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Assessment of the Effectiveness of Homestead Raising and Mound Protection Works Implemented by the SHOUHARDO Program

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LIST OF PNGOs

ASEAB	Association Socio Economic Advancement of Bangladesh)
BDSC	Bangladesh Development Service Center
BRIF	Bangladesh Rural Improvement Foundation
BURO-Tangail	Basic Unit for Resources & Opportunities
DAM	Dhaka Ahsania Mission
ESDO	Eco-Social Development Organization
GBS	Gram Bikash Sangstha
JSKS	Jhanjira Samaj Kallyan Sangstha
MISUK	Mirjagonj Samaj Unnayan Sangstha
MJSKS	Mahideb Jubo Samaj Kallyan Samity
MMS	Manab Mukti Sangstha
NDP	National Development Program
PP	PASASHIK PARSAD
SAP	South Asia Partnership
SKS	Samaj Kallyan Sangstha

ABBREVIATIONS

CAP	Community Action Plan
CEGIS	Centre for Environment and Geographical Information Systems
CFW	Cash for Works
CHD	Comprehensive Homestead Development
CLP	Chars Livelihood Project
EKATA	Empowerment, Knowledge and Transformative Action
FGD	Focus Group Discussion
FY	Financial Year
HFL	Highest flood level
HH	Household
IFSP	Integrated Food Security Program
IGA	Income Generating Activity
PEP	Poor and extremely poor (households)
USAID	United States Agency for International Development
VDC	Village Development Committee

EXECUTIVE SUMMARY

BACKGROUND

S1. CARE Bangladesh launched the SHOUHARDO program in the haor, and north and mid-char of Bangladesh in October 2004. The SHOUHARDO program is funded by USAID and the Government of Bangladesh and intends to improve livelihood opportunities of poor and extreme poor (PEP) households by implementing opportunities to enhance their socio-economic conditions, livelihoods and rights. SHOUHARDO includes infrastructure interventions to protect households and communities from damage during floods. In the north and mid-char regions, the main infrastructure intervention is the **raising the elevation of homestead areas** of vulnerable poor households so that the homestead area is above flood level and in haor areas, the main infrastructure intervention is works to **protect village mounds from wave erosion**.

S.2 SHOUHARDO commissioned this independent Study to evaluate the effectiveness and assess the performance of raised homesteads and village mound protection works during the 2007 flood season. The Study was undertaken from January 9th to February 1st, 2008. The Study Team comprised of Dr. Ian Tod. Water Resources Specialist and Team Leader; Ms. Dil Afroz, PRA Specialist and HR Trainer; Mr. Md. Sekender Ali, Rural Construction Specialist; Ms. Afroza Sultana, graduate Economist, and Mr. Mihir Kanti Mondal, graduate Business Manager.

PART I ASSESSMENT OF HOMESTEAD RAISING IN CHAR REGIONS

S.3 Homesteads (*bari*) in the chars comprise of one or more buildings and a courtyard that may be partly shielded by a fence. The buildings tend to have a single room though sometimes there are internal partitions. Poorer households can only afford one building for all purposes including domestic activities, keeping livestock, etc., and cooking is done in an open space adjacent to the building. More than one household may share the same courtyard but each household will have a separate cooking place (*chula*).

S.4 Traditionally, individuals and rural communities have been left to develop their own strategies for coping with floods, but a shortage of resources combined with changing hydrologic conditions have resulted in many households not being able to protect their property or possessions from larger floods, as was the case in 1987 and 1988 and more recently in 1998, 2004 and 2007. Even in years with average floods, more than 50% of homesteads may be flooded and income-earning opportunities scarce during the flood season. Poor and extreme-poor households are particularly vulnerable as they have few resources to cope with floods and protect their homesteads

S5. In order to reduce the vulnerability of PEP households in char areas during floods, SHOUHARDO funds the raising the homestead areas under the Food and Cash for Works Program (F/CWP). Homesteads are raised by placing earth in layers on top of the existing compound area until the level of the homestead courtyard is above the design flood level (usually taken as the 1 in 25 year flood level) plus a freeboard of 0.6 m (2 ft). Existing homestead buildings are dismantled and removed prior to raising the compound area, and reconstructed once earthworks are complete. Raising the level of homestead compounds directly benefits individual households or groups of households sharing the same compound and implementation of the measure is only targeted towards PEP households.

S6. The Study Team collected information about the impact of recent floods on households in the char regions by holding 22 Focus Group Discussions (FGDs) in 12 SHOUHARDO villages in 7 districts. In addition, the Team reviewed reports on the floods in the chars and held discussions about the impacts of homestead raising and recent floods with SHOUHARDO staff at their headquarters and regional offices, and with staff of government, non-government and program organisations working in the chars. The Study Team used the information and data collected to assess the effectiveness of homestead raising in reducing the impact of flood on SHOUHARDO households.

RAISING OF HOMESTEADS UNDER THE SHOUHARDO PROGRAM

S7. SHOUHARDO activities are based on helping communities take actions to improve their food security and improve livelihoods, and homestead raising was identified as a priority need during the preparation of Community Acton Plans (CAP) prepared by the Village Development Committee (VDC) and all households in the community. The purpose of the homestead raising is to provide a flood-free environment so that households can undertake or continue activities to improve their livelihoods rather than use their resources in coping with or recovering from floods. SHOUHARDO also provides funds to lengthen hand tubewells so that the hand pumps are on the top of the raised homestead mound to provide safe water for drinking during floods.

S8. Homestead raising was implemented by either 16 partner non-government organisations (PNGOs) or directly by SHOUHARDO. During FY06 and FY07, a total of 3671 homestead raising schemes were implemented. 34% of the raised homesteads belonged to extreme-poor households, while 65% belonged to poor households. Based on a sample of 22 villages, the average (top) area provided on raised homesteads was 210 m^2/HH, and homestead areas were raised an average height of 1.5 m. The average volume of earthworks was 308.9 m^3/HH. The average program cost of homestead raising was Tk 18032/HH. In the same sample villages, 45% of the workers were female and 55% male. The schemes generated 20386 person-days of employment for female workers and 27173 person-days for male workers. An average raised homestead scheme provided 193 person-days of employment of which 43% was for female workers and 57% for male workers.

S9. During the 2007 flood, 77% of the homesteads raised were above the 2007 peak flood level, but unfortunately 23% of raised homesteads were inundated during the flood. Although the homesteads were inundated, the households were still much better off than those households whose homesteads were not raised as the depth of water in the inundated raised homesteads was 1.0 to 1.5 m less than the depth of water in non-raised homesteads. The quality of the raised homesteads in the FGD villages was generally good. Side slopes were turfed and also frequently used for homestead gardening. There were no incidents reported in SHOUHARDO villages of homestead mounds collapsing during the flood. Overall, no raised homesteads in the Mid-char region and only 23 raised homesteads in the North Char Region (<1% overall) were lost to river erosion following the 2007 flood.

S10. During the 2007 flood, households with non-raised homesteads took refuge on raised homesteads. An estimated 3143 households took refuge on the 3671 homesteads raised by SHOUHARDO, which means that on average about 1 additional household took refuge on each raised homestead.

ASSESSMENT OF HOMESTEAD RAISING

S11. Floods are an annual hazard for households living in the chars. Households develop strategies to cope with and recover from floods, including caring for livestock, maintaining their houses and homestead compounds, and securing stored items such as firewood and personal possessions,

although extremely poor SHOUHARDO households have few possessions and do not store food grain. Most SHOUHARDO households were able to access clean drinking water from hand tubewells (HTW) during the floods, but the availability of sanitary latrines in SHOUHARDO households is still low. SHOUHARDO households did not receive any warning of the floods or any forecasts of water level changes during the floods.

S12. Water levels during the 2007 flood were about 1-1.5m above the average flood level. The return period for the flood was in the range of 1 in 25 years. The duration of the flood was about 55 days. This is longer than the duration of normal floods, and caused additional hardship as employment opportunities were not available for an extended period. The main problems for women from households with raised homesteads during the 2007 floods were sanitation and preparing and cooking food, while for men the main problems were getting food and transport. Women from non-raised households had similar problems but the additional problem of finding a suitable place to give birth was frequently mentioned. Households from raised and non-raised homesteads took similar actions to recover from the flood, mainly migrating to find work and taking loans. Households from raised homesteads had the advantage of being able to migrate earlier as they did not have to repair so much damage to their buildings or ensure security of their homestead.

S13. Benefits of creating a flood-free homestead area include more dry space for domestic activities, reduction in diarrhoea and skin diseases, more scope for homestead gardens, fewer distress sales of livestock, removing need to move household and livestock to higher ground, reduction in building maintenance costs, increased social cohesion, increased confidence in dealing with floods and outside services, and enhancing the impact other SHOUHARDO support services.

S14. Taking into account the periodic nature of flooding and the risk of losing the investment to erosion, the financial analysis indicates that raising of homesteads is a sound financial investment as long as the homesteads remain for at least 7 years after construction in the North Char region and 5 years in the Mid-char region, the difference being due to the higher initial investment in homestead raising in the North Char region. There is evidence to suggest that this rate of homestead survival is achievable.

S15. In the short-term, a major benefit of homestead raising is the generation of employment that can be targeted at women from PEP households. Overall, about 30-50% of the employment in homestead raising was allocated to women. Workers on homestead raising activities are paid the same wage rates. In the long-term, homestead directly benefits women by providing a greatly improved environment during floods for carrying out domestic activities; opportunity for year-round income and enhanced nutrition from homestead gardening; better conditions for livestock rearing; scope for greater mobility during the flood season as homestead area is more secure; better conditions for giving birth; access to safe drinking water during floods, improved family well-being and health, due to less diarrhoea and skin disease; and scope for uninterrupted delivery of other SHOUHARDO services. During the FGDs, participants often said that women were empowered by raised homesteads due to several factors including increased bargaining power, improved access to markets, scope for developing income earning activities that continue throughout the flood, and enhanced capacity for leadership

S16. The Study concludes that homestead raising is provides major benefits to PEP households by providing flood-free homestead in an environment where floods are a major annual hazard. Homestead raising can be targeted directly to benefit PEP households and is a cost effective intervention that provides scope for uninterrupted delivery of other SHOUHARDO support services.

DISCUSSION AND RECOMMENDATIONS

S17. Issues related to homestead raising that need further consideration and action include:

- Determination of Highest Flood Level.
- Need for Higher Level Planning
- Wage Rates
- Ownership of Homestead Land
- Sustainability
- Risk Assessment
- Advocacy of transboundary water issues and impact of physical works on major rivers
- Rights issue of adequate shelter as a basic human right

S18. The main recommendations of the Study are:

- SHOUHARDO should continue to fund the raising of homestead areas, as homestead raising provides significant benefits directly to PEP households.
- SHOUHARDO should increase the funding for homestead raising to make the benefits of the activity available to a greater number of PEP households.
- As part of their homestead raising activities during the remaining period of Program, SHOUHARDO should develop ways to make the investment in homestead raising sustainable.
- SHOUHARDO should update the risk of floods and erosion in the chars and promote homestead raising as a way to address poverty in the chars of major rivers in Bangladesh.

PART II MOUND PROTECTION WORKS IN THE HAOR REGION

S19. People in the haor area live in densely-populated, scattered villages located on ati (raised mounds of earth) that have been built up over many years on kandha (raised river banks) and ridges of wetlands. Villages comprise of one or more distinct settlement mounds that are sometimes connected but are often separate ‘islands’ during the monsoon. Mounds are constructed on the highest land available but still need to be 3-5 m above ground level for the top to be above normal flood levels. Many villages are very isolated and have limited interaction with services from government or non-government organizations. One of the main problems of villagers during the monsoon is the erosion of the village mound by waves

S20. The task of protecting village mounds from wave erosion is difficult because the mounds are constructed from easily-erodable local soils. Technical solutions to protect village mounds from wave erosion involve measures to absorb the energy of waves and comprise of either re-establishing trees and other vegetative materials around the village to absorb the energy of waves before the waves reach the mound, or constructing a barrier made of hard, durable materials such as bricks, stones or rocks to absorb the energy of the waves when they break on the mound. Unfortunately, in the haor area, as in most of Bangladesh, there are no naturally occurring ‘hard’ materials such as stones or rocks, and ‘hard’ materials have to be imported, at considerable expense due to the transport costs involved.

S21. In 2003, towards the end of the CARE-Bangladesh’s previous Program in the haor (IFSP), brick walls without mortar were identified as being a feasible option for wave protection walls. This type of wall was tried because reportedly some villagers successfully constructed such walls using their

own resources. During FY06 and FY07, SHOUHARDO funded the construction of 28 wave protection schemes comprising of un-mortared brick walls. Three (3) other wave protection schemes comprising of concrete block revetments or freestanding concrete-and-brick walls (referred to as wave protection walls) were also constructed by LGED under SHOUHARDO.

S22. With respect to floods and wave erosion, a key factor is the depth of water adjacent to the mound, as the water depth needs to be greater than about 0.5 to1 m for waves to threaten the mounds. If the water depth is less than about 0.5 m, waves will break before reaching the mound. Significant floods occurred in the haor area in 1987, 1988, 1993, 1998, 2004 and 2007, and, during these years, village mounds were very vulnerable to wave erosion as water levels were high for extended periods.

S23. The approach of the Study Team was to collect information about the impact of recent floods on households in the haor regions by holding Focus Group Discussions (FGDs) with SHOUHARDO households in 4 communities with wave protection brick walls (Rahmadpur, Boali, Shibpur, and Baher Bauli) and one community still relying on traditional methods to protect their mound. In addition, the Team reviewed reports on floods in haor areas and held discussions about the impacts of wave protection walls and recent floods with SHOUHARDO staff at their headquarters and regional offices, and with staff of government, non-government and program organisations working in the haor.

REVIEW OF VILLAGE PROTECTION WORKS

S24. The purpose of the wave protection brick wall is to resist a combination of earth, hydrostatic and hydraulic loadings. The brick wall is in effect functioning as a retaining wall, with the reliance based on self-weight to satisfy stability requirements, both in respect to overturning and sliding. The absence of cement mortar between the bricks means that resistance to horizontal loads is from the friction between the bricks.

S25. Soil loadings occur when there is active pressure from the soil. Active loads may occur when the soil is saturated due to rainfall or drainage water from tubewells and there is no water on the outside of the wall. The brick wall provides little resistance to active pressures in the soil, with the result that the bricks will move and potentially fail. This is the probable cause of failure of sections of the brick wall in Baher Bauli and Rahmadpur villages. The remedy to avoid repetition of this failure mechanism is to install drains within the soil mound to prevent water pressures from building up within the soil mass.

S26. Additional details of the design that need further consideration are:

- Corners:
- Foundations:
- Drainage from the top of the mound;
- Planting of Trees; and
- Maintenance.

A comprehensive structural analysis of the wave protection brick wall should be undertaken to ensure the integrity of the design. In addition, a manual describing the maintenance requirements of brick walls should be prepared and disseminated to all villages with brick wave protection walls.

S27. The long-term benefits of the wave protection measures include: improved health of children and adults; improved environment due to more space for domestic activities and for income earning activities; scope for latrine facilities; more space for livestock husbandry; removal of the need for the

annual expense of constructing traditional protection works; improved family relationships due to increased security and less strain on resources; improved 'security' of settlement; and improved status for villagers amongst neighbouring communities.

S28. Wave protection schemes benefit all households in a village, including better off households as it is not possible to separate out the homesteads of SHOUHARDO households. In contrast, homestead raising in the Char Regions is targeted at only PEP households.

S29. The cost of wave protection structures funded by SHOUHARDO ranges from Tk 264,000 to Tk 6,260,000 per scheme. The number of households benefiting from wave protection schemes ranges from 39 to 952 households, of which 31 and 467 were poor or extremely poor (PEP) households respectively. There is a great range in the cost/HH of brick wave protection walls. The cost per household in the four villages visited by the Study Team ranged from Tk 36,322/all households (Tk49.942/PEP households) to Tk 7,570/all households (Tk 14,976/PEP household) in Baher Bauli. In other villages, the cost per household of brick wall protection works was much lower. For example, the brick wall protection in Krishnapur (Poschim Austagram) cost Tk 528/all households (Tk 1000/PEP households). Community contributions to the costs are in the range of 20-30% of the total costs, depending on the area of highland restored.

S30. The main quantifiable benefits of replacing the traditional protection measures with the un-mortared brick wall are savings to villagers from: removing the need to construct traditional protection methods annually; preventing annual erosion of highland and the need to replace the highland lost to erosion; providing secure highland for IGAs; avoiding the costs of moving houses when erosion threatens; reduction in health care costs due to less sickness in the drier environment and increased value of homestead land. Financial assessment of the benefits and costs indicate that the construction of the wave protection brick wall is a sound financial investment (IRR =12%) if the wall lasts for 20 years or more. There are additional benefits that are either difficult to quantify or there are insufficient data to quantify such as improved security and enhanced well-being of all households in the community. If these benefits were included in the benefit/cost analysis, the IRR would increase and the investment would be even more favourable.

