22,607,737	2,711,567

Employment losses: Loss of employment and income was widespread. Most businesses had to close for a while as a result of the cyclone, and many were closed for a long while, especially in coastal areas affected by the tidal wave surge. A total of 567,000 persons were affected in their income and employment by the impact of Cyclone Sidr. This includes 189,000 farmers and 4,100 fishermen, and members of their families, forced to seek alternative employment because of loss of income in their farms; nearly 80,000 wage workers in the agricultural sector (farms and fisheries), including 21,000 seasonal harvest workers (who are themselves mostly marginal farmers with insufficient land); about 160,000 persons engaged in nonagricultural establishments (owners, family help, or wage workers); and about 134,000 self-employed workers (including their family help), for a total of 567,000 persons affected. This figure corresponds approximately to 436,000 households (nearly 14 percent of all households in the 12 districts), with an average 1.3 persons per household in the labor force. In the four worst affected districts there were 325,000 workers affected, corresponding to approximately to 250,000 households, or 25 percent of all households in that area.

Income losses: Direct loss of income caused by the cyclone is shown in Table 71. This table does not include indirect income losses such as the forgone production from animals lost in the cyclone (meat, milk, or eggs otherwise to be provided by animals killed in the disaster, or fish to be grown from lost fingerlings).

Table 70: Summary Estimates of Cyclone SIDR Impact on Employment: Labor Force Affected

Districts	Additional demand for casual jobs from farmer households	Loss of jobs in self-employed fishery households	Farm wage labor	Fishery wage labor	Seasonal farm wage labor	Jobs affected in establishments	Jobs affected in non-established self employment	Total labor force affected
Barguna	78,200	1,058	7,804	2,416	8,713	3,793	37,477	139,460
Patuakhali	29,338	0	12,267	0	4,127	7,866	1,614	55,212
Bagerhat	28,028	380	4,104	624	2,616	11,417	62,059	109,228
Pirojpur	303	1,724	35	6,075	31	6,281	6,851	21,299
Subtotal	135,869	3,161	24,210	9,115	15,487	29,357	108,000	325,199
Jhalokati	36,793	432	15,198	505	3,795	4,264	882	61,869
Satkhira	1,767	0	1,436	0	151	11,099	2,743	17,195
Khulna	1,402	92	178	133	116	59,223	9,306	70,451
Gopalganj	680	0	356	0	80	7,077	614	8,807
Madaripur	480	0	278	0	52	8,645	1,268	10,723
Shariatpur	2,179	0	1,420	0	273	6,627	2,119	12,617
Barisal	6,375	0	4,021	0	724	25,750	3,648	40,518
Bhola	3,679	458	644	707	482	8,409	5,455	19,834
Subtotal	53,355	981	23,531	1,345	5,673	131,095	26,035	242,015
Total	189,223	4,142	47,741	10,460	21,160	160,452	134,035	567,213

Source: Mission estimates based on baseline census and survey data, cyclone damage data, and fieldwork findings.

Table 71: Total Estimated Loss of Private Income due to Direct Impact of Cyclone Sidr (US\$)

Districts	Lost crop production	Lost fisheries production	Industrial establish.	Commerce establish	Industrial Self employed	Comm & service self employed	Total income loss
Barguna	57770.30	1525.10	1598.70	12855.60	9.60	233.10	78083.80
Patuakhali	63252.00	940.70	2997.10	28379.00	0.60	9.00	100007.70
Bagerhat	34596.30	1280.10	6294.00	28559.20	19.80	366.50	73591.50
Pirojpur	22950.40	351.00	2421.40	21757.70	2.30	39.80	49130.40
Subtotal	178569.10	4097.00	13311.20	91551.60	32.30	648.40	300813.50
Jhalokati	23370.30	309.90	871.80	4999.50	0.40	4.80	31190.60
Satkhira	9689.00	0.00	3111.50	13816.60	1.40	13.40	27300.40
Khulna	31075.70	0.00	8563.50	19003.50	8.90	25.20	60821.00
Gopalganj	6821.00	20.60	1443.90	6929.00	0.20	3.50	15690.20
Madaripur	7977.30	0.00	1562.30	7466.50	0.60	6.70	17563.80
Shariatpur	15720.70	0.00	1381.50	7536.40	1.00	10.70	25735.10
Barisal	48463.70	0.00	4563.50	19709.60	1.70	18.70	76101.20
Bhola	37622.70	189.10	1731.20	11302.90	1.40	34.10	53490.40
Subtotal	71283.60	20.60	16062.70	54752.00	12.20	59.40	147110.50
Total	249853.00	4118.00	29373.90	146303.60	44.50	707.90	447924.10

Note: Based on loss assessment in agriculture, industry and commerce.

