Char Development and Settlement Project Phase IV
Bangladesh

Feasibility study on the development of a cluster of island chars in the Lower Meghna in Bhola - and Noakhali Districts

Dhal Char

Integrated Main Report

September 2016

Government of Bangladesh / IFAD / Government of the Netherlands

Implementing Government Agencies:

- **Bangladesh Water Development Board (BWDB)**
- **Ministry of Land (MoL)**
- **Local Government Engineering Department (LGED)**
- **Department of Public Health Engineering (DPHE)**
- **Department of Agriculture Extension (DAE)**
- **Forest Department (FD)**

and NGOs

BETS **Euroconsult Mott MacDonald** **Socioconsult**

Content

Tables

Figures

Annexes

Appendices (separate documents)

Feasibility Study of Cluster of Chars (Dhal Char), Development Design Consultants Ltd. (DDC)/ Institute of Water Modelling (IWM), September 2016.

CDSP IV Feasibility Study of Cluster of Island Chars, Dhal Char, TA-contribution, Euroconsult Mott MacDonald/ BETS/ Socioconsult, September 2016.

List of abbreviations

BDT	Bangladesh Taka
BWDB	Bangladesh Water Development Board
CBO	Community Based Organization
CDSP	Char Development and Settlement Project
cm	centimetre
DAE	Department of Agriculture Extension
DDC	Development Design Consultants Ltd.
DRLS	Directorate of Land Records and Surveys
DLS	Department of Livestock Services
DPHE	Department of Public Health Engineering
DoF	Department of Fisheries
DPP	Development Project Proforma
DTW	Deep Tube Well
EIA	Environmental Impact Assessment
EIRR	Economic Internal Rate of Return
EMP	Environmental Management Plan
FCDI	Flood Control Drainage Irrigation
FD	Forest Department
FF	Farmer Forum
FIRR	Financial Internal Rate of Return
GDP	Gross Domestic Product
GOB	Government of Bangladesh
GPWM	Guidelines for Participatory Water Management
ha	hectare
HYV	High Yielding Variety
IEC	Important Environmental Components
IFAD	International Fund for Agricultural Development
IGA	Income Generating Activity
IMSC	Inter Ministerial Steering Committee
IWM	Institute of Water Modelling
IPCC	Intergovernmental Panel on Climate Change
kg	kilogram
km	kilometre
LCS	Labour Contracting Society
LGED	Local Government Engineering Department
m.	meter
MFI	Micro Finance Institution
MHWL	Mean High Water Level
Mm	millimetre
MoL	Ministry of Land
MOWR	Ministry of Water Resources
MT	Metric Ton
NGO	Non Governmental Organization
NPV	Net Present Value
O&M	Operation and Maintenance
PCD	Project Coordinating Director
PKSF	Palli Karma-Sahayak Foundation
PMC	Project Management Committee
ppt	parts per thousand
PWD	Public Works Datum
RCP	Representative Concentration Pathway
RFLDC	Regional Fisheries and Livestock Development Component

SFG	Social Forestry Group
TA	Technical Assistance
TBA	Traditional Birth Attendant
Tk	Taka
TSP	Triple Super Phosphate
TUG	Tube well User Group
Unesco-IHE	Institute of Water Education
UP	Union Parishad
WARPO	Water Resources Planning Organization
WMG	Water Management Group
WMO	Water Management Organization
yr	year