S31. SHOUHARDO do not have the resources to solve wave protection problems throughout the haor and hence SHOUHARDO needs to start advocating on behalf of haor communities for wave protection works to be funded by large funding organisations such as the World Bank or Asian Development Bank. In order for SHOUHARDO to advocate for wave protection works for haor communities to be provided by others, SHOUHARDO needs to make their work on wave protection known to a wider audience, and, for this purpose, the following actions are recommended:

- Prepare a manual on wave highlighting the un-mortared brick wall.
- Identify the scope for protective walls.
- Study in detail the social and economic impact of the wave protection walls.
- Organize a workshop on wave protection measures for haor communities.

S32. The main conclusions of the Study are that there are major benefits to PEP households from the construction of wave protection walls. Investment in the walls is technically and financially sound. The walls constructed by SHOUHARDO have generally performed well, although some modifications are required to the design. The main recommendations are that SHOUHARDO should continue with funding the construction of wave protection measures and advocate the provision of wave protection works as a solution to a major and fundamental problem of haor communities.

PREAMBLE

BACKGROUND

In October 2004, CARE Bangladesh launched SHOUHARDO program in different geographical locations (haor, north and mid-char and coastal regions) of Bangladesh. The SHOUHARDO program is funded by USAID and the Government of Bangladesh and intends to improve livelihood opportunities of the poor and extreme poor (PEP) households through its program implementation. The goal and objectives of SHOUHARDO were formulated after careful analysis of overall food insecurity in Bangladesh.

In SHOUHARDO, opportunities are implemented to enhance the socio-economic conditions, livelihoods and rights of households and include infrastructure interventions to protect households and communities from damage during floods. The type of infrastructure intervention is based on meeting the specific needs of households living in the different flood environments of the program's geographical regions.

In the north and mid-char regions, the main infrastructure intervention is the **raising the elevation of homestead areas** of vulnerable poor households so that the homestead area is above flood level, and, in haor areas, the main infrastructure intervention is works to **protect village mounds from wave erosion**.

SHOUHARDO commissioned this Independent Study to evaluate the effectiveness of these main infrastructure interventions and to assess:

I) How well the raised homestead areas and village mound protection works performed during the last flood season;

II) The extent the infrastructure interventions were able to protect household assets, and

III) The possibility of further expansion of these interventions.

The timing for the Study is appropriate as both the char and haor areas experienced significant floods during the2007 monsoon season.

FLOOD ENVIRONMENTS

Floods are an annual feature of life in Bangladesh, and the extent of flooding each year varies with the flood environment at a specific location. The flood environment is influenced by various factors including the source of floodwater, the amount of rainfall, the layout of water bodies, the rate of rise of floodwater, the duration of floods, local topography and constrictions to drainage.

Different types of flood environments in Bangladesh include:

- Overbank spill from the major rivers.
- Active flood plains (chars) in the main river channels
- Overbank spill form secondary or minor rivers
- Major beels
- Haor areas
- Flash floods
- Storm surges in coastal areas.

In addition to flood hazards, communities face the related hazard of erosion. As with the hydrology, the erosion hazard varies in the different flood environments and depends on the characteristics of the floods. In the char region, the main erosion hazard is from erosion of land (including homestead land) when river

channels change their course. In haor areas, the main erosion hazard is the erosion of village mounds by waves generated by wind passing over the large expanses of open water that dominate the landscape during the monsoon season.

The char and the haor areas are two of the most challenging flood environments in Bangladesh, as the hydrologic characteristics create extreme contrasts in living conditions between seasons and physical conditions that may change severely within short periods of time. In both the char and haor areas, communities have adapted their livelihoods to cope with the challenges of the physical environment, and have features that are unique to the respective environments, but there are still many poor or extremely poor households that remain very vulnerable to the vagaries of the environment.

The planning, design and implementation of activities to improve the livelihood and food security of the inhabitants of char and hoar areas need to take account of the physical and social characteristics of the different flood environments. The two basic questions that need to be asked of SHOUHARDO activities and indeed of activities of any development program working in the char or haor regions are: "What happens to the activity during and after the flood?" and "What happens to the activity during and after erosion?"

THE SHOUHARDO PROGRAM

SHOUHARDO (Strengthening Household Ability to Respond to Development Opportunities) is a five-year program covering the period between October 2004 and September 2009. The overall goal of SHOUHARDO is to **sustainably reduce chronic and transitory food insecurity of 400,000 vulnerable households (HHs) in 18 districts of Bangladesh, by 2009** (CARE 2007). A total of 392,581 rural households and 19,894 urban households are targeted from 493 unions, 16 municipalities and one city corporation. The program operates in four major regions: Haor, North Chars, Mid-Chars and Coastal.

The Program has four strategic objectives are:

- SO1: Agriculture: Improved availability/economic access to food through the strengthening of livelihoods entitlements and enhancing accountability of service providers;
- SO2: Health and Nutrition: Sustainable improvement in the health and nutrition of project participants.
- SO3: Empowerment: Enhanced empowerment of 400,000 women and girls from targeted vulnerable households.
- SO4: Humanitarian Assistance: Targeted communities and institutions are better able to prepare for, mitigate and respond to natural disasters.

The Program targets the poorest and most vulnerable households, especially the most disadvantaged women and girls living in the most poverty stricken and remote chars and haors, coastal and urban slums.

The population of the Program consists of four major occupational groups: "Agriculture based", "Fisheries based", "Comprehensive Homestead Development (CHD) based" and Income Generation Activities (IGA) Based". To these occupational groups, other interventions are provided such as Health Hygiene and Nutrition (HHN) and Early Child Care and Development (ECCD) and Women's Groups. In addition, SHOUHARDO undertook Food for Works (FFW) but this has been replaced completely by Cash for Works (CFW). Through Cash for Work (CFW), SHOUHARDO generates employment for the hardest-hit households within the Program's target population thereby alleviating potential under-nutrition in the periods of greatest distress, and improves the physical environment by flood proofing homesteads, communities and communal places, and constructing embankments, drains, renovates access roads and emergency shelters.

SHOUHARDO activities are being implemented in partnership with non-government organisations, research institutions and government and private sector organisations, all of whom are actively involved in different aspects of the program. In September 2007, the Program was being implemented by 46 partner non-government organisations (PNGOs), union parishads, the Local Government Engineering Department and directly by CARE-Bangladesh staff. The Ministry of Local Government, Rural Development and Cooperatives is the line ministry for the Program. Program Advisory and Coordination Committees (PACC) have been formed at national, divisional district and upazila levels to ensure inter-ministerial and inter-departmental coordination at the different levels.

A significant dimension of SHOUHARDO is providing direct food assistance to beneficiaries to mitigate under-nutrition of children from the onset to positively impact on stunting and wasting. Food is distributed under the "Mother, Child, Health Nutrition (MCHN)" component to pregnant and lactating mothers to ensure that they remain healthy so that the children they nurse are also kept healthy within the first two years of their life.

SHOUHARDO facilitates numerous advocacy and awareness campaigns to increase knowledge, promote behavioural change, influence policy, implement programs and increase understanding of the issues of he hard-core poor. The awareness campaigns are designed and implemented using creative methods jointly developed by CARE-Bangladesh and their partners.

SCOPE OF WORK

The overall objective of the Study is to assess the effectiveness of the elevated homestead raising and mound protection works implemented during FY06 and FY07 and document the justification for wide/long-term expansion. The specific objectives are to:

- Assess how well the elevated homesteads/mounds performed during last flood, including saving mitigation costs;
- Document cost versus benefit analysis of the homestead elevation/mound protection activities;
- Review whether the intervention needs a social or technical adjustment; and
- Identify some key points/variables to conducting a detail land tenure system study.

The specific tasks required to accomplish the overall objective are:

- Review the relevant documents and discussion with program people;
- Review the design and implementation methodology, magnitude of flood 2007, environmental consideration etc.;
- Determine survey area, such as, the districts, unions, and villages;
- Conduct focus group sessions (FGDs) in around 20 villages covering significant number of elevated homesteads in the North char and Mid-char regions and a few mound protection sites;
- Make a comparative analysis between elevated cluster homesteads and individual homesteads and communities with protected mounds and unprotected mounds;
- Analyze the findings of the assessment and share reporting format with CARE;
- Suggest areas for improvement in the technology adopted; and
- Facilitate a debriefing session on the key findings, analysis, and recommendations for CARE, Donors, and relevant stakeholders.

THE STUDY TEAM

The Study Team comprised of Dr. Ian Tod. Water Resources Specialist and Team Leader; Ms. Dil Afroz, PRA Specialist and HR Trainer; Mr. Md. Sekender Ali, Rural Construction Specialist; Ms. Afroza Sultana, graduate Economist, and Mr. Mihir Kanti Mondal, graduate Business Manager.

The Study was undertaken from January 9h to February 1st, 2008. The Study Team focused mainly on assessing the effectiveness of raised homesteads in the north and mid-char regions, but also more briefly reviewed village protection works in the hoar region. The Study Team visited the North and Mid-Char Regions for 11 days from January 13th to January 23rd inclusive. The Team visited the Haor Region for two days on January 27th and 28th inclusive. The Team also held discussions with CARE-Bangladesh HQ staff, government officials and staff of other organisations and programs working in the char and haor areas. The Team presented the findings of their Study to CARE-Bangladesh HQ staff on January 30th and to USAID staff on January 31st.

THIS REPORT

The physical and social environments of the char and haor areas are very different, and the infrastructure needs of communities living in the respective environments are also very different. Hence, the analysis and findings of this Study are presented in two parts to reflect the different environments. In Part I, the raising of homestead areas in the char regions is assessed and in Part II, village protection works in the haor areas are reviewed.

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PART I RAISING OF HOMESTEAD AREAS IN CHAR REGIONS

1. INTRODUCTION

1.1 The Char Environment

The land within the active flood plain of the main rivers is termed as *chars*. Char is the Bengali term for a "mid-channel island that periodically emerges from the riverbed as a result of accretion" (Elahi et al 1991). Char is also used to refer to other land in the active flood plain that is subject to erosion and accretion, and is classified as:

- Island chars: land that even in the dry season can only be reached by crossing a main river channel, and
- Attached char: land that is accessible during the dry season without crossing a main river channel and yet is inundated or surrounded by water during the monsoon floods.

Additionally, some mainland adjoining the major rivers while not chars in the above sense is also at risk from bank erosion and is just as flood prone as the chars. Setback land is mainland on the riverside of flood protection embankments. It differs from other unprotected mainland because the embankments may provide refuge during floods but may also constrain floodwater, thereby raising flood levels. Unprotected mainland has no embankment between it and the main river channels and is inundated during higher than normal floods.

Chars are a feature of the main rivers of Bangladesh as the main rivers are in a constant state of adjustment and change in response to seasonal variations in their flow and sediment loads. Within the last 200 years or so the river system in Bangladesh has undergone several dramatic changes. In about 1770, the Brahmaputra curved through Bengal and joined the Upper Meghna northeast of Dhaka, while the Ganges followed a separate course to reach the Bay of Bengal west of the Meghna estuary. A major change in the course of the Brahmaputra occurred between 1780 and 1830, when the main flow in the river switched to follow the new Jamuna River and join the Ganges to the east of Dhaka. Flows from the combined rivers formed the Padma River to join the Lower Meghna in a wide delta some 65 kilometres south of the present confluence. Between 1830's and 1857-60, the Padma broke through to join the Meghna near their present confluence. Since then, the Old Brahmaputra is reduced to a flood spillway, and the combined Ganges-Jamuna flow passes through the Padma to join the Meghna just north of Chandpur (ISPAN 1993).

Life in the Brahmaputra-Jamuna chars is dominated by the hydrology of this riverine area. The physical environment changes significantly throughout the year depending on how much water is present, and the changes strongly influence the livelihoods of the char-dwellers including the requirements for shelter and their access to water for domestic, agriculture and other uses.

During monsoon months (June to September), river flows are characteristically high, as a result of snowmelt and monsoon rains in the catchment. River levels start to fall by October as the monsoon rains end, and continue to decline throughout the winter (November - February). During the summer months (March-May) water levels are relatively low being up to 6-8 m below monsoon water levels. The catchment of the Brahmaputra-Jamuna is naturally subject to severe erosion and as a result the river carries

a very heavy silt load, especially during the monsoon months. The combination of large and variable discharges of water and sediments is responsible for the river's braided pattern of multiple and shifting branches separated by chars ('braid bars').

Over the past two centuries, the river channel has been widening, increasing from an average of 6.2 km in 1830 to 10.6 km in 1992. Furthermore, although the long-term widening trend (1830-1992) has averaged 27 m per year, analysis of the trend from 1973 to 1992 shows that the widening has proceeded at an average of 140 m per year. The west bank eroded at an average rate of about 100 m per year between 1973 to 1992 but there are considerable local and short-term variations in erosion. Local bank erosion rates can be much higher but rarely continue for many years (Currey 1985, ISPAN 1993 and EGIS 2000).

The process of bankline erosion and widening has had a major effect on char dwellers and households living in adjacent mainland. From 1981-92 an estimated average of 36,220 people were displaced by erosion of mainland and attached chars every year. Island char erosion and accretion results in more households being displaced. Ninety percent (90%) of the within-bank area had changed between char and water at least once during the period 1973 - 1992, with the consequence that the majority of char dwellers are likely to have been forced to move at least once during this period due to erosion (ISPAN 1993 and Kar et al 2001).

Floods are the main natural hazard faced by char dwellers and, in recent years, there were severe floods in 1987, 1988, 1998 and more recently in 2004 and 2007. In 1987 and 1988, less than 10% of the char area was above water during peak flood. By comparison, in the 'high normal flood' of 1991, about 50% of charland was flooded. Over 90% of houses were flooded in 1988 compared to about one third of the houses in 1991. Normal monsoon floods in the chars tend to be last for weeks rather than months, but floods can occur several times during the monsoon season.

As the floodwater recedes, the emerging land is predominately formed from fine sands. During the late winter and summer seasons when rainfall is sparse, the sand is picked up by frequent strong winds and occasionally tornadoes, causing great discomfort to char dwellers as airborne sand penetrates everything including their houses, their food and their clothing.

Once chars emerge, they change; and human populations make use of the chars in differing ways as the land develops. One progression takes a char from sand deposition to siltation, and then to some kind of vegetation (usually grasses), followed after a period of years by cultivation and eventually human settlement. Given the vagaries of the river morphology, the process can be aborted at any point, and the prospects of change in a given char are a major topic of conversation amongst char men and women. Settlements can be established on a temporary basis while people wait to see whether the island chars will be stabilise or be again lost to erosion.

About 4.3 million people lived on the active floodplain of the main rivers, with the majority living on the Jamuna and Meghna rivers (see Table 1.1 for details). Of the total floodplain population, 1.85 million (43 percent) live on chars, and they are concentrated on the Jamuna and Meghna. In Jamuna, the population are spread along the length of the river, while in the Meghna they are concentrated around the confluence and lower reach. These two rivers are the only ones where the island char population grew after the 1981 census. The island chars of the Padma and Ganges fell during this period as a result of morphological changes and channel widening.