Households affected: About 2.2 million farms were affected in some degree by agricultural damage, but most of them were marginal in size, and farming is not the main source of income of the concerned households. About two-thirds of households own some agricultural land, and some more till land on tenancy terms, but farming is the main source of income for only 30 percent of households in the area, and just that proportion of the affected farms (about 700,000) are likely to have their livelihoods seriously affected by agricultural loss. Out of them, about 190,000 are likely to seek casual jobs outside agriculture to make up for the income loss sustained by their farms.

At least 2,800 fisherman (boat owner) households and about 34,000 agricultural labor households (supplying about 47,000 laborers) were affected in the agricultural sector.

In the rural non-agricultural sector, the loss of about 300,000 jobs in establishments and self-employment corresponds to about 250,000 affected households (at a rate of 1.3 jobs per household). However, the vast majority of nonagricultural business was economically affected by the cyclone, being forced to interrupt or reduce operation (however briefly) owing to lack of electricity, damaged roads, or direct damage to their assets.

Some Case Studies

The following boxes summarize the case of some specific businesses that were affected by the cyclone with damage to their assets and inability to rapidly access credit for recovery of lost equipment and inventory and restarting operation.

A family pottery in Pirojpur

In Pirojpur Sadar, Pirojpur district, a cluster of pottery factories can be found. One of those was studied during the ILO assessment. It is owned by six families, and operates 15 brick-and-mud ovens heated with fuel wood. About 30 people usually work in the various tasks involved in making pottery objects, mostly simple household goods (plates, trays, cups, pots). Workers include a significant number of women and children. Young boys and girls from the age of 6 onward participate in the pottery making in some way or another. The output is marketed locally and also in Khulna and Dhaka.

The cyclone completely destroyed 14 of the 15 ovens, and damaged the remaining one. At the time of the assessment (one month after Cyclone Sidr) the one surviving oven was in operation but unable to reach maximum temperature. Production was about 1/20 of normal. Large amounts of uncooked pottery lay about waiting for a chance to be put in the oven. The stoppage in the pottery had also meant a stop in purchases of clay at a clay mine 15 km away, with additional loss of jobs there.

Rebuilding the 14 destroyed ovens and putting the other one in full working order would require about US\$ 12,000. The families have little access to credit because their land is not agricultural, they lack formal title, and their needs exceed micro-credit ceilings. They did not know when and how they could restart full operation.

A floating trader

In Bagerhat district a trader in aluminum goods operated from a barge in the river, with 12 workers earning approximately BDT 4,500/month. Both the barge and the goods were lost in the cyclone. Total cost was BDT 300,000 (US\$4,350) for the barge and BDT 175,000 (US\$ 2,540) for the goods.

A saw mill in Bandaria Upazila, Pirojpur

The saw mill owned two large wooden sheds, one for timber and the other for cut planks, plus a diesel-operated saw. It was operated by its owner and eight wage workers.

The cyclone washed away the two sheds and their contents, that is, all the company's infrastructure and inventory, and badly damaged the saw's engine. All workers were suspended, effective the day after the cyclone, and were still suspended one month afterwards.

The timber business was flourishing because of the large number of trees fallen during the cyclone, but the miller could not repair his machine nor rebuild the infrastructure. The local bank, a branch of the State-owned agricultural bank, would only lend to farmers, and the next closest bank was about 20 km farther away.

Total reconstruction and recovery needs amounted to about US\$ 4,500.

Vulnerability and Other Livelihood Impact Issues

The cyclone-affected areas suffer from high levels of chronic poverty and widespread vulnerability to natural and man-made hazards. Within this broader context, the following groups have been identified as having the greatest need for external support to recover from the adverse impacts of Cyclone Sidr on their lives and livelihoods:

- Landless laborers working in agriculture and fisheries
- Small-scale river and coastal fishers
- Small-scale farmers who lost most, or a substantial part, of their *amon* rice crop
- Female-headed households (FHH), including de facto FHH
- Small-scale retailers.