Executive Summary

1. **Area:** The emergence of Dhal Char in the Lower Meghna northwest of Hatiya island started already about 70 years back. The char covers a gross area of 2,210 ha and is located in two Upazilas belonging to two Districts: Hatiya Upazila of Noakahli District (79%) and Monpura Upazila opf Bhola District (21%).
2. **Population:** Settlers started to migrate into the area in the beginning of this century, with about half moving in between 2006 and 2010, mainly from Noakhali District. Currently 253 households are living in Dhal Char; total population is 1,417. The people are mainly involved in agriculture (76%). For 16% of the household, there is food security for only three months and for another 60% for six months; 8% has enough food for nine months and the remaining 16% for the whole year.
3. **Physical conditions**: Around 77% of the area has an elevation between 2.5 and 3.5 m PWD, 14% between 1.5 and 2.5 m PWD and remaining 9% is lower than 1.5 m PWD. The largest part (77%) of the area is used for agriculture, while 20% is under forest.
4. **Integrated program:** The study proposes to initiate a CDSP-type of project in the area. This means a multi-sectoral and multi-agency development program, with a distinct role for both government agencies and NGOs. The program should cover the following fields: water management (Chapter 2), internal infrastructure (Chapter 3), land settlement (Chapter 4), agriculture (Chapter 5), livestock (Chapter 6), fisheries (Chapter 7) and social forestry (Chapter 8). In addition it is advised to have a specific social- and livelihood component (Chapter 9). Such an approach requires specific governance related arrangements (Chapter 10). The integrated approach follows the principles of Integrated Coastal Zone Management, as reflected in the Coastal Zone Policy of Bangladesh.
5. **Water management:** The char is inundated twice a day during high tide, especially in monsoon time. Only 3% of the area stays flood free during monsoon time. The largest part (54%) has an inundation depth between 0.90 m and 1.80 m, and 39% between 0.30 m and 0.90 m. The water comes from all sides, but stays only for 2.5 to 3 hours. There is no stagnant water. In the dry season, the char is largely flood free. Mean high water level during monsoon time is 2.68 m. PWD in that part of the Lower Meghna. At that land level no further significant sedimentation of the land surface can be expected
6. **Water management, planning options:** Basic planning options are to leave the char unprotected or to construct a polder. The latter option is very much the wish of the settlers and will indeed bring them the most benefits. For protection, the land level must have reached 2.68 m of MHWL at monsoon time. This can be achieved by allowing natural sedimentation to continue or by increasing land levels through deposition of dredging spoils. With a view on current land levels and on the average sedimentation rate (4 cm a year), it can be expected that Dhal Char will reach that required level in about eight years. This would be within the expected period of a new char development program (roughly 2019 to 2025) and would avoid costly interventions as dredging. It is recommended to select that option: leave the char unprotected till about 2023 and then start building a polder. For this the construction of embankments (3.9 km sea facing and 15.81 interior) and seven one-vent sluices are required, as well as the re-excavation of 14.1 km drainage channels. The presentation of the future scenarios in the various sectors below, (6 to 10), are based on the recommended option. In the report itself, consequences and costs of other options have been elaborated upon for each of the sectors.
7. **Internal infrastructure:** The internal infrastructure of Dhal Char is not well developed. The earthen roads (total length of nearly 5 km) are not properly maintained and can only be used by small cars in winter time. There are only two deep tube wells, no cyclone shelters, 15 mosques, a few small bazaars and six primary schools and madrasas. It is proposed to upgrade the existing roads and construct new ones (total 8.4 km of earthen roads and 2 km of pucca road), including eight culverts. The plan provides for four cyclone shelters, 90 deep tube wells and 1,500 pit latrines. Also two public toilets, five rain water harvesting schemes and three community ponds are proposed.

8. **Land settlement:** In Dhal Char 1,783 acres have been officially distributed to 1,783 households. But most of these households are living outside the area; only about 100 are settled in the char itself. Taking into account forest land and land required for the planned infrastructure, about 1,530 acres, all in Hatiya Upazila) are available for official settlement of landless households. Providing the families already present in the char without any land title with 1.5 acre each, would need about 300 cares. The remaining 1,236 acres can be given to 1,024 families, not yet settled in Dhal Char.
9. **Agriculture:** About 76% of the settlers are directly involved with farming. Crop intensity stands at 136%, based on the cultivable area. The dominant crop is the monsoon rice, followed by the rabi crops. There is no cultivation of aus rice. Reported yields of rice ranges from 2.35 to 2.96 tons per ha. Homestead gardening is not well developed. The main constraints are high soil- and water salinity, tidal flooding, deficit in information and knowledge due to lack of extension services, land ownership and lack of proper credit facilities. Main elements in the proposed development plan are improvement of water management (including a peripheral embankment), introduction of modern technologies (such as improve varieties and better cultivation methods), providing land titles (see 6 above), construction of community ponds to increase irrigation possibilities and strengthening extension services. The Department of Agriculture Extension has to expand their services to the area, while NGOs can support households in homestead agriculture. The plans for the road network will facilitate marketing of produce. The combination of these measures will significantly increase cropping intensity and overall production.
10. **Livestock:** In the vulnerable environment of char areas, livestock has a strong element of risk aversion. It is seen as a reliable source of income for small farmers and landless families. Nearly half of all households rear cattle, 24% have sheep, 92% chicken and 84% rear ducks. However, as in the case of agriculture, lack of support services is hampering livestock development, in addition to theft, diseases, poor genetic quality, shortage of feed and the poor marketing system. Improvement of extension – and support services is a major component of the proposed development package. It is recommended not to rely only on the services of the Department of Livestock Services, but to engage a NGO to develop semi-skilled manpower and employ a veterinary doctor. Training of farmers should follow the Livestock Farmer Field School methodology, supported by the NGO and livestock field workers, and with assistance from DLS. The Department should facilitate the supply of drugs and vaccines. The expected growth in agricultural production will improve the supply of fodder (crop residues); this can be further enhanced by including more leguminous crops in the farming system and by planting of trees with protein reach leafs. It is critical that livestock rearing households organize themselves in order to make collective bargaining possible to reduce the risk of being exploited by the middlemen. The groups can establish direct contacts with sellers of inputs and with buyers of livestock products.
11. **Fisheries:** Households are involved in fishing in closed water bodies (ponds, ditches), in wild fisheries (khals and floodplains), or in fishing outside the area (Meghna estuary), but for none of the households fishing is the main occupation. The main constraints for fisheries are the limited number of ponds, tidal flooding, insufficient input supplies and extension services, and adverse marketing conditions. More intensive cultivation methods and improve extension services by engaging a NGO are essential components of the proposed development plan. Establishment of a fish hatchery in the area (adjacent char) would address the demand for fingerlings. Protection of the area by an embankment would change the situation dramatically. Cultured fisheries in ponds, ditches and in the two large fish farms will be greatly benefitted. The lack of floods and salt water intrusion will encourage households to invest in intensified aquaculture methods.
12. **Social forestry:** The char was brought under mangrove forest by the Forestry Department in 1978. Development started by the Forest Department in 1992, but immigration of settlers led to deforestation. Currently, 1,200 ha of mangrove forest are still present. There is hardly any more forest in the remaining part of the char. It is recommended that the Department renews its presence with a substantial forestry program with strip plantation along all the roads (10. 4 km) and channels (14.1 km) and along the whole length of the embankment (19.7 km); with foreshore plantation in front of the sea facing part of the embankment (20 ha); and with plantation grounds of public institutions (like cyclone shelters, schools, mosques). NGOs should be given the responsibility to promote and support agro-forestry on homesteads. It is standing policy in Bangladesh to apply the social forestry approach. Men and women from the area, organized in Social Forestry Groups, are involved in planning, implementation and maintenance of the forestry schemes and are rewarded though benefit sharing arrangements.
13. **Social and livelihood component:** Although many of the proposed activities have a distinct social impact and will favourably influence the livelihoods of the settled families, it is recommended to emphasize the importance of these aspects by a specific social and livelihood component, to be carried out by a NGO, as