Table 1.1: Population in the Chars (1993 data)

Location	Island chars	Attached Char	Unprotected + Detached mainland	Total
Brahmaputra/Jamuna	512,996	407,052	897,712	1,817,760
Ganges	54,395	141,245	495,788	691,428
Padma	55,630	92,506	470,519	618,655
Meghna	325,485	260,635	572,667	1,158,787
TOTAL	*948,506*	*902,438*	*2,436,686*	*4,286,630*

Source: ISPAN (1995)

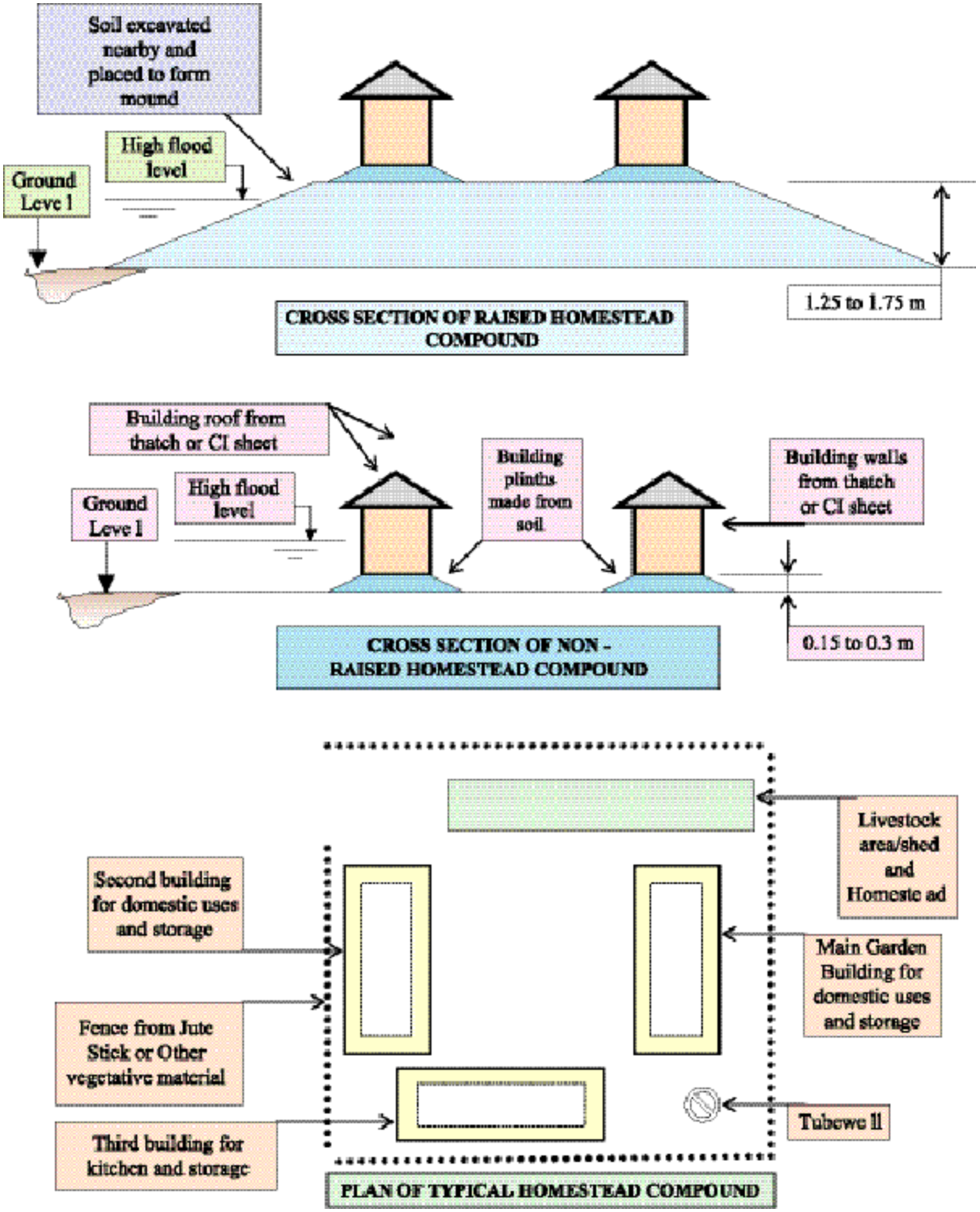
Island and attached chars offer some advantages over mainland area as, for example, the availability of cultivable land is higher than the national average, although chars tends to be less productive. The reasons for the lower productivity may be due to less-fertile soils, but the uncertainties of erosion, frequent flood damage and control by large landowners are also contributing factors. Given the extensive grassland in the chars and the risk of erosion and flood, livestock are ideal assets since they can be moved to safety (unlike the land) and can be sold in times of need.

Meeting the requirements for living in such a harsh environment pose major challenges for households living in the chars, and many households struggle to maintain their livelihoods resulting in widespread poverty amongst char communities. Even by their own assessment, about 80% of char households are poor or extremely poor.

1.2 Homesteads and Shelter

Homesteads (*bari*) in rural Bangladesh including the chars comprise of one or more buildings and a courtyard that may be partly shielded by a fence made from jute sticks or other vegetative materials (see Figure 1.1). The buildings tend to have a single room though sometimes there are internal partitions. If a household has sufficient resources, they will have separate buildings for different purposes. One building will be used for sleeping, sitting, storing possessions and other domestic and social purposes, while a second building will be used for cooking and food preparation, and a third for keeping livestock. Poorer households can only afford one building for all purposes including domestic activities, keeping livestock, etc., and cooking is done in an open space adjacent to the building. More than one household may share the same courtyard but each household will have a separate cooking place (*chula*).

Figure 1.1 Layout of Raised Homestead



The constant threat of erosion and the exposure to frequent floods have a strong influence on the planning, design and construction of shelter in the chars. Two basic types of houses are generally found in the chars:

- *kutcha* house are a basic type of shelter, that is built with a bamboo frame and catkin grass or other natural materials for the roof and wall cladding. The plinth is made from earth.
- *semi-pucca* house are an improved version of the basic shelter. CI sheet is used instead of thatch for the roof, and sometimes also for the wall cladding. Timber is used for the frame and the floor is made from earth.

Pucca houses constructed with concrete roofs, brick walls and concrete floors are not appropriate for the chars due to the high risk of erosion and the only *pucca* buildings found in the chars are constructed by the government.

Costs of houses range from Tk 4,000-6,000 for a typical *kutcha* house to Tk 15,000 - 30,000 for a *semi-pucca* house, depending on the quality of the CI sheet. Ideally, *kutcha* houses should be rebuilt every year, as the materials tend to perish due to insect damage and damp rot after one wet season. However, poor households can seldom afford complete replacement of their house, and spend Tk 500-1000 every year on makeshift repairs. The effect of underspending on maintenance is that the performance of buildings deteriorates over time, and they become flimsy and hazardous structures providing less protection from the weather.

1.3 SHOUHARDO Program and Homestead Raising

SHOUHARDO is implemented in the char regions where floods are major annual hazards that cause severe economic and social disruption to poor and extreme-poor households. Traditionally, individuals and rural communities have been left to develop their own strategies for minimizing the effects of floods, but a shortage of resources combined with changing hydrologic conditions have resulted in many households not being able to protect their property or possessions from larger floods, as was the case in 1987 and 1988 and more recently in 1998, 2004 and 2007. Even in years with average floods, more than 50% of homesteads may be flooded and income-earning opportunities are scarce during the flood season. Poor and extreme-poor households are particularly vulnerable as they have few resources to cope with floods and protect their homesteads

In order to reduce the vulnerability of poor and extreme poor households in char areas during floods, SHOUHARDO facilitates the flood proofing of their homesteads by providing funds to raise the level of the homestead areas (see Figure 1.1) as part of the CFW Program. Homestead raising activities are being undertaken to assist SHOUHARDO in meeting SO1 (Agriculture), SO2 (Health and Nutrition) and SO4 (Humanitarian Assistance).

When homesteads are flooded, the traditional method of coping is to initially raise the height of the bed by attaching short bamboo poles to lengthen the legs. If water continues to rise beyond about 0.3 – 0.6 m (1-2ft), households construct a *macha* or raised platform inside the house. The *macha* is usually about 0.9 0 1.5 m (3-5 ft) above the ground, and all household activities take place on the confined platform including food preparation and cooking, childcare, sleeping etc. As the *macha* may be built almost to roof level, one wall of the house may be removed to provide access to the *macha*, and the lower portions of

walls are removed to allow water to pass through the building without damaging the structure or the walls being washed away by floodwater. If flood water continues to rise more than about 4-5ft inside the house, the space between the *macha* and the roof becomes too confined and the family have to find refuge elsewhere. Platforms for cattle are made by forming mounds of catkin grass and banana stems adjacent to the buildings.

Homesteads are raised by placing earth in layers on top of the existing compound area until the level of the homestead courtyard is above the design flood level (usually taken as the 1 in 25 year flood level) plus a freeboard of 0.6 m (2 ft). Existing homestead buildings have to be dismantled and removed prior to raising the compound area, and reconstructed once the earthworks are complete. The side slopes of the raised compound are turfed to reduce erosion of the soil by rain or floodwaters.

Raising the level of homestead compounds directly benefits individual households or groups of households sharing the same compound and implementation of the measure is targeted towards the poor and extreme-poor households within a village.

During construction of the raised compounds, many householders remarked that they had heard about raising the level of compounds but this was the first time that they had seen it being done. More importantly, householders also said that it was the first time that assistance had been given to them before a flood so that they could change their lifestyle and improve their well-being on their own initiative. Usually they received assistance to repair losses or damages after a flood.

Raising individual or cluster homesteads is in effect providing individual or household-level flood shelters. Until homestead raising was started in the mid-1990's as part of CARE's Infrastructure for Development (IFFD) Program, common practice was to provide community flood shelters that provided to give refuge to numerous households and their possessions. SHOUHARDO is also funding the construction of flood shelters and raising the level of community places such as schools, markets etc. to serve as flood refuges for households without raised homesteads.

1.4 Other Programs in the Char Regions

When CARE-Bangladesh started working in the chars in the mid-1990s, there was no large development program focused on addressing the needs of char households. There were several small and medium-sized programs being implemented by non-government organisations such as Rangpur Dinajpur Rural Service (RDRS) in Kurigram, Gana Unnayan Kendra (GUK) in Gaibandha and Jamuna Char Integrated Development Project (JCIDP) in Tangail. Since the mid-1990s, CARE-Bangladesh worked in the Brahmaputra-Jamuna chars with different large programs (initially the Flood Proofing Pilot Project under the Integrated Food for Development (IFFD) Program, and subsequently the Flood Proofing Project under the Integrated Food Security (IFSP) Program), and are currently implementing the SHOUHARDO program in the North and Mid-Char Regions.

In August 2004, a second large development program was initiated in the Brahmaputra/Jamuna chars, when implementation of the Charland Livelihood Program (CLP) started. CLP is funded by Britain's Department for International Development (DFID), and has a budget similar to SHOUHARDO (CLP 2006). CLP's purpose statement is "improved livelihood security for poor and vulnerable women, men and children living within the riverine areas of five districts of the northern Jamuna" and raising homestead areas for poor and extreme-poor households is the major infrastructure intervention of CLP.

As the chars are prone to floods, flood forecasts and warnings are of relevance to char households. The early warning system for floods in Bangladesh developed from the flood forecasting work done by the BWDB's Flood Forecasting and Warning Centre (FFWC). FFWC was established in 1972, and, since then, FFWC developed a comprehensive system of collecting and processing hydrologic and other data as input

to forecasting models; preparing flood forecasts and warnings on a daily basis and disseminating the forecasts and warnings to a range of government and non-government organisations, media groups and other interested parties. Although there is good work to forecast floods on the main rivers, there is a shortfall in making the forecasts available to potential end-users such as char households (ADB 2006).

Several projects are focused on addressing the shortcomings of the existing EWS for floods including:

- Consolidation and Strengthening of Flood Forecasting and Warning Services (CSFFWS). The objectives of the project were development of flood forecast and inundation model; dissemination of flood forecast information and warning messages; and making FFWC sustainable by the end of the project. (DHI 2005)
- Environmental Monitoring and Information Network (EMIN) embodies a participatory and needs based process to improve coordination between key players in flood plain management and implement an information network to facilitate the planning and management of water and land as it relates to flood and erosion monitoring among national stakeholders and relevant agencies in the Brahmaputra-Jamuna region (ICTDG 2004)
- Community Flood Information Systems (CFIS). The objective of CFIS is to disseminate information on the flood extent, duration and depths of water/ water levels to the community before the flood occurs. The CFIS project was funded by USAID.
- Climate Forecast Applications in Bangladesh (CFAB) Phase I. CFAB's aims are to develop forecasts schemes for short (1-6 days), medium (20-30 days) and long (1-6) months time scales and incorporate these schemes into the FFWC and BMD. CFAB prepares climate forecast data to improve the performance and the lead-time of flood forecasts IWM (2003). CFAB was funded by the USAID Office of Foreign Disaster Assistance (USAID/OFDA).
- Climate Forecast Applications in Bangladesh (CFAB)-Phase II. Based on positive evaluation results, Government of Bangladesh (GoB) endorsed a project to further develop CFAB to improving climate/flood forecast technology and transferring the technologies to Bangladesh institutions (BMD and FFWC). CARE-Bangladesh is one of the partners implementing the project, which is funded by USAID.

There is no recent work analysing changes in erosion and accretion patterns in the Brahmaputra/Jamuna, since the analysis carried out in the early 1990's as part of the Flood Action Plan and funded by USAID (ISPAN 1995 a-e), although there has been work on identifying mainland areas beside the Jamuna that are prone to erosion and informing local communities of the erosion hazard (CEGIS 2007).

1.5 Recent Floods in Char Areas.

Floods are an annual feature for households living in the chars. The key flood characteristics that are of most concern to char households are:

- **Height of floodwaters**. The height of the floodwaters is important as this determines the availability of dry land and determines whether or not their homesteads are under water and also whether or not land-based economic activities will continue.
- **Rate of rise.** The rate of rise of floodwaters determines the time available for households to respond to the flood, especially with respect to ensuring livestock are kept out of the water. Generally water levels in the Brahmaputra/Jamuna change relatively slowly, but in 2007, water levels reportedly changed fairly rapidly, giving households limited time to respond.

- **Timing**. The timing of floods is critical with respect to how the flood coincides with the agricultural calendar. If the flood comes early, then boro/aus crops may not be harvested and if the floods are late, as happened in 2007, planting of aman crops might be delayed.
- **Duration**. Duration of the flood is critical as economic activities and the related employment opportunities almost stop completely during floods. The availability of employment is of importance as most poor char households are reliant on day-labouring, and no employment due to long and high floods causes great hardship.

Data on peak water levels and the return periods of different floods on the Brahmaputra/Jamuna are shown in Table 1.2. Chilmari is about 30 km south of Kurigram town on the Brahmaputra River in the North char, while Sirajganj is on the western side of Bhuapur, Tangail on the Jamuna River in the Mid-Char.

In the last three decades, the most severe flood was in 1988, when over 90% of homesteads in the chars were flooded. Peak water levels during the floods in 2007 were slightly less than the peak water level during 1988 flood at both Chilmari and Sirajganj. Water levels during the 1998 flood were similar to water levels in the 1987 flood.

Table 1.2: Peak Water Levels and Return Periods

Year	Water Level Recording Station			
	Chilmari	Sirajganj		
	Peak Flood level	Return Period (1)	Peak Flood level	Return Period (1)
1987	24.69	20	14.57	12
1988	25.04	86	15.11	52
1989	23.58	1.1	13.65	1.2
1990	23.66	1.2	13.97	2.2
1991	24.37	5.0	13.88	1.8
1998	24.77	Not available	14.76	Not available
2004	24.51	Not available	14.81	Not available
2007	24.81	Not available	14.95	Not available

Notes: (1) A return period of 20 years indicates a flood that occurs about once every 20 years. Based on analysis of data until 1991 (ISPAN 1994).

Features of the floods that are relevant to SHOUHARDO activities including homestead raising include:

- The extent of a flood varies along the length of the rivers, and hence the impact of a flood will be different in different reaches. For example, overall, the return period for the 1988 flood varies from 1 in 50 years at Sirajganj in the Lower Jamuna of the Mid-char region to about 1 in 86 years at Chilmari in the Upper Brahmaputra of the North Char region. In Chilmari, peak water levels were greater in 1998 than 2004, while in Sirajganj; peak water levels were greater in 2004 than in 1998.
- The difference in water levels for the return periods is small. For example, at Sirajganj the difference in water levels between the 1 in 12 year flood and the 1 in 50 year flood is only 0.54 m (1.8 ft). This is due to a greater are of flood plain being available for the floodwaters as water levels rise. The critical factor is that small increases of water level can make a difference between a normal flood, which most char dwellers can accommodate, and a disastrous flood, which causes widespread disruption and suffering.

- Embankments constructed to protect the mainland from flooding restrict over-bank flood flows resulting in higher water levels in the main channels and hence on the chars. Similarly, works to protect the mainland from erosion, such as the groynes constructed north of Sirajganj, affect the erosion and accretion patterns in the nearby chars.

As discussed in Section1.4, there are no systems to warn char households of pending floods, and flood forecasts prepared by the government do not reach the chars in a form that is useful. Char households have to depend on their own observation and interpretation of changes on water level to forecast floods. In addition, there are no data available on the impact of recent floods on the erosion and accretion patterns in the chars.

Additional work is required to determine the present trends of floods in the chars, and the potential impact of climate and other changes on the characteristics of the floods, as consideration of these was outside the scope of this Assessment.

1.6 Purpose and Methodology of this Assessment

The purpose of the Study is to assess the performance of the raised homesteads during the 2007 floods, determine the financial soundness of the investments in homestead raising, and review social, technical and land tenure issues related to homestead raising in order to make recommendations on the way forward for homestead raising.

The approach of the Study Team was to collect information about the impact of recent floods on households in the char regions by holding Focus Group Discussions (FGDs) with SHOUHARDO communities. In addition, the Team reviewed reports on the floods in the chars and held discussions about the impacts of homestead raising and recent floods with SHOUHARDO staff at the headquarters and regional offices, and with staff of government, non-government and program organisations working in the chars. The Study Team used the information and data collected to assess the effectiveness of homestead raising in reducing the impact of flood on SHOUHARDO households.