While these groupings have been made for ease of reference, in reality, many low-income groups rely on a variety of sources of income for their survival. Some fishers also farm, some farmers also fish, and many from both livelihood groups also depend on their own production, wage labor, and collection of timber and non-timber forest products.

The majority of poor and middle-income farmers and fishers do not have sufficient financial capital, seeds, tools and other inputs required for their next cropping and fishing seasons as a result of their production losses and the damage to their houses and livelihoods assets.

For poorer fishers, farmers, and day laborers, the loss of tree and forest crops also is compounding their vulnerability. For example, in the subdistrict of Bhandaria it is estimated that 50-80 percent of the betelnut crop was lost or damaged. Betelnut obtains a high market price and, hence, is a valuable source of household income. The trees take several years to grow to maturity, so the loss of this resource will be felt for a considerable period of time. In Bagherat, honey (*mouwalis*) and golpata (*bowalis*) collectors advised CARE that they currently have little access to the Sunderban mangroves because of government policies adversely affecting household incomes.

Currently, there is a windfall of fallen timber, creating some temporary employment opportunities. However, there are concerns that the overall loss of timber trees will adversely affect the carpentry, furniture, and boat-building businesses in the medium run, due to a shortage of timber resources.

Landless laborers: Most of the landless live illegally on government lands outside of the river embankments. They experienced the highest degree of losses to their homes and assets, as they bore the brunt of the tidal surge that accompanied the cyclone. Those who owned or occupied land just inside the embankments also suffered severe losses, where the embankments were breached or damaged by the surge, including having their land washed away in some cases.

The landless have a higher exposure to shocks and natural hazards and most are unable to access institutional credit (often relying on unregistered money lenders with higher interest rates). Many lost their livestock during the cyclone, a major means of insurance for paying off expenses such as medical bills and school fees. Reduced access to fodder and injury has left their surviving animals distressed and in a weakened condition, increasing susceptibility to disease and infection and reducing levels of meat, egg, and milk production.

For those who rented farmland, the one crop of rice grown per year has been damaged or destroyed, presenting serious problems for earning income and meeting rental or credit repayments.

Small farmers: A large number of poor small farmers (those with less than 66 decimals of land) also have become very vulnerable as a result of significant loss of or damage to their amon rice crops, livestock, and houses. Many are concerned that they will not be able to repay current loans or to get new lines of credit to replace productive assets and purchase seed to grow new crops during upcoming planting seasons. Without external support, some are likely at risk of moving from a situation of transient poverty into one of chronic poverty.

The loss of the amon rice crop also is having a negative impact on the earnings of middle-income farmers (those with around 66-200 decimals of land). For example, in focus group discussions held by Oxfam in the Char Duani Union of Barguna District:

Middle-income farmers confirmed that they would be selling up to 60 percent of their reaped harvest in order to have cash to repair their houses before the rains. They believe this would leave them with sufficient own production to meet two months of food. In a normal year they would be able to harvest sufficient grain to meet 12 months of food. They are unsure of the future prospects of taking credit to begin their production activities.

It is projected that these farmers will be decreasing their nonfood expenditures, as a coping strategy over at least the next 12 months, including employing fewer landless laborers.

Shrimp and fish farming in ponds also is an important source of income for many small- and medium-scale farmers. The shrimp fry, which are gathered primarily by women and children, are reported to have largely survived the cyclone, but the larger shrimp and the fish were washed away. In addition, many ponds were damaged or polluted by debris. Some NGOs advised that the shrimp farmers, who largely produce for companies, are concerned about their ability to repay existing loans and access new lines of credit.

“Shrimp farmers have become massively vulnerable as most shrimp farms are devastated. Such farmers are now under tremendous pressure as they don’t know any other way out to pay back their installments to the micro credit provider NGOs. Fish farmers are also afraid that water is becoming highly contaminated with dead bodies of cattle, poultry and branches of trees, and no fish can survive in this rotten water.”⁴¹

⁴¹ ActionAid (January 2008?), *Cyclone ‘SIDR’: Damage Assessment and ActionAid’s Intervention*. Dhaka: ActionAid, p 2.

Farmers were reported to need seeds, tools, tillers, buffalo, and other items to prepare the land and plant their *boro* season crops in January.

Fishers: Fishers fall into three broad categories: hired laborers, small boat owners, and large boat owners. Fishing is done in the river and along the coast. Fishing techniques and equipment can vary over the year, with different types and sizes of boats and nets used to catch different varieties of fish at certain times of the year.

There are a number of ways in which fish get marketed. One method that was flagged as a concern by some was: fishers who take loans from private businessmen (*aratdah*) and then are obligated to sell their catch back to this one purchaser below the market rate. This was seen as putting pressure on fishers to risk bad weather conditions, in order to ensure continual payments of their loan, and was suggested as a reason why some fishers ignored the cyclone warnings and remained at sea.

For those who worked as laborers on the larger fishing boats (usually owned by more well-off businessmen living in urban centers), income-earning opportunities will be dependent on the speed with which the owners are able to finance and carry out the rebuilding or repair of their boats. While some have access to the *sunderbahns* and can try to collect forest products to supplement their incomes, this source of livelihood will be very limited. For many, their only option over this period will be to find alternative unskilled day labor or other income-earning opportunities, such as rickshaw pulling for companies in urban areas. Such opportunities also will be limited.

Additionally, some former small boat owners are now seeking work as hired laborers on other larger boats in order to save funds to rebuild or repair their own boats and nets. Boat and net replacement or repair have been identified as major needs throughout the affected areas, and those individuals who can find the resources have already initiated such activities in preparation for the March fishing season.

The disaster may provide an opportunity to identify ways to diversify the income of fishing day laborers and increase their resilience to future shocks, as well as to find more environmentally friendly alternatives to depleting forest and fish resources. At least one local NGO, *Rupantar*, has been investigating such possibilities.

Female-Headed Households (FHH): FHH were recognized as highly vulnerable from the outset of cyclone response operations. The GoB and many agencies providing relief have targeted FHH for distributions of food and nonfood items, as well as for cash for work (CFW) programs to clean up debris. At the same time, many women who have been widowed are reported to be dependent on the charity of their neighbors or to have resorted to begging, as have some orphaned children. Many FHH, along with those of the disabled, are experiencing difficulty rebuilding temporary shelter and permanent housing.

De facto FHHs, whose male relatives have migrated to work in other locations, also are highly vulnerable. The women have to earn an income and manage the household simultaneously. Many do not receive regular income from their absent male relatives. In one upazila, CARE reported that the local authorities did not recognize de facto FHHs for relief distributions, as they did not fit the official definition of an FHH.

More broadly, in addition to care giving responsibilities, the roles of women in supporting livelihoods in rural households include activities such as: collecting shrimp fry (with their children); repairing nets and cleaning fish; managing livestock; growing vegetables; and home-based activities such as sewing and basket-making. Some also work as day laborers.

Small business (retailers and transporters): At the subdistrict level, market infrastructure has not been severely affected or has been repaired quickly. However, many small shops have been destroyed or damaged at the union level, along with their stock of goods. Many retailers had purchased their stock on credit and are now unable to repay capital and interest. The wholesalers and traders themselves have procured stock on credit with their own suppliers and are now unable to clear debt. Estimates of 50-70 percent downturns in customers at all levels have been reported and, for some commodities, rising prices.

“There were originally six grocery stores. All but one has been totally destroyed. The owner of one of the destroyed shops used to provide a service to 500-1000 people. He took a loan to start his business and purchases his stock with his own income. He is now in debt and cannot restart his livelihood.” – Oxfam focus group discussion, Harinpala Village, Pirojpur

Along the coastal belt, it was advised that smaller transport is now harder to find. The village-level rickshaw transporters cannot use some of the damaged access roads to reach the main road. This lack of transport also restricts the ability of small retailers to replenish their stock and of consumers to purchase goods in their localities.

Ultimately, local markets will play an important role in the recovery of the affected population. It was the view of a number of NGOs that the recovery of retailers at this level will only take place if the affected population has an increased purchasing power or if the retailers can access interest free loans or grants to restart their businesses.

Other Sources of Increased Vulnerability

Housing: The emergency shelter cluster group has estimated that around 70 percent of destroyed housing stock, in situations where the occupant cannot rebuild without external support, is in marginal areas in close proximity to the riverbanks. Many of these families are currently living in flimsy temporary shelters. A number of NGOs are concerned that some of these highly vulnerable households may be inundated by floods again, if repairs are not done to damaged areas of the river embankments before June.