The Team held 22 FGDs in 12 SHOUHARDO villages as shown in Tables 1.3. The number of FGDs was based on the requirements of the Terms of Reference and the resources and time available for the Study. The locations of the FGD villages were selected by considering:

- Geographical Spread: SHOUHARDO is implemented in 11 districts over about 200 km length of the Brahmaputra/Jamuna River and 100 km of the Teesta River. FGD villages were located in 7 out of the 11 SHOUHARDO districts, with 7 villages being in the Mid-char Region and 5 villages in the North Char Region.
- Age of char. The environment of chars is dynamic and constantly changing. As chars stabilise and become older, communities become more established and invest more resources in and around the homestead. 4 FGD villages were located on mature chars, while 6 FGD villages were located on intermediate chars and 2 FGD villages were located on new chars.
- Impact of Floods. The impact of floods varies depending on the hydrologic features of the flood and the local conditions such as topography. Reportedly, the 2007 flood was more severe for communities in the mid-char region. 7 FGD villages were located in the Mid-char while 5 FGD villages were located in the North Char.

- Number of homesteads raised. An average of about 10 homesteads were raised in most SHOUHARDO villages, benefiting about 5-10% of the eligible households, as shown in Table 1.3. In some direct delivery villages, the number of homesteads raised was higher. In 7 FGD villages, between 4-8% of the eligible homesteads were raised while in 5 FGD villages between 14-30% of the eligible homesteads were raised.
- Implementation. Homestead raising was implemented by either PNGOs or by direct delivery by SHOUHARDO staff. In 7 FGD villages, homestead raising was implemented by PNGOs, while in 5 FGD villages homestead raising was implemented by direct delivery as shown in Table 1.4.
- Accessibility. Villages needed to be accessible by boat and/or walking and/or motorbike within one day. Adjacent or nearby villages were selected to reduce travelling times. Even with planning based on local knowledge, one village, Chowhali, took more than six hours to access, as recent changes in river channels restricted boat access and a 3 km walk was required to reach the village.

Details of the participants in the 22 FGDs are shown in Table 1.4. PNGO staff or SHOUHARDO staff asked SHOUHARDO households to participate in the FGDs, prior to the arrival of the Study Team. Upon arrival, the Study Team divided the assembled households into two groups: households with raised homesteads and households whose homestead had not been raised. 8 FGDs were held with households with raised homesteads, 10 FGDs were held with households whose homesteads had not been raised and 4 FGDs were held with mixed households.

In the 12 FGDs with households with raised homestead, the number of participating households ranged from 4 to 16 households, with an average participation of 11 SHOUHARDO households in each FGD. On average, participating households were represented by 7 females and by 4 males. In the 10 FGDs with SHOUHARDO households whose homesteads had not been raised, the number of participating households ranged from 10 to 34, with an average participation of 17 households in each FGD. On average, 12 females and 5 males represented participating households. The number of households participating in the FGDs with non-raised households was larger than the number of households participating in the FGDs with raised homesteads because only a small percentage of eligible households were raised as shown in Table 1.3. In both sets of FGDs, more females participated in the FGDs, as male members of households were working outside the village.

The Study Team followed a guideline while facilitating the FGDs and the Guideline for the FGDs with households with raised homesteads is given Annex A. The Guideline for the FGDs with households with non-raised homesteads was similar but some questions were adjusted to enquire about impacts specifically arising from homesteads not being raised during the 2007 flood, and the impacts of another recent flood. The large number of participants in some FGDS resulted in a range of responses to specific questions, as the experiences and responses of households varied depending the particular situation and the resources available.

Table 1.3: Villages Selected for Focus Group Discussions (FGDs)

Region	District	Upazila	Village	Total HHs in Village	SHOUHARDO HHs		SHOUHARDO HHs as % of Total HHs in village (3)	Details of Homestead raised by SHOUHARDO			Remarks
					Poor (2)	Extremely poor (2)		Number of Schemes (1)	Number of HHs benefiting (1)	% of HH receiving Raised Homesteads to total SHOUHARDO HH in village (3)	
				(number)	(number)	(number)	%	(number)	(number)	(%)	
MID-CHAR	Pabna	Bera	Kalyanpur (West)	174	80	33	65	2	16	14	Mature char
		Bera	Kalyanpur Varenga	265	42	169	80	3	9	4	Mature char
	Sirajganj	Chowhali	Alengahata	147	112	12	85	10	10	8	Intermediate char 9 raised homesteads flooded in 2007
	Jamalpur	Sharisha-bari	Dakhin Damodorpur	263	108	18	48	8	10	8	Mature char Raised homesteads flooded in 2007
		Sharisha-bari	Uttar Damodorpur	224	51	96	66	8	10	7	Mature char All raised homesteads flooded in 2007
	Tangail	Bhuapur	Gobindapur	324	211	26	73	19	35	15	Intermediate char
			Borarbouyra	273	175	74	91	36	75	30	Intermediate char
NORTH CHAR	Gaibandha	Fulchari	Paschim Khatiamari	626	391	141	85	11	27	5	Intermediate char I homestead lost to erosion in 2007
		Fulchari	Kawabadha	182	136	12	81	9	22	15	Intermediate char
	Kurigram	Kurigram Sadar	Prothom Alo Char	90	25	63	98	6	7	8	New char
		Kurigram Sadar	Char Rolakata	85	27	49	89	6	15	20	New Char
	Lal-monirhat	Lal-monirhat Sadar	Majher Char	216	76	63	64	9	11	8	Intermediate char 4 raised homesteads lost to erosion in 2007

Source SHOUHARDO Tangail and Rangpur Regional Offices

Notes (1) Homestead Raising Schemes were either single (involving 1 household) or cluster (involving 2 or more households)
(2) Based on villagers own ranking of households in their community
(3) All SHOUHARDO households are eligible to receive SHOUHARDO support to raise their homestead.

Table 1.4 : Participants in Focus Group Discussions (FGDs)

District/ Upzila	Village	SH'DO HHs in Village	Number of HHs benefiting from raised homestead	Participants of FGD with households with Homestead raised			Participants of FGD with households with Non-Raised Homesteads			Homestead Raising Implemented by:
				Number of HHs	Number of males	Number of Females	Number of HHs	Number of males	Number of Females	
		(number)	(number)	(number)	(number)	(number)	(number)	(number)	(number)	
MID-CHAR										
Pabna/ Bera	Kalyanpur (West)	113	16	23 (1)	11	12	-	-	-	ASEAB
Pabna/ Bera	Kalyanpur Varenga	211	9	8 (2)	2	6	-	-	-	ASEAB
Sirajganj/ Chowhali	Alengahata	124	10	4	0	4	14	0	14	MMS
Jamalpur/ Sharishabari	Dakhin Damodorpur	126	10	16 (3)	1	16	34	9	25	DAM
Jamalpur/ Sharishabari	Uttar Damodorpur	147	10	8	3	5	27	0	27	DAM
Tangail/ Bhuapur	Gobindapur	236	35	12	2	10	12	4	8	Direct Delivery
Tangail/ Bhuapur	Borarbouyra	249	75	13	9	4	16	7	9	Direct Delivery
NORTH CHAR										
Gaibandha/ Fulchari	Paschim Khatiamari	532	27	8	6	2	12	10	2	SKS
Gaibandha/ Fulchari	Kawabadha	148	22	8	2	6	10	3	7	SKS
Kurigram Sadar	Prothom Alo Char	88	7	6	2	4	11	7	4	Direct Delivery
Kurigram Sadar	Char Rolakata	76	15	17(4)	4	13	14	3	11	Direct Delivery
Lalmonirhat Sadar	Majher Char	139	11	5	1	4	20	8	11	Direct Delivery

Source Data collected by Study Team during FGD

Notes (1) Mixed FGD with 7 HH with raised homesteads and 16 HHs with non-raised homesteads
(2) Mixed FGD with 5 HH with raised homesteads and 3 HHs with non-raised homesteads
(3) Mixed FGD with 10 HH with raised homesteads and 6 HHs with non-raised homesteads
(4) Mixed FGD with 15 HH with raised homesteads and 1 HH with non-raised homesteads. Also, 2 participants came from same HH.

2. RAISING OF HOMESTEAD AREAS UNDER THE SHOUHARDO PROGRAM

2.1 Identification and Planning

SHOUHARDO activities are based on helping communities take actions to improve their food security and improve livelihoods. The needs of a community are identified through the preparation of a Community Action Plan (CAP) prepared by the Village Development Committee (VDC) and all households in the community, facilitated by the SHOUHRADO Program. The VDC is supported to take the initiative and lead on actions to improve the livelihoods and food security of all households in a village in general and poor and extreme poor households in particular. In the CAP, homestead raising and/or provision of high land for use during floods is usually one of the main needs identified by SHOUHARDO communities.

2.2 Design

The purpose of the homestead raising is to provide a flood-free environment so that households can undertake or continue with activities to improve their livelihoods rather than use their resources in coping with or recovering from floods. The raising of homestead areas comprises of constructing an earthen mound on the homestead land so that the buildings and courtyard between the buildings is above flood level, as shown on Figure 1.1. The main activities of homestead raising are shown in Table 2.1. SHOUHARDO also provides funds to lengthen hand tubewells so that hand pumps are on top of the raised homestead mound and can provide safe water during floods.

Table 2.1: Description of Homestead Raising

Activity	Description	Main Activities	Responsible
Homestead Raising	Raising the ground level of homestead compounds using earthworks so that buildings and compound and courtyard are above 1:25 year flood level	• Provision of land for borrow • Excavation of Soil • Carrying and placing of soil • Compaction of soil • Turfing of side slopes • Dismantling/re-assembling of buildings	• Homestead owners • SHOUHARDO • SHOUHARDO • Homestead owners • Homestead owners • Homestead owners

Two key design parameters for raising homesteads are:

- Height above Highest Flood Level (HFL): The design flood level for homestead raising is taken as the 1998 flood level (which is about the 1:25 year flood) plus 0.6 m freeboard. The height of the 1998 flood is usually based on information provided by villagers.
- Area on top of the Raised Mound: Initially, the intention was to raise the plinth level of buildings to above flood level, but in practice, this was to difficult as the soil forming the side slopes of the raised plinth covered part of the courtyard, making significant areas of the courtyard unusable. Hence, homestead areas comprising of the courtyard and buildings were raised, as this had the added benefit of householders being able to continue with their regular household activities throughout the flood. Under SHOUHARDO, the raised homestead area ranges from a minimum of 70m^2 to a maximum of 230 m^2. The area of raised homestead is constrained by the area of land

owned by the homestead and the availability of land to borrow material. Additional land area is required for raised homestead to accommodate the side slopes of the earthen mound, and households may not own land outside their existing homestead area.

Additional design factors include:

- Ownership of the homestead land. To avoid possible conflicts over land and the benefits of raised homesteads, SHOUHARDO tends to limit homestead raising to households that claim ownership of the homestead land.
- Slope protection. If the soil available to form the mound is sandy, a layer of more silty soil is placed on the outside of the mound to provide better rainfall protection and a better medium for establishing grasses etc.
- Side slopes: for silty soils side slopes are 1:2 (vertical to horizontal) and for sandy soils, the side slopes are 1:3.
- Dismantling/Reconstruction of Buildings. Prior to the start of earthworks, buildings have to be cleared from the compound. Generally dismantling takes about 1 day and costs about Tk 300/homestead. Reconstruction takes about 6-8 days and costs about Tk1000-1500 as building materials often have to be replaced due to the fragility of especially vegetative components. Earthwork labourers often assist households to dismantle buildings to avoid delays in the start of earthworks. Households were left to reconstruct their own buildings using their own resources. The requirement to rebuild their houses means that householders were not available for employment on earthworks elsewhere, and hence they lose the opportunity for waged employment.

2.3 Implementation

Homestead raising was implemented by 16 partner non-government organisations (PNGOs) or directly by SHOUHARDO staff.

During FY06 and FY07, SHOUHARDO implemented a total of 3671 homestead raising schemes benefiting 3671 households, as shown in Table 2.2. 2894 of the schemes were located in the Mid-Char Region and 777 schemes located in the North Char Region. 34% of the raised homesteads belonged to extreme-poor households, while 65% belonged to poor households. The well-being category of 1% of households receiving raised homesteads was not certain. 94% of the raised homesteads were on land owned by the benefiting households.

The type of char where the raised homesteads were located, the homestead patterns and implementing organisations of the raised homesteads are shown in Table 2.2. 59% of the schemes were located on mature chars, while 34% were located on intermediate chars and 7% on new chars. 51% of the schemes benefited a single household, while 49% of the schemes were cluster schemes benefiting 2 or more households. 16 PNGOs were involved in implementation of raised homesteads. SHOUHARDO directly delivered homestead raising in four locations (Belkuchi, Bhuapur, Lalmonirhat and Kurigram).

The employment generated by homestead raising in the FGD villages is shown in Table 2.4, as disaggregated data on employment generation by for all homestead raising schemes are not available. For the FGD villages, 45% of the workers were female and 55% male. The schemes generated 20386 person days for the female workers and 27173 person days for male workers. On average, a household scheme generated 193 person-days of employment of which 43% was for female workers and 57% for male workers. In one village, Kalyanpur (West) in Pabna, all the employment generated was for female workers.

Table 2.2: Details of Homestead Raising Schemes During FY06 and FY07.

Region	District	HS Raised by SHOUHARDO Program (3)	Distribution of Raised HS by Well-being Category						Ownership of HS Land	
			Extremely poor (1)	%	Poor (1)	%	Other (2)	%	Own	Lease/Rent/ Khas
		(number)	(number)		(number)		(number)		(number)	(number)
Mid-Char	Pabna	165	15	9	150	91	0	8	145	20
	Sirajganj	650	156	24	488	75	6	1	511	139
	Tangail	677	222	33	435	64	20	3	641	36
	Jamalpur	1032	315	30	708	69	9	1	1018	14
	Sherpur	230	60	26	170	74	0	0	230	0
	Bogra	140	31	22	103	74	6	4	140	0
Mid-Char	S/total	2894	799	28	2054	71	41	1	2685	209
North Char	Gaibandha	130	108	83	22	17	0	0	130	0
	Kurigram	214	94	44	119	56	1	0	196	18
	Lalmonirhat	62	14	23	47	76	1	1	62	0
	Rangpur	85	46	54	34	40	5	6	85	0
	Nilphamari	286	195	68	91	32	0	0	286	0
North Char	S/total	777	457	59	313	40	7	1	759	18
Mid and North Char	Total	3671	1256	34	2367	65	48	1	3444	227

Source SHOUHARDO Tangail and Rangpur Regional Offices

Notes: (1) Well being category of households determined by community.
(2) Other category not specified by respective region
(3) Includes homesteads raise din rural and urban areas.

Table 2.3: Location, Homesteads Patterns and Implementing Organisation of Raised Homesteads (1)

Region	District	Homesteads Raised by SHOUHARDO Program	Location of Homesteads raised (2)			Homestead Pattern		Implemented by (3)
			Mature Char	Intermediate Char	New Char	Single	Cluster	
		(number)	(number)	(number)	(number)	(number)	(number)	
MID-CHAR	Pabna	151	134	17	0	70	81	ASEAB
	Sirajganj	598	294	179	125	365	233	MMS, NDP and DD-Belkuchi
	Tangail	677	354	320	3	415	262	BURO, PP and DD-Bhuapur
	Jamalpur	1032	793	218	21	554	478	SAP, DAM
	Sherpur	230	230	0	0	82	148	US
	Bogra	140	39	76	25	35	105	GBS
MID-CHAR	S/total	2828	1844	810	174	1521	1307	
NORTH-CHAR	Gaibandha	130	27	103	0	31	99	SKS
	Kurigram	214	75	72	67	136	78	BDSC, MJSKS, and DD-Kurigram
	Lalmonirhat	62	37	14	11	50	12	ESDO, DD-Lalmonirhat
	Rangpur	85	20	65	0	16	69	BRIF
	Nilphamari	286	130	156	0	91	195	MISUK,JSKS
NORTH CHAR	S/total (3)	777	289	410	78	324	453	
TOTAL MID & NORTH CHAR		3605	2133	1220	252	1845	1760	

Source SHOUHARDO Tangail and Rangpur Regional Offices

Notes: (1) Not including 66 homesteads raised in urban areas.