Many who have lost their houses also are reported to be sheltering with relatives, but the numbers are not known, nor the impact on the hosting families.

The GoB provided an emergency grant to households for rebuilding of BDT 5,000, along with distributions of corrugated galvanized iron (CGI) sheeting. This distribution reached the majority of its intended recipients, though not all, according to anecdotal reporting. A number of NGOs advised that poorer households could not afford to purchase the fastenings for the CGI sheets, so have assembled them together loosely into a shelter or stored them for future use. It was reported that the amount of funding provided was insufficient to rebuild, and many individuals used this cash instead to finance the repair or replacement of boats, nets and other lost livelihoods assets. While not used for the original intended purpose, the cash grants appear to have played a key role in supporting the self-recovery of some poor and vulnerable households and illustrate the importance of providing early injections of cash for livelihoods asset replacement into disaster-affected areas.

There are a number of types of house building used in the cyclone-affected areas. Generally, the most poor and vulnerable communities had cheaper and less safe structures, which were heavily impacted by the disaster. For example, where houses were timber-framed, the roof was usually of poor-quality CGI sheeting, and wind bracing was not incorporated in the roof frame. Whether mud and bamboo or timber, many had no plinths or the plinths were low-set. Regardless of the type of house lived in before Cyclone Sidr, the capacity of these communities to rebuild their homes has been reported to be largely limited to salvaging building materials from destroyed houses.

In looking for cost-effective solutions to increase the safety of housing for poorer families, some NGOs are focusing on supporting households to strengthen their plinth construction and to build their plinths higher as protection against storm surge—for example, putting the house on stilts in coastal areas. Additionally, there are plans to undertake “cash for training” programs to educate carpenters, masons, and households in hazard-resistant construction techniques, including simple forms of wind bracing.

As homes serve multiple purposes, a few NGOs are also investigating ways to better protect animals, seeds, crops, and other important household assets. Some households traditionally create a *killa*, a raised mound of earth, to protect livestock, but this does not seem to have been sufficient protection against a high storm surge. Consideration is being given to the height of the veranda and the possible provision of water-resistant storage containers for seeds, grains, and items of value (such as land ownership, identity, and loan documents). One local NGO has developed a design for a two-story house on stilts with an upper floor veranda where livestock may be sheltered during floods and cyclones.

Work is being done on the development of core housing and core cyclone shelter models by the GoB and through the shelter cluster. At the same time, some national NGOs have cautioned that there are no proven models of multi-hazard resistant housing in Bangladesh. Whatever designs are adopted, they must be acceptable and affordable for those whose are poor and vulnerable, with community participation in their development. Lack of community participation and inappropriate designs were identified as major weaknesses in the shelter/housing response to the 1998 floods.⁴²

Land ownership: There was some anecdotal reporting of loss of land title documents but the extent was not clear. Those who have lost their documents may have difficulty proving their eligibility for various forms of recovery and reconstruction assistance. This already has occurred with relief distributions, to some extent. Measures to provide back-up storage of key records may need to be considered, given the vulnerability of many households and communities to multiple hazards.

The situation of the landless, particularly those living outside of the river embankments, is one of acute vulnerability, and there are no simple solutions. Some communities currently are living on the embankments, as the result of a loss of land during the cyclone. The GoB has adopted a policy of relocating such households into “cluster villages” on safer land inside the embankments. There are many challenges to implementing this policy successfully. In some districts, there is insufficient public land available and purchases must be made from private landlords, which tend to be more costly. In other cases, there is a shortage of land, even public land owned by the GoB. Livelihoods strategies would also need to accompany such relocations, if they are to be lasting. Even if households were to be relocated, given land and population

⁴² Beck T (April 2005), *Learning Lessons from Disaster Recovery: The Case of Bangladesh*. Washington: The World Bank, p vi.

pressures, others would likely soon replace them outside of the embankments. Flood-proofing of households and land titling strategies may need to be considered as longer-term solutions to reduce the vulnerability of the people and the environment in these areas.