(2) In Mid-Char, Age of Mature Char (>20 years); Age of Intermediate Char (10-20 years); Age of New Char (<10 years)
In North Char, Age of Mature Char (>15 years); Age of Intermediate Char (5-15 years); Age of New Char (<5 years)

(3) Homestead raising is implemented by Partner Non-Government Organisations (PNGO) or by Direct Delivery (DD) by CARE-Bangladesh.
See Page (iv) for list of PNGOs

Table 2.4: Employment Generated by Homestead Raising Activities in FGD Villages

Region	District	Upazila	Village	Homesteads Raised and Benefiting Households	Workers			Person-Days of Employment		
					Male	Female	Total	Male	Female	Total
				Number	(number)	(number)	(number)	(number)	(number)	(number)
MID-CHAR	Pabna	Bera	Kalyanpur (West)	16	0	34	34	0	1088	1088
		Bera	Kalyanpur Varenga	9	0	51	51	0	1157	1157
	Sirajganj	Chowhali	Alengahata	10	159	84	243	888	475	1363
	Jamalpur	Sharishabari	Dakhin Damodorpur	10	466	111	577	1661	397	2058
		Sharishabari	Uttar Damodorpur	10	210	97	307	964	421	1385
	Tangail	Bhuapur	Gobindapur	35	20	10	30	2675	162	2837
			Borarbouyra	75	28	12	40	7187	1191	8378
NORTH-CHAR	Gaibandha	Fulchari	Paschim Khatiamari	27	263	409	672	4817	6558	11375
		Fulchari	Kawabadha	22	177	173	350	3641	3412	7053
	Kurigram	Kurigram Sadar	Prothom Alo Char	7	123	154	277	1448	1781	3229
		Kurigram Sadar	Char Rolakata	15	43	39	82	1290	1170	2460
	Lal-monirhat	Lalmonirhat Sadar	Majher Char	11	321	320	641	2602	2574	5176
TOTAL MID AND NORTH CHAR				247	1810	1494	3304	27173	20386	47559

Source SHOUHARDO Tangail and Rangpur Regional Offices

The physical works constructed and the costs of the homestead raising schemes in the FGD villages are shown in Table 2.5. The average (top) area provided on raised homesteads was 210 m^2/HH, and homesteads were raised an average height of 1. 5 m. The average volume of earthworks was 308.9 m^3/HH. The average Program cost of homestead raising was Tk 11218/HH in the Mid-Char and Tk 24845/HH in the North Char. The overall average cost was Tk 18032/HH.

Table 2.5: Physical Works and Project Costs of Homestead Raising Schemes in FGD Villages

Parameter	Units	North Char	Mid-Char	Combined North and Mid-Char
Number of Villages	number	5	7	12
Number of Schemes	number	43(1)	84(2)	127
Number of Households	number	82	165	247
Average Area provided/HH	m^2/HH	204.16	218.18	211.49
Average Height/HH	m/HH	1.68	1.14	1.41
Volume of earthworks/HH	m^3/HH	346.16	269.15	307.65
Average Cost/HH	Tk/HH	24845.53	11015.46	17930.50

Notes: (1) The 43 schemes comprised of 20 cluster schemes involving 59 households and 23 single schemes involving 23 households.
(2) The 84 schemes comprised of 30 cluster schemes involving 111 households and 54 single schemes involving 54 households.

The difference in the cost of homestead raising in the Mid-Char and the North Char regions is due to in part to the greater volume of earthworks of the homesteads raised in the North Chars, and in part to the different costs covered by the Program. In the Mid-Char region, SHOUHARDO funds the excavation of soil and the carrying and placing of soil to form the mound. Homestead owners are responsible for the breaking of clods and compaction of the soil forming the mound, and for grassing the side slopes of the mound to protect the slopes from erosion. Homestead owners are also responsible for dismantling and re-erecting the buildings. In contrast, in the North Char, SHOUHARDO funds the excavation of soil and the carrying and placing of soil to form the mound and also the compaction and turfing.

2.4 Performance of Raised Homesteads in 2007 Flood

The performance of raised homestead during the 2007 flood is shown in Table 2.6. 77% of the homesteads raised were above the 2007 peak flood level, but unfortunately 23% of raised homesteads were inundated during the flood. Although the homesteads were inundated, the households were still much better off than those households whose homesteads were not raised as the depth of water in the inundated raised homesteads was 1.0 to 1.5 m less than the depth of water in non-raised homesteads.

The quality of the raised homesteads in the FGD villages was generally good. Side slopes were turfed and in several homesteads also used for homestead gardening. The slopes of some mounds had erosion cuts, but households seem to have repaired flood damages to the mounds. There were no incidents reported, either in FGD villages or other SHOUHARDO villages, of homestead mounds collapsing during the flood. Overall, no raised homesteads in the Mid-char region and only 23 raised homesteads in the North Char Region (<3% overall) were lost to river erosion following the 2007 flood.

Households from non-raised homesteads used raised homesteads as refuges. An estimated 3143 households took refuge on the 3671 homesteads raised by SHOUHARDO which means on average about 1 household took refuge on each raised homestead.

Table 2.6: Performance of Raised Homesteads during 2007 Flood

Region	District	Raised HS	Inundation Status during 2007 flood				HHs taking shelter on Raised HS	Duration under water			Height of Water above raised homestead		
			Raised Homesteads Not Inundated		Raised Homesteads Inundated								
		(number)	(number)	%	(number)	%	(number)	1 to 2 days	3 to 6 days	> 7 days	<1 ft	2-4 ft	>5ft
Mid-Char	Pabna	165	142	86	23	14	201	0	0	23	6	17	0
	Sirajganj	650	375	58	275	42	603	22	174	78	132	134	8
	Tangail	677	422	62	255	38	710	2	133	120	115	139	1
	Jamalpur	1032	855	83	177	17	574	41	108	31	64	100	16
	Sherpur	230	214	93	16	7	0	7	3	1	4	2	5
	Bogra	140	100	71	40	29	65	0	0	38	38	0	0
Mid-Char	S/total	2894	2108	73	786	27	2153	72	418	291	359	392	30
North Char	Gaibandha	130	122	94	8	6	152	7	1	0	4	4	0
	Kurigram	214	148	69	66	31	202	4	41	21	66	0	0
	Lalmonirhat	62	62	100	0	0	210	0	0	0	0	0	0
	Rangpur	85	85	100	0	0	261	0	0	0	0	0	0
	Nilphamari	286	286	100	0	0	165	0	0	0	0	0	0
North Char	S/total	777	703	91	74	10	990	11	42	21	70	4	0
Mid & North Char	Total	3671	2811	77	860	23	3143	83	460	312	429	396	30

Source SHOUHARDO (2007) And SHOUHARDO Tangail Regional Office

3. ASSESSMENT OF HOMESTEAD RAISING

3.1 Features of SHOUHARDO Households

Floods are an annual hazard for households living in the chars, and households have to develop strategies to cope with and recover from floods. Based on discussions during FGDs and previous studies of floods in the chars, features of char households relevant to floods include:

Livestock

- Livestock have a major role in livelihoods of all households in the chars, but SHOUHARDO households rarely own cattle. Common practise is for SHOUHARDO households to share cattle in a way similar to share cropping. The owner of the cattle pays the initial purchase of the cattle and then the SHOUHARDO household raises the animals, being responsible of all inputs. On maturity, the animal is sold and 50% of the increased value goes to the owner and 50% to the SHOUHARDO household. If the animal is lost during floods, the owner bears the cost. During floods, fodder becomes scarce and the growth rate of animals decreases. Many livestock are sold after floods as distress sales. For example, in Bhuapur Upazila, Tangail district after the 1988 flood, the cattle population had dropped by 47% three years after the flood (ISPAN 1994).
- During floods, goats and sheep do not survive so well as cattle, as the smaller ruminants are not so adaptable to the wet conditions during floods, and there is a high mortality rate amongst sheep and goats even during floods that are just above average (such as in 2004 and 2007). In addition, the high mortality rates of sheep and goats are also due to households taking more care of the higher-value cattle during floods when there is stress and fodder shortage. In the surveyed villages, the majority of sheep and goats given to households as asset transfers before the flood under various programs, did not survive the 2007 flood.
- Most SHOUHARDO households own poultry and/or ducks, although poultry also have high mortality rates during floods due to the wet environment and the shortage of fodder. For example, even households with raised homesteads lost up to 70% of their flocks in the 2007 floods. Ducks do not seem to survive any better than poultry during floods.

Homesteads

- SHOUHARDO households own the fabric of their homestead buildings, that is the CI sheet, the timber or bamboo frame and the vegetative wall cladding (fencing). Depending on the quality of materials, a single building with CI sheet roof, vegetative walls and dimensions of about 6m (20 ft) length, 3.6 m (12 ft) width and 2.1 m (7 ft) height costs about Tk 10000-15000.
- SHOUHARDO households that do not own their homestead land and are often unwilling to invest in trees as they are not sure whether they will be able to benefit from the trees in the long-term.
- Extremely poor SHOUHARDO households have few possessions. Physical assets comprise of a bed, a clothes rack, maybe chair or stool, cooking pots and utensils, some clothes and few items of jewellery. Their small possessions can be stored in a box that can be easily moved to avoid damage during floods. The value of their possessions is in the range of Tk2000-Tk5000. One participant in a FGD commented that “the only possession I have is my wife and the only possession she has is me.”

- All SHOUHARDO households store firewood in advance of the flood season as firewood becomes very scarce during floods. On average, each household stores about 180 kgs (4.5 mds) of firewood. On being asked why firewood was stored, one householder remarked that it was possible to get loans to buy rice, but impossible to get loans to buy firewood.
- SHOUHARDO households do not store food grains as most are day-labourers, and spend their income as it is earned to purchase food for immediate consumption. Households have no surplus resources to purchase food grains for future consumption. During floods, when employment opportunities become very scarce, access to food becomes a major problem.
- Most SHOUHARDO households can access clean drinking water from hand tubewells (HTW) during the dry season. The incidence of arsenic contamination of water from HTWs in the chars is rare.
- The availability of sanitary latrines in SHOUHARDO households is still low SHOUHARDO staff work on many divergent activities and promotion of 'total sanitation' is not seen as a priority activity.
- SHOUHARDO households did not receive any warning of the floods or any forecasts of water level changes during the floods.

3.2 Impact of Recent floods on SHOUHARDO Households

Water levels during the 2007 flood were about 1-1.5m above the average flood. The return period for the flood was in the range of 1 in 25 years. Water levels during the flood had two distinct peaks: the first peak was in July and the second peak was in August/September. Overall water levels were high for about 55-60 days. The duration of the flood was longer than normal, which caused additional hardship as employment opportunities were not available for an extended period.

Based on discussions during FGDs, the impacts of the 2007 flood on SHOUHARDO households included:

Households and Homesteads

- Most SHOUHARDO households were able to access clean drinking from tubewells throughout the 2007 flood due to the availability of clean drinking water from tubewells in raised homesteads. There was little incidence of dysentery and other diarrhoea during or after the flood.
- In all except 2 FGD villages, households did not evacuate outside the village as there was sufficient land above flood level to serve as refuges for households and livestock. The land above flood levels was either raised homesteads or raised community places such as flood shelters, schools etc. In contrast, in 1988 when flood levels were 0.2 m higher, up to 80% of households evacuated to the mainland or embankments.
- The main problems for women from households with raised homesteads during the 2007 floods were sanitation and preparing and cooking food, while for men the main problems were getting food and transport. Women from non-raised households had similar problems but the additional problem of finding a suitable place to give birth was frequently mentioned.
- Households from raised and non-raised homesteads took similar actions to recover from the flood, mainly migrating to find work and taking loans. Households from raised homesteads had the advantage of being able to migrate earlier as they did not have to repair so much damage to their buildings or ensure security of their homestead.

- Raised homestead provided benefits to neighbouring households with non-raised homesteads by providing a place of refuge. Raised homesteads in the FGD villages provided on average refuge from 2 neighbouring households and their possessions, including livestock.

3.3 Benefits

Based on discussions with villagers during the FGDs and previous research (for example, Thompson and Tod 1998 and Tod 2000), the benefits of raising the level of homestead compounds and creating a flood-free homestead area include:

- More dry space for domestic activities such as food preparation, cooking, child rearing, minding of elderly which decreased tensions within the household;
- When a homestead is flooded, women's' saris become wet, but as many women have only one sari they have to continue wearing the same wet sari
- In the wet environment of a flooded house, diarrhoea and skin diseases are common. Such diseases are greatly decreased when households can keep dry.
- More scope for homestead gardens as the area becomes wet less often
- Before raising, poultry and livestock were sold prior to floods when prices were low. After raising, it was possible to keep poultry and livestock for longer periods, and sell them when prices were higher;
- The need to move livestock to a distant refuge areas was avoided. Security in refuges is often a problem and hence one family member has to stay at the refuge to look after the livestock;
- The drier areas available for livestock results in less disease
- The raised courtyard can be used to grow paddy seedlings for planting out as the flood recedes;
- Better storage and maintenance of seeds and food grains are possible;
- Dry space is available to keep fodder;
- Building maintenance costs are reduced as the structure is no longer submerged;
- 'survival loans' with high interest charges required to pay evacuation costs are avoided. The loans were often obtained by the selling of future labour;
- The availability of employment during construction allowed villagers to purchase essential items such as a second sari that they could not afford otherwise.
- Social cohesion increased as households with raised homesteads could offer refuge to neighbours with non-raised homesteads.
- Households with raised homesteads had increased confidence in dealing with floods and outside services.
- Households with raised homesteads had increased mobility as they could leave their homestead secure in the knowledge that it was safe from floods.
- Homestead gardening and other IGA activities could be continue during and after the flood
- Women were empowered as they were able to carry out their domestic much more efficiently and effectively. In addition, women also benefited form being able to be more mobile during floods, including, in one case, taking produce from their homestead garden to market.

- Homestead raising allows other SHOUHARDO support services such as Comprehensive Homestead Development (CHD), EKATA etc. to be provided year round, thereby greatly enhancing their impact.
- Permits longer-term asset generation, by for example, planting and nurturing trees.

Problems with raised homesteads were also identified and include:

- Borrow pits are hazardous for children when filled with water;
- Communication between homesteads compounds can be difficult during floods; and
- Side slopes of the mound are sometimes difficult to climb
- Access to hygienic sanitation during floods remains a problem as latrines were not usable when water levels are high.

3.4 Costs

The construction cost of a house with vegetative (catkin, jutesticks etc.) walls and a thatch roof is about Tk 4000, and for a house with corrugated iron (CI) roof and vegetative walls about Tk 10,000-15,000. The cost of a 0.5 m high plinth for a building is about Tk 250-300. Householders often first fill the courtyard and then make plinths on top of the raised courtyard. The dimensions of courtyards including buildings range from about 90 m^2 to about 270 m^2 depending on the number of households living within one homestead. On average, homesteads were raised by about 1.5 m in height that is equivalent to about a 1 in 25 year flood (1998 levels) plus 0.6 m freeboard.

The average costs of raising homesteads under SHOUHARDO are shown in Table 2.5. The project paid for collecting, transporting and placing soil from an adjacent borrow pit adjacent to the homestead site. The community paid for:

- Dismantling/re-assembling the buildings (costing about Tk 300/homestead for dismantling and Tk 1100 for re-erection),
- Compaction of the soil forming the new mound (costing about Tk 3290/HS for compaction of an average of 117.5 m^3 of soil), and
- Turfing of the side slopes (costing about Tk 1120/HS for an average of 160 m^2 of turf).

Overall, the community contribution was about 30% of the total cost.

3.5 Financial Assessment

The main quantifiable benefits of raising the level of homestead courtyards and buildings are savings from avoiding or reducing:

- Evacuation costs including transport, temporary shelter, increased cost of domestic essentials (fuel, food etc.)
- Livestock losses
- Losses to household possessions and expenses
- Coping Costs
- House damage repair and rebuilding

Based on the average costs determined from the FGD and previous reports on flood proofing in the char lands (ISPAN 1994, Thompson and Tod 1998, Tod 2000), these benefits are quantified for a typical village of 70 households as shown in Table 3.1.

Table 3.1: Potential Benefits of Raising Homestead Compounds

	Return Period and Probability 1 in 2 0.5	**1 in 8 0.2**	**1 in 15 0.1**	**1 in 25 0.04**	**1 in 50 0.02**
# of households	70	70	70	70	70
% HH evacuating	10%	16%	40%	60%	75%
Savings of evacuation Losses					
:temporary shelter including transport	2800	8400	14000	21000	25200
:increased cost of domestic goods	1750	5250	8750	13125	15750
:travel costs for livestock	613	3063	3675	4288	5513
:maintaining evacuated livestock	5250	26250	31500	36750	47250
S/total Evacuation Savings	*10413*	*42963*	*57925*	*75163*	*93713*
Savings of livestock					
:cattle losses	7700	77000	115500	192500	231000
:sheep/goat losses	7875	78750	94500	110250	141750
:improved well-being from less disruption	1400	4200	7000	10500	12600
S/total Livestock Savings	*16795*	*159950*	*217000*	*313250*	*385350*
Savings of Possessions/HH expenses					
:food grain	0	0	0	0	0
:personal possession	12250	12250	12250	12250	12250
:poultry and ducks	6300	37800	44100	50400	56700
:tree vegetable damage	3500	3500	3500	3500	3500
:medical	35000	140000	175000	227500	280000
S/total Possessions savings	*57050*	*193550*	*234850*	*293650*	*352450*
Savings on coping costs					
Construction of macha	*2800*	*8400*	*14000*	*21000*	*25200*
Availability to work	*16800*	*50400*	*84000*	*126000*	*151200*
S/total coping savings	*19600*	*58800*	*98000*	*147000*	*176400*
Savings from House Damage					
:Repair of damage	*157500*	*122500*	*87500*	*43750*	*17500*
:rebuilding	59500	178500	297500	446250	535500
S/Total House Savings	*217000*	*301000*	*385000*	*490000*	*553000*
Total All Savings	321038	756263	992775	1369063	1560913

Other benefits that are difficult to quantify include improved well-being of the household and community, and increased social cohesion. In addition, non-raised households took refuge on raised homesteads; that is the raised homesteads became 'mini-shelters' for households who had to evacuate their own homestead.