Food security: The provision of food aid and Cash-for-Work (CFW) programs appears to have averted a food crisis. No acute malnutrition or distress sales of remaining household assets were reported, although living conditions remain precarious for many. Some NGOs reported avoiding the vulnerable group feeding distribution system, because of concerns about its targeting, and that more marginalized groups in the affected area felt CFW was a more equitable and accessible system of support.

The reduction in rice yield for 2008 may impact on food security, particularly given the high prevalence of chronic malnutrition among poorer groups. The cyclone's impact also may intensify the normal lean periods, in the months leading up to the harvest and main fishing season, for fishers (Feb-Mar) and farmers (Aug-Sept).

Even though markets have largely stabilized and are functional, most NGOs advised that these households are currently dependent on food relief to meet their basic needs. This is reported to have changed the quality and quantity of their dietary intake. The phasing out of food aid assistance in February-March may change this scenario. Likewise, an increased demand for livelihoods and construction-related materials may drive up the prices and/or reduce the availability of some key nonfood items (NFIs). Some price rises have already been reported by households, retailers, wholesalers, and traders. The situation will need to be closely monitored and appropriate measures taken, if required, to maintain market stability in the affected districts.

"Another big worry is the increasing price of rice. Now we have to pay BDT 30 per kilo (up from BDT 25 one week ago) and so instead of three meals per day, we are now struggling to serve our families even with two ... and if we do not get job opportunities soon, we do not know if we will survive." – Oxfam, women's focus group discussion, Ketachara I, Mathbaria upazila

Health and education: The health system was reported to have returned to its normal state, which is not strong. The main health concern was acute respiratory infections (ARI), particularly among children and the elderly. The cold winter weather, combined with exposed living conditions, lack of suitable clothing, and chronic malnutrition were seen as high risk factors. At the same time, the loss of livestock and other assets by vulnerable households is likely to have reduced the ability to pay for medical expenses, should the need arise.

Some households have already expressed concern about their ability to pay for school fees and lost school uniforms in 2008. Save the Children Fund (SCF) reported that, in some subdistricts of Pathuakali and Barguna, school attendance has decreased because of lack of uniforms and supplies. Action Aid also found that:

"Students are reluctant coming back to school and many of them are busy searching for new livelihood options, which may increase the dropout rate."⁴³

Psychosocial impacts of the disaster were observed by some NGOs among the fishers (fear of returning to the sea), the elderly, and children, especially those who lost their parents. CARE reported that many children in Borguna, Southkali, and Pathargata lost either one or both parents and SCF that longer-term support program for these children would be required.

⁴³ ActionAid (January 2008?), Cyclone 'SIDR': Damage Assessment and ActionAid's Intervention. , p 4.

“Siuty is about 12 years old. She lost her mother Saleha on the cyclone night. Her father also died two years back. On the cyclone night, her mother asked her to hold a tree strongly but, unfortunately, her mother suddenly washed away and died. Now, Siuty is staying with one of her relatives (cousin) nearby their house. She is traumatized, silent and does not know what is good for her and what will happen to her.”⁴⁴

Regarding water and sanitation, the agencies participating in the Water and Sanitation Cluster Group have identified a number of needs for: improved protection of drinking water ponds such as draining and cleaning; use of adapted slow sand filters for water treatment, which has the added value of protection against arsenic; increasing the quality of latrine construction and the distance between houses and latrines; improving the affordability of latrine construction for poorer households; and training and water-quality testing in chlorination, alum and lime use. Reviews and evaluations of past cyclones and floods in Bangladesh have also highlighted the importance of raising the height of tube wells. One local NGO further suggested the introduction of elevated community water storage systems for use in emergencies.

One NGO expressed concern about the possibility of the cyclone exacerbating the prospects for a cholera outbreak at the beginning of the next rainy season, although Bangladesh is not considered by WHO to have a cholera problem and no data exist on the prevalence of cholera in the disaster-affected areas.

Disaster Preparedness: A small survey carried out through the shelter cluster found that only around 12 percent of respondents had actually used cyclone shelters on the evening of the disaster. Focus group discussions held by Oxfam with women in some heavily affected communities revealed a number of noteworthy observations about the current early warning and shelter systems.

A number of FHH, or whose husbands were away fishing, did not receive the warnings, as they were given in the marketplace which was distant from their homes. Several households ignored the warnings, as they thought it was a false alarm and they did not want to make a long journey with their possessions (as happened with earlier tsunami warnings). Fear of theft of goods discouraged others from using the cyclone shelters. Some women’s perceptions of domestic responsibility for the household assets, in the absence of the male head of household, inhibited them from leaving their homes. In a few cases, the form of purdah practiced precluded women from leaving the home unaccompanied by male relatives.

“There is no cyclone shelter in the village – the nearest one is far away (approx. 4 km). When the cyclone hit, most of us took shelter in the sturdier houses, in one building there were about 500 people... If we could make recommendations to the government, we would tell them to build more cyclone shelters (with enough space for both people and livestock) and to make sure that warnings are announced on microphones in all villages, not just in the market, so that the women can also hear them in their homes.”
- Ketachara I, Mathbaria upazila

“When the cyclone hit, most of us were alone with our children because our husbands are fishermen and they travel far away for their work... Many people in the village did not survive... We did not receive any warnings about the cyclone because there were no microphone announcements in the village. If we had received any warnings about the cyclone we would have moved. We would have gone to the cyclone shelter (even though it’s 5 km away) to save our children. We want the government to build a cyclone shelter that is closer to our village.” – Katchara II, Hatchira Village, Mathbaria upazila

⁴⁴ CARE (December 2007), *Rapid Gender Assessment of SIDR Response of CARE Bangladesh*. Dhaka: CARE Bangladesh, p 5.

Facilities within cyclone shelters for water and sanitation, women's privacy, food storage, and general maintenance were reported to be poor. One NGO also reported that some people were denied access to the shelters, such as sex workers. A study by SCF, following the 1998 floods, found that certain marginalized groups do get turned away from the shelters, such as street children. It also found several cases of abuse and neglect of children within shelters for a range of reasons.⁴⁵

Given the seeming preference among many households to shelter in neighboring houses that are strong enough to withstand surge and winds, in communities where such houses exist, it may be possible to identify such "safe havens" where people can go in the event of a warning being issued. This could reduce the need for expensive cyclone shelters to focus on locations where suitable houses cannot be found.

The British Red Cross, in partnership with the Bangladesh Red Crescent Society, is also investigating options to strengthen asset protection as a part of disaster preparedness (for example, identifying safe havens for boats).

Coping strategies

It was anecdotally reported by some NGOs that many poor and vulnerable households were showing a considerable degree of resilience and some were initiating self-recovery strategies, based on established coping mechanisms. However, some of these coping strategies have potentially negative consequences over the medium term, as they may further increase poverty and/or vulnerability to future shocks and hazards.

The coping strategies reported to be most widely in use include:

- Borrowing funds
- Relying on relief distributions and changing the normal diet;
- Reducing the frequency and quality of meals
- Searching for "wild foods" from the forest, instead of normal market purchases
- Using savings to meet basic needs
- Begging.

The major single source of income for many of the rural poor is loans and credit. An average poor family may have one to three loans at any one time, totaling in the region of BDT 5,000-10,000. All poor communities in the cyclone-affected areas were already carrying debt loads.

During the relief phase of the Cyclone Sidr response, livelihoods have received relatively less attention than other areas. The cyclone has negatively affected people's debt as they have been forced to take out further loans for immediate survival and to replace livelihood assets. A number of households have taken out loans from landlords or neighbors to replace their lost livelihoods assets, for example, to buy chickens or goods to restock a shop.

Moneylenders also are offering high interest loans for small business, and Oxfam has reported that some lack the financial literacy to understand the implications for loan repayment. For example: A woman in Pirojpur District has taken a private loan for one year of BDT 10,000 to rebuild a boat. The interest owed will be BDT 5,000. If she defaults, the woman will have to

⁴⁵ Save the Children Fund (2000), *Watermarks: Child Protection During Floods in Bangladesh*. Dhaka: SCF.

forfeit the boat and her fishing nets. The average daily catch is BDT 150 over approximately 15 days during the month.

Most NGOs expressed concern about the ability of poorer households to repay their loans, potentially increasing both their poverty levels and vulnerability to future shocks. One anticipated an out migration from the area once the current six-month credit repayment grace period is lifted by the microfinance institutions and the banks. The impact of potentially higher than normal default rates on financial institutions is unknown.