Financial analysis of raising homesteads is complicated by the:

- periodic nature of flooding, and
- risk of losing the investment to erosion.

The periodic nature of flooding is taken into account by calculating the annual average benefit, which is the area under the loss probability curve where losses are in money units and probabilities are the excedence probabilities (reciprocal of return periods) for different events (USACE 1979; Penning-Rosewell and Chatterton 1977; Penning-Rosewell and Chatterton 2000). Summing the probabilities within each interval in Table 3.1 and multiplying by the average of the pair of losses gives an annual average benefit of house raising of Tk 392,891.

The risk of losing the investment to erosion is determined by calculating the sensitivity of having to replace the raised homesteads at different intervals as shown in Table 3.2. The difference in the IRRs between the two regions is due to the higher initial investment in homestead raising in the North Char region.

Table 3.2: Risk of Investment Loss

Complete loss of raised homestead in:	IRR North Char	IRR Mid-char
	(%)	(%)
4 years	<0	<0
7 years	14	41
10 years	22	46

Overall, raising the level of homestead compounds is a sound financial investment as long as the homesteads remain for at least seven years in the North Char and 5 years in the Mid-char after the construction. There is evidence to suggest that this rate of homestead survival is achievable. For example, Elahi (1991) found that most households in main river chars land (60% in Chilmari and 69% in Kazipur) moved house at least once in a seven-year period. Under CARE-Bangladesh's previous programs, of the 431 homesteads raised in FY 97, only 8 (2%) were lost to erosion during the first year. In the following year, of the 1314 homesteads surveyed, only 3 (less than 1%) were lost to erosion (Tod 2001). Also, under SHOUHARDO, only 23 out of 3671 (<1%) raised homesteads were lost to erosion during the initial two years, and under CLP 6% of raised homesteads were lost to erosion.

3.6 Gender

In the short-term, a major benefit of homestead raising is the generation of employment that can be targeted at women from poor and extremely poor households. In the FGD villages, 20386 person-days of employment were provided for 1494 women workers, providing an average income of about Tk 900/worker. Overall, about 30-50% of the employment in homestead raising was allocated to women. Workers on homestead raising activities are paid the same wage rates.

In the long-term, homestead directly benefits women by providing:

- A greatly improved environment during floods for carrying out domestic activities such as preparing and cooking food, child rearing, caring for elderly etc. all of which are the responsibility of women;

- Opportunity for year-round income and enhanced nutrition from homestead gardening;
- Better conditions for livestock rearing;
- Scope for greater mobility during the flood season as homestead area is more secure;
- Better conditions for giving birth;
- Access to safe drinking water during floods, resulting in improved family well-being and health, due to less diarrhoea and skin disease;
- Better conditions for poultry and duck rearing; and
- Scope for uninterrupted delivery of other SHOUHARDO services such as Mother, Child, Health Nutrition (MCHN) and Empowerment, Knowledge and Transformative Action (EKATA).

Problems during floods that remain after homestead raising are sanitation for women, lack of income earning and employment opportunities, and isolation.

During the FGDs, participants often said that women were empowered by raised homesteads due to several factors including increased bargaining power, improved access to markets, scope for developing income earning activities that continue throughout the flood, and enhanced capacity for leadership.

3.7 Conclusions

Homestead Raising results in major benefits to poor and very poor households by providing flood-free homesteads in an environment where floods are a major annual hazard. Homestead raising can be targeted directly to benefit poor and extremely poor households and is a cost effective intervention that provides scope for delivering other SHOUHARDO support services throughout the year.

4. DISCUSSION AND RECOMMENDATIONS

4.1 Discussion of some issues

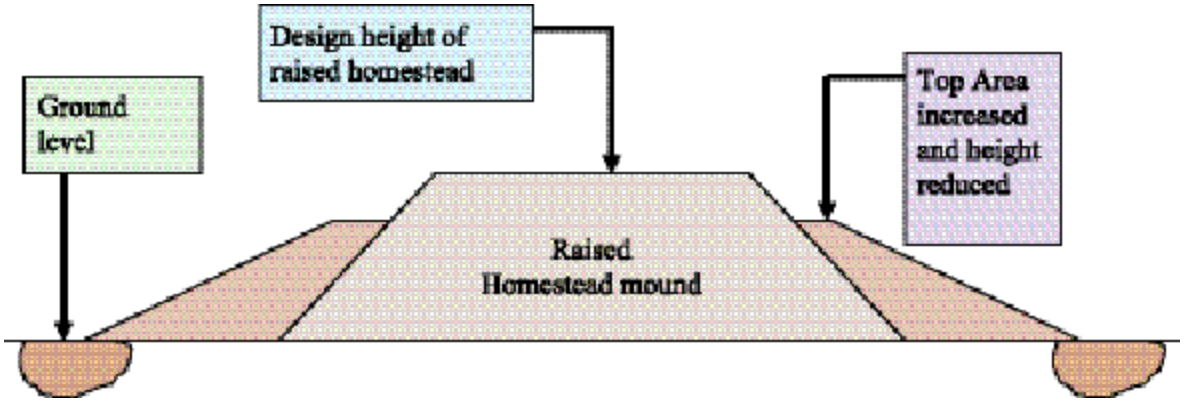
Highest Flood Level.

The purpose of homestead raising is to flood proof homesteads and the critical design requirement is for the homestead to be raised above highest flood level. In 2007, about 75% of homesteads raised by SHOUHARDO were above peak flood level while about 25% of raised homesteads were inundated. Even though some homesteads were flooded, the households were in a better situation than if their homesteads were not raised because of the reduced depth of water in their homesteads.

Determining the highest flood levels at a specific location in the chars is based on local knowledge, but this is sometimes flawed as the villagers may not have resided there when the last major flood occurred.

Another factor contributing to raised homesteads being flooded is that households sometimes spread the soil forming the mound to create a larger area on top of the mound as shown in Figure 4.1. The result is that the homestead area is lower than planned.

Figure 4.1: Spreading of Homestead Mounds



One way to verify highest flood levels at a specific location is to determine the water level in a nearby main channel close to the village, and then determine the water level at the same day at the nearest BWDB Gauging station. The height of the highest flood level above the water level at the gauging station can be calculated, and the same difference can be applied to the survey village to give an independent estimate of the highest flood level.

Higher Level Planning

SHOUHARDO (and even CLP) activities are focused on the household and community level. There is also a need to consider higher-levels of planning at union, upazila and district to make sure that for example, markets can operate efficiently to serve the needs of char dwellers. Another example concerns flood shelters. SHOURHARDO and other organisations are investing in numerous schemes to provide either individual or community flood shelters. At the end of SHOUHARDO will SHOUHARDO communities have adequate flood shelters or are more required to cater for local needs? In coastal areas, CARE worked

with the CEGIS to assess the current status of cyclone shelters and developing an operational cyclone shelter management information system (CEGIS 2004).

Coverage

The number of homesteads raised by SHOUHARDO is constrained by the availability of funds. In 2007, funds were available to raise on average about 10 homesteads in each Mid-char village. The number of homesteads raised by SHOUHARDO is much less than the need or demand for raised homesteads. For example, in 4 FGD villages in the Mid-char, less than 10% of eligible households received raised homesteads (see Table 1.3). In 2 FGD villages with direct delivery of project services, funds were available to raise a greater number of homesteads, and 15-30% of eligible households received raised homesteads. SHOUHARDO should consider increasing the funds allocated to homestead raising so that the benefits of homestead raising can be forthcoming to more SHOUHARDO households, including the more effective delivery of other SHOUHARDO services.

Sustainability

At present, homestead raising for SHOUHARDO households is possible through grants provided by SHOUHARDO. The impact of other SHOUHARDO activities will take some time to fulfil their potential, and it may take some years before the income of char households will rise sufficiently so that households can afford homestead raising using their own resources. In the meantime, ways need to be developed to make homestead raising sustainable, given the fact that, over time, many homesteads raised by SHUHARDO will be lost to erosion.

Ways to improve the sustainability of homestead raising include:

- **Increasing assets**. There is scope with raised homesteads to plant trees that could provide benefits in the long-term. When a homestead is liable to erosion, the trees could be harvested and sold to pay for raising a homestead at a new location. Families in Britain used to plant trees when a child was born to pay the costs of transferring family assets when the child eventually died from old age, many years later.
- **Insurance.** Based on previous analysis of homestead raising in Ulipur upazila, Kurigram (Tod 2001), the scope for establishing an insurance scheme was investigated for providing raised homesteads to those subscribers who lost their homestead to erosion. In the mouza studied, raised homesteads worth Tk 203,718 (or 8%) of the original investment of Tk 2.51 million has been lost to erosion within three years. This is equivalent to an annual loss of Tk 120/raised HH or Tk28/HH if all households in the five mouzas in the active flood plain are included. The challenge is how to make the benefits of flood proofing sustainable when 8% of households are lost to erosion within 3 years, and eroded households do not have the resources to flood proof their new homesteads.

The solution proposed was to form a 'Local Flood Proofing Board' or similar institution to provide flood-proofing insurance. Households would pay an annual premium or levy and in return their new homesteads would be flood proofed (that is raised above flood level) when they were forced to move because of erosion. Institutions could also be included in the insurance scheme. The annual levy for each household in the five flood-prone mouzas studied would be Tk 28, and from this payment there would be sufficient funds generated to raise the homesteads of those households forced to relocate due to erosion. Collection of the premium and utilisation of the funds to assist eroded households would result in initial investment in flood proofing becoming sustainable.

As an objective of SHOUHARDO is to move char households away from relief and become more self-sufficient by mobilising local resources and break away from dependence on outside resources. If flood proofing of homesteads is considered by villagers to be beneficial and a priority, households should be willing to contribute to a process that would ensure continued access to these benefits of flood-proofed homesteads.

Risk Assessment

The char is a very harsh environment where the physical condition frequently changes due to floods and erosion. Chars are dynamic earthen structures that expand (due to accretion during floods) and contract (due to settlement after floods) over time (Hassan et al 1999). Sound risk assessment is critical to determining the impact of activities supported by SHOUHARDO, and there is an urgent need to update the analysis of the current and future trends of the major risks in the chars, that is the hydrology and erosion/accretion. For example, answers are required to such questions as "are floods in the chars getting more frequent and/or larger an/or of longer duration" and "are the rates of erosion and accretion increasing or decreasing"? SHOUHARDO and other programs working to improve the livelihoods and food security of char households need to answer these questions to be able to assess the long-term impact of their activities.

Advocacy Issues

Households in the chars are very vulnerable and have little voice in the wider politic. Advocacy issues that would assist people in the char include:

- **Trans-boundary water**. More than 90% of the flow in the major rivers comes from upstream, and originates in India or China. Both countries have grand plans to divert the flows of the Brahmaputra for their own use. China is considering diverting Brahmaputra flows to water-short central China and India is considering diverting flows to water-short peninsular India. In ether scheme were implemented, there would be major impacts on the livelihoods of those living in the chars.
- **Physical works** affecting flows in the main rivers. Structures constructed alongside (such as embankments to protect the mainland from flooding or river training works to protect the mainland from erosion) or across (such as the Jamuna or Padma bridges) affect flows in the main river channels and influence, inter alia, the height of peak water levels, and accretion and erosion of char land. The interests of char dwellers need to be represented when such structures affecting river flows are being considered by national authorities.

Rights issues

Housing/shelter. Adequate shelter is a basic human right. The shelter of SHOUHARDO households is of very poor quality, and many households live in flimsy and hazardous structures that provide limited protection from the weather. Ways to improve the quality of houses need to be discussed with communities, local government bodies and NGOs, some of whom have programs to the quality of housing stock. For example, OXFAM have a project to develop low-cost housing for the chars, and HABITAT have programs focused on improving housing. CARE along with USAID and others also funded the preparation of a handbook on the Design and Construction of Housing in Flood Prone Areas of Bangladesh (Iftekhar 2005).

Wage Rates

The wage rates paid by SHOUHARDO in CFW are equivalent to Tk 60/day in the North char and Tk 70/day for the Mid-char. Previously under FFW, workers were paid in kind with rice, oil and pulses. The FFW program was stopped in 2007 due to the shortage of available food. Taking into account recent rises

in food prices, the amount paid to workers under FFW is now equivalent to about Tk 145 per day. The wage rate being paid to workers on homestead raising are low and should be revised to take into account recent rises in food prices.

Ownership of Homestead Land

Land ownership is far from transparent in the chars as there are no formal land ownership records. Although some households claim to 'own' land, they tend not to have legal documents to verify the claim. Land ownership rights in the chars are usually by community recognition of ownership. In reality, a few powerful households lay claim to most of the land even though until 1994, eroded land was meant to resort to government ownership. In 1994, this requirement was changed so that land that re-appeared within 30 years reverted to the owner and land that is eroded for more than 30 years will resort to government ownership. The ownership of homestead land is similarly opaque, although within a community, there is generally agreement about the ownership of both homestead and agricultural land. CARE's previous homestead raising programs tried to make sure there was a 'formal' agreement in the form of a 'no objection certificate' (NOC) between the landowner and household living in the homestead to be raised so that the land owner committed to allowing the householder to remain on the land after the homestead was raised. Under SHOUHARDO, the need for a 'formal agreement' has been relaxed but to avoid potential problems. SHOUHARDO has mainly provided raised homestead to households who own the homestead land (see Table 2.2). CLP follow a different approach and raise only homesteads of households owning no assets including land. Community agreement is taken to sanction the investment in the raised homestead without a formal agreement with the landowner.

In both SHOUHARDO and CLP, there are no reported incidents of households being forcibly evicted after homesteads are raised, and hence SHOUHARDO should consider relaxing land ownership requirements to ensure the extreme poor benefit from homestead raising.

4.2 Recommendations

Adequate shelter is a human right and homestead raising enhances the basic shelter available to SHOUHARDO households by reducing or eliminating the risk of homesteads being flooded in an environment where floods are a recurring annual hazard. SHOUHARDO should continue to fund the raising of homestead areas, as homestead raising provides significant benefits directly to SHOUHARDO households. SHOUHARDO should increase the funds available for homestead raising so that more SHOUHARDO households can benefit from homestead raising including less disruption of the delivery of other SHOUHARDO services during floods.

As part of their homestead raising activities during the remaining period of Program, SHOUHARDO should develop ways to make the investment in homestead raising sustainable. In addition, SHOUHARDO should update the risk of floods and erosion in the chars and promote homestead raising in the chars of other major rivers in Bangladesh.

PART II MOUND PROTECTION WORKS IN THE HAOR REGION

5. INTRODUCTION

5.1 The Haor Environment

Haor is defined as "water body formed in the monsoon season by the inundation of several beels under one continuous water body. "Beel is defined as "a natural depression, the bottom of which normally remains wet throughout the year."

The haor area lies within the low-lying Central Basin or Sylhet Depression, a large bowl-shaped depression that occupies the middle of the north-east of Bangladesh. The area of the Central basin is about 6,000 km^2, with the maximum north-south and east-west widths being about 113 km. The basin is believed to have evolved as a result of alluvial and shallow lacustrine deposition into a rapidly subsiding trough. There are several saucer shaped, seasonally-flooded, inter-fluvial depressions called haor that are bordered by natural levees from the complex maze of ancient and recent distributary channels that cross the basin. The small permanent lakes in the lowest pockets are called beels.

Land elevations within the basin range between 3-8 m, with approximately 25% of the land lying below 4 m and 50% below 5 m elevation. Soils consist of grey or bluish grey clays, black herbaceous peats and yellowish grey silts. Alternating beds of peat and peaty clay are common in beels and haors. Drainage patterns throughout the haor area follow the land gradient, sloping from north to south.

The main rivers traversing the Basin include the Surma, Kalni, Kushiyara, Baulai and Dhanu. These rivers are characterized by highly sinuous, meandering sand-bed channels with cohesive banks. Channel shifting occurs erratically, leaving behind a maze of ancient channel scars, abandoned distributaries, oxbow lakes and channel levees, known as *kandha*. Flows in the river systems are governed by inflows entering the Basin through the main rivers and tributary streams from India, by inflows or losses that occur through distributaries, spill channels and breaches along the river channel system, and by run-off generated from rainfall over the Basin. In addition, backwater from the lower Meghna river controls river water levels, which affects the distribution of flow carried in the main river channel and the overbank flow on the flood plain.

Pre-monsoon flash floods are a normal feature of the region. Low magnitude pre-monsoon floods usually stay within the channel banks and enter the adjacent flood basins and haors through open spill channels and distributaries. Larger pre-monsoon floods overtop riverbanks and flood the back basins and flood plain by overland flow as well as through spills. These floods are very flashy, and may last from a few days to about a week, depending on the time of occurrence. The pre-monsoon flood volume is sufficient to fill the haor depressions, and they are the cause of major damage to the boro rice crop.

Monsoon season floods are large and normally last from July through October. Flooding in 1993 was even more severe than the 1988 flood and almost the entire Basin was under water. The monsoon season floods are a combination of flood inflow from external rivers, seasonal rainfall, and lack of drainage due to backwater effects of the Lower Meghna River. Agricultural damage from monsoon season floods tends to be less since farmers either leave their land fallow during this time or they plant low yielding deep water aman rice capable of elongating with the gradual rise of flood levels.

Historically, much of the Basin was forested with *hijal* Barrubgtonia racemosa and *koroch* pangamia pinnata that provided habitat for many fish species. During the last two centuries, land use changed: the forest was consumed and in its place winter season (*boro*) rice is now cultivated. Submersible embankments that confine the rivers within their channels during the pre-monsoon period were constructed in places to protect the *boro* rice from flooding prior to harvest. However, the combination of deforestation, embankments, changes in sediment deposition patterns, and poor biological management has adversely affected fisheries production.

The two main economic activities of agriculture and fisheries follow four distinct seasons based on the availability of water, as shown in Table 5.1.

Table 5.1: Seasons and their influence on economic activities

Season	*Calendar Period*	*Hydrologic feature*	*Influence on economic activities*
Winter	December through March	Dry though there may be winter floods of relatively short duration that rarely overtop the riverbanks.	Main growing season for the single *boro* rice crop that may require irrigation. Fishing restricted mainly to beels and low-lying areas where water remains.
Pre-monsoon	April and May	Flash floods:	Harvesting of rice crop though crop may be lost to flooding in low-lying area. Fish start to migrate from the beels to breed and grow on the flood plains
Monsoon	June through September	Flooding	Cropping restricted to small areas of higher land close to the village mounds. Main fishing season.
Post-monsoon	October and November	Drainage	Land preparation for *rabi* crops. Fishing continues

5.2 Village Mounds and Wave Protection Measures

People in the haor area live in densely-populated, scattered villages located on ati (raised mounds of earth) that have been built up over many years on kandha (raised river banks) and ridges of wetlands. Villages comprise of one or more distinct settlement mounds that are sometimes connected but are often separate 'islands' during the monsoon. Mounds are constructed on the highest land available but still need to be 3-5 m above ground level for the top to be above normal flood levels. Many villages are very isolated and have limited interaction with services from government or non-government organizations.

During the monsoon when the haor is flooded, settlement mounds become islands surrounded by vast expanses of open water, and the mounds are subject to erosion by waves formed by winds blowing across the large areas of open water. The layout of homestead land into long thin rectangles with the short sides facing the water and the long side facing neighbouring homesteads is based on spreading the responsibility for protecting the mound throughout the whole community by restricting the exposure of each plot to

erosion to the two smaller sides. The forest that once grew throughout the Basin reduced the areas of open water and provided masses of vegetation to absorb the energy of waves. Removal of the forest increased the plight of villagers, to the extent that traditional methods of protecting mounds are becoming less effective and, in many villages, the highland is slowly being lost to erosion. Shortage of funds and/or inadequate organizational arrangements prevent villagers from undertaking the full restoration of settlement mounds by themselves, although many mounds are often partially restored each year. Several settlements have lost the battle, forcing the inhabitants to relocate to other villages nearby or migrate to urban areas.

Village mounds are dynamic structures as the soil forming the mound settles over time, and the rate of settlement increases when mounds are submerged or subject to wetting and drying. Mounds can settle up to about 150 mm/year, and this rate can be increased by about 50 mm/year if the mound is flooded (SNC/LAVALIN 1994). In addition, when homestead land on the mound is flooded, plinths of buildings and the related structures start to disintegrate, and buildings sink into their platforms, walls fall apart and wall materials and supports start to rot.

The task of protecting village mounds from wave erosion is difficult because the mounds are constructed from easily erodable local soils. Technical solutions to protect village mounds from wave erosion involve measures to absorb the energy of waves and comprise of either:

- Re-establishing trees and other vegetative materials around the village to absorb the energy of waves before the waves reach the mound, or
- Constructing a barrier made of hard, durable materials such as bricks, stones or rocks to absorb the energy of the waves when they break on the mound.

Unfortunately, in the haor area, as in most of Bangladesh, there are no naturally occurring 'hard' materials such as stones or rocks, and such materials have to be imported, at considerable expense due to the transport costs involved. Brick making is also a challenge in the haor due to the shortage of highland on which to construct brick kilns, and fuel wood to fire bricks has not been available locally for many years.

5.3 SHOUHARDO and Village Protection Works

When CARE-Bangladesh started working in the haor in the late 1990's, the problems caused by wave erosion of village mounds became rapidly apparent, and wave protection measures for village mounds were identified as priority need during participatory planning meetings with villagers. A range of hard protective measures was tried including cement-filled bags, concrete block revetments, vertical brick and concrete retaining walls and freestanding concrete-and-brick walls. Some of the measures worked well while other failed within one or two seasons. Also, *hijal* and *koroch* trees were planted as vegetative wave protection measures at some villages as an alternative to the hard measures. The main problem with 'hard' wave protection measures is the cost and the main problem with vegetative measures is that the trees take 7-10 years to grow and become effective, during which time the village mound remains vulnerable.

In 2003, towards the end of the CARE-Bangladesh's previous Program in the haor (IFSP), brick walls without mortar were identified as being a feasible option for wave protection walls. This type of wall was

tried because reportedly some villagers successfully constructed such walls using their own resources. In addition, bricks were seen as an 'indigenous technology' but this is not correct as, except for government structures, brick construction is extremely rare in haor villages

Un-mortared brick walls have been the main wave protection measures funded under SHOUHARDO and 28 wave protection schemes comprising of un-mortared brick walls were constructed during FY06 and FY07. Three (3) other wave protection schemes comprising of concrete block revetments or the freestanding concrete-and-brick walls (referred to as wave protection walls) have also been constructed by LGED under SHOUHARDO.

5.4 Recent floods in the Haor

Floods are an annual feature for households living in the haor, as the landscape changes dramatically between seasons. With respect to floods and wave erosion, the key factor is the depth of water adjacent to the mound, as the water depth needs to be greater than about 0.5 to1 m for waves to threaten the mounds. If the water depth is less than about 0.5 m, waves will break before reaching the mound.

Significant floods occurred in the hoar area in 1987, 1988, 1993, 1998, 2004 and 2007.

5.5 Purpose and Methodology of this Review

The purpose of the Review is to assess the performance of the wave protection walls in the 2007 floods, determine the financial soundness of the investments in wave protection walls, and review social, technical and land tenure issues related to wave protection walls in order to make recommendations on the way forward for wave protection walls.

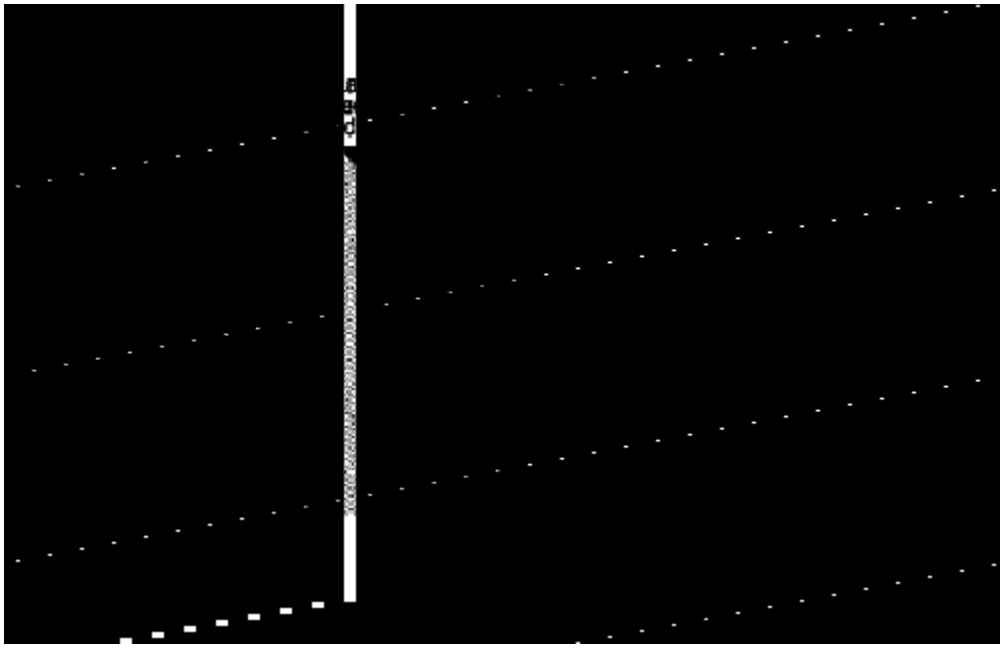
The approach of the Study Team was to collect information about the impact of recent floods on households in the haor regions by holding Focus Group Discussions (FGDs) with SHOUHARDO households in 4 communities with wave protection brick walls (Rahmadpur, Boali, Shibpur, and Baher Bauli) and one community still relying on traditional methods to protect their mound. In addition, the Team reviewed reports on the floods in haor areas and held discussions about the impacts of wave protection walls and recent floods with CARE-Bangladesh staff at their headquarters and regional offices, and with staff of government, non-government and program organisations working in the haor. The Study Team used the information and data collected to assess the effectiveness of village protection works in reducing the impact of floods on SHOUHARDO households.

6. REVIEW OF VILLAGE PROTECTION WORKS

6.1 Technical

The purpose of the wave protection brick wall is to resist a combination of earth, hydrostatic and hydraulic loadings. The brick wall is in effect functioning as a retaining wall, with the reliance based on self-weight to satisfy stability requirements, both in respect to overturning and sliding. The absence of cement mortar between the bricks means that resistance to horizontal loads is from the friction between the bricks.

Figure 6.1 Cross Section of Brick Wall-with-no-Mortar Wave Protection Wall.



Soil loadings will occur when there is active pressure from the soil. Active loads may occur when the soil is saturated due to rainfall or drainage water from tubewells and there is no water on the outside of the wall.. The brick wall provides little resistance to active pressures in the soil, with the result that the bricks will move and potentially fail. This is the probable cause of failure of sections of the brick wall in Baher Bauli and Rahmadpur villages. The remedy to avoid repetition of this failure mechanism is to install drains within the soil mound to prevent water pressures from building up within the soil mass.

Hydrostatic loading occurs when there is a difference in water level across the wall. The hydrostatic loading tends to be small as the rate of rise and fall of floodwaters is relatively slow, and there is sufficient time for the hydrostatic forces to adjust. In the absence of cement mortar, the spaces between the brick allow water to drain freely through the wall.

The hydraulic loading on the wall is from the impact of waves on the outside surface of the wall. The requirements are to ensure that the brocks do not move and that water does not penetrate the bricks to erode the backfill soil. The brick wall seems to be effective in resisting the hydraulic loading from waves and thickness of the bricks at 0.76 m (30 inches) is sufficient to prevent water from penetrating through the brocks. When the water level is close to the top of the wall and waves occur, there is a problem of waves breaking over the top of the wall and water running across the top of the wall to erode the top of the mound and damage the plinths of the houses. In such circumstances, householders construct small walls of vegetative matter to prevent the water from the waves from reaching the house plinths. Current practice is

for cement mortar to be placed between the top two layers of bricks to prevent the bricks from being knocked loose by villagers. A further refinement of the detail at the top of the wall would be to install a lip protruding from the outside of the wall to deflect waves from breaking onto the top of the mound.

Additional details of the design that need further consideration are:

Corners. During construction of the first batch of brick walls under CARE-Bangladesh's previous program (IFSP), cement mortar was placed in the bricks to strengthen right-angled corners. This practice was not followed in the design of subsequent brick walls due to concerns that the mortared brickwork would impeded drainage. Some corners that were not mortared are not performing well, and consideration should be given to including cement mortar at all corners to help spread the load.

Foundations: At present there are no design criteria for the foundation conditions of brick walls, and there is limited investigation of sub-soil conditions. A rational method for the design of brick wall foundations needs to be developed to ensure that foundation soils can bear the weight of the wall.

Drainage from the top of the mound. There is no provision for drainage of rainfall or excess tubewell water from the top of the mound. In places, households have installed pipes to drain the water through the wall and for the drainage water to fall freely from the end of the pipe to the ground below. This results in the bricks on the wall being frequently wet which may reduce their effective life. In some places such as Baher Bauli the ponding of drainage water on top of the mound is causing environmental problems. Provisions for drainage of water from the top of the mound should be included in the design of brick walls.

Planting of Trees. In places, villagers have planted trees close to brick walls. The root system of large trees, such as coconut and mango, may adversely affect the wall in the long-term. A guideline on the planting of trees on the top of protected mounds should be prepared to avoid walls being damaged by tree roots.

Maintenance. Some of the wave protection walls are almost five years old and there is scope to identify the maintenance required to ensure the integrity of the wall. At present, there are no recommendations given to communities on maintenance, and it is apparent from the condition of some walls that communities need guidance on maintenance to avoid walls deteriorating and the integrity of the wall being damaged in the long-term.

A complete structural analysis of the wave protection brick wall should be undertaken to ensure the integrity of the design. In addition, a manual describing the maintenance requirements of brick walls should be prepared and disseminated to all villages with brick wave protection walls.

The main activities to construct the wave protection brick wall are shown in Table 6.1.

Table 6.1: Description of Wave Protection Brick Wall

Activity	Description	Main Activity	Contributors
Village protection works	Provision of un-mortared brick wall to absorb the energy of waves generated during floods	• Provision of land for borrow and the wall • Excavation of soil for wall foundation • Purchasing materials • Constructing brick wall • Excavation of soil for backfill • Carrying and placing of soil for backfill • Compaction of backfill soil	• Community • SHOUHARDO • SHOUHARDO • SHOUHARDO • SHOUHARDO • SHOUHARDO • Community

A potentially interesting SHOUHARDO activity related to brick walls is the manufacture of bricks by haor communities. In FY07, the community in Shibpur village made bricks. The bricks were formed from locally available soil and a kiln was constructed next to the village mound. The bricks were fired using mainly rice husks that are abundant after the rice harvest and have no value. Unfortunately temperatures in the kiln were not sufficiently high, and the quality of the bricks produced was only Grade 2. The community used the bricks to extend the brick wall constructed earlier with funds from CARE-Bangladesh. There is a real financial benefit from local manufacture of bricks if the manufacturing process can be improved because the bricks manufactured at Shipur cost about Tk 2/brick as compared with Tk 5/brick for bricks imported from elsewhere. SHOUHARDO intend to try again in FY08 to manufacture bricks locally.

6.2 Benefits

Based on discussions with villagers and review of previous reports, the long-term benefits of the wave protection measures include:

- Improved health of children due to more space and drier environment around homesteads;
- Improved environment due to more space (for example, more space to walk between houses and for trees and plants etc.).
- More space for income earning activities[1] such as nurseries, market gardens, fruit trees etc.;
- More space for domestic activities including food preparation, cooking, child rearing, looking after the old and infirm etc.);
- Cleaner water (less muddy) for washing beside the mound;
- Latrine facilities better for women;
- More space for livestock husbandry, including construction of a separate buildings for keeping livestock, storage of fodder etc.;
- Reduced house maintenance;
- Savings in cost of moving house and personal possessions at end of dry season if house located on low land;
- Savings in having to sell livestock before floods when prices are low;
- Removal of the need for the annual expense of constructing traditional protection works;
- Improved family relationships due to increased security and less strain on resources;
- Less stress for women during flood as concern about leaving children and old people to help with repair of traditional protection;
- More interaction with other households possible
- Opportunity to take employment elsewhere as there is no longer requirement to construct and maintain protection works for one's own homestead land;
- More assured return from investment in permanent facilities such as hand tubewells and water sealed latrines;
- Improved 'security' of settlement;
- Improved status for villagers amongst neighbouring communities.

[1] The potential annual income from highland is estimated as Tk 760-1570/decimal ($1800-3500/acre) (SNC/LAVALIN 1994).

The following short-term benefits were also identified:

- Income from employment during construction work;

The following negative benefits were identified for the wall:

- The risk of children falling off the wall; and
- Difficulty of access across the wall during the dry season, particularly for cattle and livestock

Wave protection schemes benefit all households in a village, including better off households as it is not possible to separate out the homesteads of PEP households. In contrast, homestead raising in the Char Regions is targeted at only PEP households.

6.3 Costs

The cost/HH of wave protection measures varies greatly between villages, as the cost of the walls is sensitive to:

- **Height of the structure**. In the deep haor, the depth of water adjacent to villages can be 3-5 m, and wave protection walls need to be of a similar height in order to protect the mound from wave erosion and ensure the mound is not inundated during more severe floods. In villages closer to the edge of the haor, walls of only 2-3 m height may be sufficient.
- **Layout of the village**. The number of benefiting households per unit length of wall varies greatly between villages. For example, the number of benefiting households per unit length of wall in Rahmadpur is about 1-2 HH, while in Baher Bauli, the number of households per until length of wall ranges from 4-8HH. Many of the most threatened village mounds previously had more households living on the mound, but many households were forced to leave due to erosion and only a small number of households remain, living in a linear row of single homesteads.