Following the 1998 floods, households also borrowed from non-institutional sources such as relatives, friends, and neighbors. Borrowing from NGOs or banks was more focused on farming and business investments. There was also considerable borrowing from money lenders at high rates of interest. Many households were still repaying these debts a year later. Despite a widespread network of microfinance institutions, there was also insufficient credit available during the recovery period.⁴⁶ A UK Disasters Emergency Committee review of assistance provided through UK sources also noted that well-developed credit and savings programs serviced the poor but did not always reach the poorest members of the community.⁴⁷

These findings echo the outcomes of a study of 62 low-income agricultural villages in Bangladesh done by the Bangladesh Institute of Development Studies. It was found that, across socioeconomic groups, only 16 percent had access to soft credit schemes. Small landowners and agricultural laborers had little access to micro-credit and few savings and assets.⁴⁸

This indicates that special efforts will be needed to ensure that sufficient amounts of credit are offered by microfinance institutions and banks on soft terms to facilitate the recovery of those affected by Cyclone Sidr and that the credit reaches the most vulnerable, poor, and marginalized. This also implies extending support beyond the existing client base.

⁴⁶ Beck T (April 2005), *Learning Lessons from Disaster Recovery: The Case of Bangladesh*, p 19.

⁴⁷ DEC (2000a). *Bangladesh 1998 Flood Appeal – An independent evaluation*. Final report. London:Disasters Emergency Committee.

⁴⁸ Sen B (2002), *Risks, Vulnerability and Poverty in Bangladesh: Issues and Evidence*. Dhaka BIDS (draft).

Annex 9 – Using Satellite Imagery for Damage Detection

Remote sensing technology is increasingly applied as a disaster damage assessment tool. Under the broad aim of identifying ways in which disaster response activities and damage and loss assessments can be improved through the integration of remote sensing technologies, EC-JRC (European Commission - Joint Research Centre) is investigating damage detection algorithms for images acquired from satellites.

JRC joined the JDNLA team with the objective of refining techniques for post-disaster damage detection from remotely-sensed imagery. Based on the comparative analysis of remote sensing images acquired before and after the event, and of ground-truthing of selected structures through field visits, the technological infrastructure and algorithms for damage assessments are being improved.

The following shows three examples from a JRC study on damages from Cyclone Sidr:

Example 1

Damage on a built-up structure - Kalapara area - EC funded village:

Quickbird image - pre cyclone (Dec-2006)



Quickbird image - post cyclone (Nov-2007)



Ground truth reference collection (20 Jan 2007)



Example 2

Damages to a village are hardly detectable from satellite imagery because of the presence of dense vegetation- Kalapara area. Nevertheless, damages on the vegetation are observable.

Quickbird image - pre cyclone (Dec-2006):



Quickbird image - post cyclone (Nov-2007):



Ground truth reference collection (20 Jan 2007). Partially rebuilt house after its complete destruction:



Ground truth reference collection (20 Jan 2007). Still-standing cyclone shelter:



Example 3

Damage on a sluice gate - Kalapara area:

Quickbird image - pre cyclone (Dec-2006)



Quickbird image - post cyclone (Nov-2007)



Ground truth reference collection (22 Jan 2007)



ECONOMIC RELATIONS DIVISION

Ministry of Finance
Government of the People's Republic of Bangladesh
Block 8, Room 3, Sher-e-Bangla Nagar
Dhaka 1207, Bangladesh
Tel: 880-2-8112641
Fax: 880-2-8113088

THE EUROPEAN COMMISSION

200 RUE DE LOI
B-1049 Brussels, Belgium
Tel: 32-2-2991111
Fax: 32-2-950151
www.ec.europa.eu

THE WORLD BANK

1818 H Street, N.W.
Washington, D.C.
20433, USA
Tel: 1-202-473-1000
Fax: 1-202-477-6391
www.worldbank.org

DELEGATION OF THE EUROPEAN COMMISSION

TO BANGLADESH

Plot 7, Road 84, Gulsjan
Dhaka-1212, Bangladesh
Tel: 880-2-8824730
Fax: 880-2- 9888622
www.delbangladesh.eu

WORLD BANK OFFICE DHAKA

Plot E-32, Agargaon
Sher-e-Bangla Nagar
Dhaka 1207, Bangladesh
Tel: 880-2-8159001-28
Fax: 880-2-8159029-30
www.worldbank.org.bd