The cost of brick wall protection schemes ranges from Tk 264,000 to Tk 6,260,000 per scheme (see Annex B). The number of households benefiting from wave protection schemes ranges from 39 to 952 households, of which 31 and 467 are poor or extremely poor (PEP) households respectively. There is wide variation in the cost per benefiting household of brick walls. The cost per household in the four villages visited by the Study Team ranges from Tk 36,322/all households (Tk49.942/PEP households) in Rahmatpur to Tk 7,570/all households (Tk 14,976/PEP household) in Baher Bauli. In some other SHOUHARDO villages, the cost per household of brick wall protection works are much lower. For example, brick wall protection costs Tk 528/all households (Tk 1000/PEP households) in Krishnapur (Poschim Austagram). A standard way for expressing the cost of brick walls should be developed to ensure a valid comparison of costs can be made between different village protection schemes.

Community costs for wave protection walls include the provision of land for the wall and for borrow areas, and the excavation, placing and compaction of soil to restore highland behind the wall. Community contributions to the costs are in the range of 20-30% of the total costs, depending on the area of highland restored.

6.4 Financial Analysis

The main quantifiable benefits of replacing the traditional protection measures with the unmortared brick wall are savings to villagers from:

- Removing the need to construct traditional protection methods annually;
- Preventing annual erosion of highland and the need to replace the highland lost to erosion;
- Providing secure highland for IGAs
- Securing trees and homestead gardens from loss to erosion
- Avoiding the costs of moving houses when erosion threatens
- Reduction in health care costs due to less sickness in the drier environment
- Increased value of homestead land

Based on a previous financial analysis of the wave protection walls, in which these benefits were quantified and compared to costs (Tod 2001 and Tod, Hasan and Uddin 2005), the internal rate of return for the investment in the brick retaining wall was calculated to be:

Period of Investment (years)	Internal rate of return (%)
10	5
20	12
30	14

The results of the financial assessment of the benefits and costs indicate that the construction of the wave protection brick wall is a sound financial investment (IRR =12%) if the wall lasts for 20 years or more. There are additional benefits that are either difficult to quantify or there are insufficient data to quantify such as improved security and enhanced well-being of all households in the community. If these benefits were included in the benefit/cost analysis, the IRR would increase and the investment would be even more favourable.

6.5 Discussion Points

CARE-Bangladesh have funded the construction of wave protection works through various programs for over 10 years, and have identified the brick wall without mortar as being the most feasible and cost-effective solution to address wave erosion of village mounds.

SHOUHARDO do not have the resources to solve wave protection problems throughout the haor and hence SHOUHARDO needs to start advocating on behalf of haor communities for wave protection works to be funded by large donor organisations such as the World Bank or Asian Development Bank. In order for SHOUHARDO to advocate that wave protection works should be provided to haor communities, SHOUHARDO needs to make their work on wave protection known to a wider audience, and, for this purpose, the following actions are required:

- Prepare a manual on wave highlighting the un-mortared brick wall. SHOUHARDO should prepare a manual describing their experiences with wave protection and their favored solution that is the un-mortared brick wall. Details of how to identify, plan, design and implement un-mortared brick wave protection walls should be provided.
- Identify the scope for protective walls. SHOUHARDO should prepare an inventory of haor villages top determine the extent of the requirement for wave protection walls, including the number the number of household and villages affected by wave erosion and their degree of exposure to wave erosion.
- Study in detail the social and economic impact of the wave protection walls. Haor communities are structured around the shared need to protect the village mound from wave erosion. As the construction of wave-protection walls provide a long-term solution to one of the major problems faced by haor communities, the social and economic changes resulting from the wall need to be closely monitored and evaluated to ensure that the walls are benefiting SHOUHARDO households as intended.
- Advocacy of solution to basic problem of haor communities. Once the extent of the requirement for wave protection is determined, SHOUHARDO should start to advocate for others to fund wave protection works for haor communities.
- Organize a workshop on wave protection measures for haor communities. Other organisations such as CONCERN and IUCN are working to solve problems for haor communities and improve the livelihoods of households. A workshop would be a productive forum to bring together and exchange experiences of wave protection works throughout the haor region.

6.6 Conclusions and Recommendations

There are clear major benefits to SHOUHARDO households from the construction of wave protection walls. Investment in the walls is technically and financially sound. The walls constructed by SHOUHARDO have generally performed well, although some modifications are required to the design.

SHOUHARDO should continue with funding the construction of wave protection measures and advocate the provision of wave protection works as a solution to a major and fundamental problem of haor communities.

ANNEX A

GUIDELINE FOR FGD

WITH HOUSEHOLDS WITH RAISED HOMESTEADS

Guide for Focus Group Discussions
With Households with Raised Homesteads

Location of Focus Group Discussion ***Date:_____***

Village Name	
Mauza Name	
Union Name	
Upazila Name	
District Name	
Char Name	
Number of Households in Village	
Number of Raised Homesteads in Village	
Other SHOUHARDO supported activities in village	
Other non-government organisations working in village and their activities	

Participants of Focus Group Discussion

Number of households	
Name of Households	
Number of males	
Number of females	
Number of households with raised homesteads	
Number of other households	

Flood and Erosion Years

In the last six years, average number of households affected by:

- Loss of homestead due to erosion/had to move (*0-no; 1-yes*)
- Loss of some land due to erosion (*0-no; 1-yes*)
- Homestead flooded (*0-no; 1-yes*)
- Constructed *macha* to be above flood level (*0-no; 1-yes*)

	Homestead eroded	Land eroded	House flooded	Built macha
2007				
2006				
2005				
2004				
2003				
2002				

Raised Homesteads

Household Members	
Number of people (men, women, children) living on homestead	
Is the head of the household male or female	
Number of households (chula) living on homestead	
Do people of your charik or gusti live in the next bari?	
Homestead land	
Area of homestead land (decimals)	
Does the household own the homestead land?	
How was the homestead land obtained (*1-inherited; 2-purchased; 3- settled new land with help of others; 4-settled new land by self; 5-lease from govt; 6-lease privately; 7-other (describe))*	
If not, was a No Objection Certificate (NOC) obtained from the landowner?	
Are the present occupants of the raised homestead the same household(s) who occupied the homestead when it was raised?	
If not, what happened to the household(s) who occupied the homestead at the time of raising?	
Assets (average number per household)	
House/buildings	
Average number of buildings on the raised homestead	
Materials of main building o walls o roof o frame *(house materials codes: 1-straw/leaves; 2-grass sticks; 3-jutesticks; 4-bamboo; 5-wood; 6-tin; 7-earth; 8-brick; 9-tiles; 10-concrete. Code main material where more than one used; if materials are in equal amounts, code higher quality material)*	
Number of rooms in main house	
Dimensions of main house o length of longer wall o length of shorter wall o height of roof above floor	ft ft ft
Total cost of building such a house now	Tk
Details of other buildings on homestead Building 1 o Purpose o Materials o Cost Building 2 o Purpose o Materials o cost (*Purpose codes: 1-livestock; 2- storage; 3-domestic; 4-additional chula; 5-other. House materials codes-see above*)	Tk Tk

Assets (continued)	
Livestock	
Number of cattle o Owned o Shared	
Number of sheep/goats o Owned o Shared	
Value of 1 cow	Tk
Value of 1 sheep/goat	Tk
Boats	
Number of boats owned	
Small boat (up to 10 maunds)	
Medium boat (11-50 maunds)	
Large boat (greater than 50 maunds)	
Food grain	
o Amount of food grain stored o Type of foodgrain stored (1-rice; 2-wheat; 3-corn)	maunds
Firewood	
Amount of firewood stored	
Vegetation	maunds
Number of banana trees	
Number of other trees and type	
Homestead garden If yes, what were dimensions of garden whether planted at time of flood (0=no;1=yes)	
Access to Tubewell for drinking water (0=no;1=yes)	
Latrine (0=no;1-kutcha;2=pucca)	
Other valuable large assets (1-motor bike; 2-mobile phone; 3- boat engine; 5-bicycle; 6-	

Comments/Other remarks

2007 Flood

Impact of Flood on Household	
Was homestead plinth flooded during the 2007 flood?	
If homestead plinth not flooded: o What was height between homestead plinth and maximum water level during first flood peak(July/August))? o What was height between homestead plinth and maximum water level during second flood peak (September)?	ft ft
If homestead plinth flooded: o What was maximum depth of water above homestead plinth during first flood peak (July/August))? o What was maximum depth of water above homestead plinth during second flood peak (September)?	ft ft
What was duration of first flood peak?	days
What was duration of second flood peak?	days
How long before the flood did you start preparing for the flood?	days
Did you receive advance warning of the flood?	
How were warning received? (*Warning codes: 0-none; 1-own observations/experience; 2-told by someone from village; 3-told by outsider; 4-told by official; 5-radio/TV; 6-mike system or drum beating)*	
How many household members were present during the flood?	
How many household members moved because of the flood?	
If any household members moved, why? (*1-house destroyed; 2- water too high for safety although house standing; 3- to safeguard livestock; 4- to find work; 5- other)*	
If any household members moved, where did they go? (*1-relatives house; 2-neighbours house; 3-flood shelter; 4-embankment; 5-public building (e.g. school)*	
If any household members moved, how long did they stay away?	days
What was the cost of moving and staying in temporary shelter?	Tk
Impact of Flood on Assets	
Livestock lost during flood o Number of cattle/buffalos lost due to flood o Number of sheep/goats lost due to flood o Total value of livestock lost during flood	Tk
Livestock moved during flood o Number of cattle/buffalo moved during flood o Number of goats/sheep moved during flood o Number of days moved o Reason for moving (*1-for safety above flood water; 2-for safety from theft; 3-to find fodder/grazing; 4-to sell; 5-other)*	days
Location where livestock moved *(1-school; 2-flood shelter; 3-embankment;4-mainland;5-other)*	
Poultry o Number of poultry/chickens lost o Total value of poultry lost	Tk

Damage to buildings o Number of homestead buildings damaged during flood o Number of buildings destroyed during floods o Costs of repairs to damaged buildings o Costs of replacing buildings destroyed	 Tk Tk
Foodgrain o Quantity of foodgrain lost during flood o Type of foodgrain stored (1-rice; 2-wheat; 3-corn) o Value of foodgrains lost during flood	 mds Tk
Other assets o Value of damage to trees and homestead garden o Value of damage to other assets (agricultural implements, furniture, household utensils, personal possessions etc.) o What percentage of these assets were saved?	Tk Tk %
What contributed to the loss/damages of assets during the flood? (*1-not enough flood warnings; 2-did not expect flood; 3-no higher ground available; 4-transport problems)*	
Was clean drinking water available during the flood? (Y/N) If yes, what was the source of drinking water? *(1-tubewell in homestead 2-tubewell in neighbouring homestead; 3-other)*) If no, why was clean water not available? (*1-tubewell in homestead broken/not working; 2-tubewell under flood water; 3- not allowed access to nearby tubewell; 4-no tubewell nearby; 5-other*)	
If latrine in homestead, was latrine usable during flood? (Y/N)	
Did any other households take refuge at the raised homestead during the floods? (Y/N) If yes, how many people took refuge? Did the refugee households bring o Number of Cattle/buffalo o Number of Sheep/goats Other possessions (describe)	
What were the biggest problems *for men* during the 2007 flood? 1st problem 2nd problem 3rd problem What were the biggest problems *for women* during the 2007 flood? 1st problem 2nd problem 3rd problem *(ask men and women separately, make notes and code later for additional problems 1-obtaining clean drinking water; 2-toilet facilities; 3-geeting fuel; 4-getting food; 5-preparing food; 6-cooking; 7-getting work; 8-safety; 9-theft;10-moving house; 11-transport; 12-lack of shelter; 13-feeding livestock; 14-livestock diseases; 15 human illnesses 16-others(describe))*	

What actions did your household take to recover from losses after the 2007 flood? Did men and women take the same actions? o Sought work outside village o Sold land o Mortgaged land o Sold livestock o Took loan o Sold jewellery o Sold other assets o Received help/gift from relative o Received help/gift from neighbours	 M/W M/W M/W M/W M/W M/W M/W M/W M/W
Was relief received relief from government or NGO? (Y/N) If yes, what kind of relief was received and how much? (*1-food; 2-money;3-building materials; 4: livestock; 5-agricultural inputs; 6-domestic materials; 7-transport; 8-other*)	
What were the main priorities for recovering after the flood? 1st priority 2nd priority 3rd priority *(1-obtain food; 2-rebuild house; 3-replace livestock; 4-obtain agricultural inputs; 5-replace other assets; 6-pay for health care; 7-other)*	

Comments/Remarks

ANNEX B

COSTS AND HOUSEHOLDS BENEFITING FROM VILLAGE PROTECTION WORKS

Scheme Number	Site location	Implementing Agency	Total Number of HHs	Number of PEP HHs	Total Cost (Tk.)	Cost per HH (Tk/HH.)
1	Village: Orionda Union: Mithamoin Sadar Upazila Mithamoin District: Kishoreganj	POPI	254	195	1,853,748	7,298
2	Village: Daudpur Union: Gazipur Upazila:Khaliazuri Dist.: Netrokona	SUS	155	99	2,176,654	14,043
3	Village: Tearkona Union: Baraibari Upazila: Ittna Dist.: Kishoreganj	ORA	137	77	2,332,062	17,022
4	Village : Kamalpur Union: Kakailcheo Upazila: Azmiriganj District: Hobiganj	IDEA	971	598	923,505	951
5	Village :Rasulpur Union: Kakailcheo Upazila: Azmiriganj District: Hobiganj	IDEA	952	467	2,219,650	2,332
6	Village :Kamalpur Union: Lakhai Sader Upazila: Lakhai District: Hobiganj	USS	236	154	2799231.00	11,861
7	Village:Bijaynagar Union: Fenarbak Union Upazila: Jamalganj Dist.: Sunamganj	CNRS	39	31	909776.00	23,328
8	Village :Pangoan Union: Vatipara Upazila: Dherai Dist.: Sunamganj	ERA	79	62	2,217,323	28,067
9	Village:Dulpushi Union: Vatipara Upazila: Dherai Dist.: Sunamganj	ERA	98	88	1,170,896	11,948
10	Village:Chondrapur Union: Sormongal Upazila: Dherai Dist.: Sunamganj	ERA	165	143	1,478,697	8,962
11	Village: Aynarghop (3 villages) Union: Maijchar Upazila: Bazitpur District: Kishoreganj	CARE	479	323	1,320,504	2,757
12	Village: Baharbauli (5 villages) Union: Maijchar Upazila: Bazitpur District: Kishoreganj	CARE	827	418	6,260,000	7,570
13	Village: Rahmatpur Union: Kawarejore Upazila: Mithamoin Dist.: Kishoreganj	CARE	88	64	3,196,310	36,322

Scheme Number	Site location	Implementing Agency	Total Number of HHs	Number of PEP HHs	Total Cost (Tk.)	Cost per HH (Tk/HH.)
14	Village: Bhara Union: Ghagra Upazila: Mithamoin District: Kishoreganj	CARE	538	311	6,710,776	12,474
15	Village:Salakanda Union:Fateypur Upazila: Madon District: Netrokona	CARE	159	115	1,974,088	12,416
16	Village:Daxminkanda Union:Fateypur Upazila: Madon District: Netrokona	CARE	115	77	2,350,420	20,438
17	Village:Hukura Union:Shibpasha Upazila: Azmiriganj Dist.: Hobiganj	CARE	171	144	1,526,915	8,929
18	Village:Bahadurpur Union:Fateypur Upazila: Bishamberpur Dist.: Sunamganj	CARE	92	73	1,505,334	16,362
19	Vill:Kamierbauli Union: Bolierdi Upazila: Bazitpur District: Kishoreganj	POPI	178	119	2,899,544	16,290
20	Vill:Bhatshala Union: Kastol Upazila: Austogram District: Kishoreganj	BS	824	664	4,052,186	4,918
21	Vill: Bedarpur Union: Fenerbak Upazilla: Jamalganj District: Sunamganj	CNRS	57	51	1,009,394	17,709
22	Vill: Poschim Fenerbak Union: Fenerbak Upazilla: Jamalganj District: Sunamganj	CNRS	120	64	2,406,457	20,054
23	Vill: Krishnapur (Poschim Austagram) Union: Austagram Sadar Uz: Austagram Dist: Kishoreganj	BS	500	264	264,000	528
24	Vill: Ghagra Union: Ghagra Upazila: Mithamoin District: Kishoreganj	CARE	699	482	1,000,000	1,431
25	Vill:Aynarghop (Market protection) Union:Maijchar Uz: Bazitpur District: Kishoreganj	CARE	479	323	450,000	939
26	Vill: Beherbauli (Market protection) Union:Maijchar Uz: Bazitpur District: Kishoreganj	CARE	827	418	427,500	517

ANNEX C

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