is the case in CDSP IV. The strategy is basically to render micro-finance services targeted at women (better credit facilities will stimulate productive pursuits) and to provide social and economic services that are not being delivered by the government at this early stage of development of the area. Subjects to be covered are: group formation (exclusively women) and micro finance; health and family planning; education; water and sanitation; homestead agriculture and value chain development; livestock development; fisheries; legal and human rights; disaster management; and awareness on the environment and on climate change. It is foreseen, with a view on the size of the area and of the population, that establishment of one branch office would suffice, established by one NGO.

14. **Governance:** As indicated earlier, it is recommended to frame the multi-sector interventions in a multi-agency program. As in CDSP III and IV, it is recommended that the following six partner agencies participate: Bangladesh Water Development Board, Local Government Engineering Department, Department of Public Health Engineering, Ministry of Land, Department of Agriculture Extension and Forestry Department. An Inter-Ministerial Steering Committee and a Project Management Committee would function as coordination mechanisms. The Department of Livestock Services and the Department of Fisheries would support the program through training efforts and supply of inputs. The private sector would have also a role in input supply and in marketing of crops, fish and livestock products. The involvement of NGOs was explained in the previous section. Important is the support and active involvement of local government institutions, especially at the level of the Union Parishad. The significance of field level institutions for a successful char development program can hardly be underestimated. That is why much attention will be given to the formation and support of Water Management Groups, Farmer Forums, Social Forestry Groups, Tube well User Groups and micro-finance groups. As much as practically possible, Labour Contracting Societies will be engaged for earth work.
15. **Environmental impact:** The proposed option (construction of a polder in about eight) will have positive impacts on most of the important environmental components including prevention of flood and salinity intrusion. Soil salinity will be reduced over time, while tidal flooding will be prevented. This will result in an improvement in land types and land use. Drainage will be improved as well and availability of fresh water in type char will increase. However, embankments will prevent further sedimentation of the char, and thus a further increase in average land levels. It will have a beneficial effect on flora, bur fauna and wildlife will suffer. Possibilities for an increase of productivity in crop agriculture, homestead gardening, forestry and aquaculture will be significant. The conclusion is justified that this option does not have such significant negative impact on the environment, that it ought to be discarded. Mitigation measures and monitoring are however necessary.
16. **Social impact:** The social impact of the proposals would in general be favourable. Physical security for the settlers would improve a great deal (embankments, cyclone shelters, roads, skills in disaster management). Economic and food security would be much better as well. The upswing in local production and the economic development in general will increase and diversify the income streams and will open up employment opportunities. The higher production in agriculture, fisheries and livestock are bound to decrease the periods of food shortages of large sections of the population, as was proven in previous CDSP-project areas. It is expected that more service providers, both from the government and from the private sector, will be encouraged to come to the area because of the economic development and the better communication network. Health status will be improved by the improved food security, including a higher availability of high protein food, as well as by the targeted interventions of the social- and livelihood component. That component will increase the access for children to primary education. The cyclone shelters can serve as school buildings. The social position of settlers will be enhanced (land titles, participation in field level institutions), especially for women.
17. **Costs and benefits:** Comparing costs and benefits for the recommended option (protection of Dhal Char by embankments) the economic internal rate of return (EIRR) would be 35.24% and the financial rate of return (FIRR) 12%. Both are above or equal to the opportunity costs of Bangladesh of 12%. This option is considered to be economically and financially sustainable. Total costs for the recommended option are estimated to be Taka 7,376.5 lakh. This equals Euro 8,210,044 or US$ 9,161,613 at the exchange rate of 19 September 2016.

1. Introduction

1.1 Background and objectives

The Inception Report of the Char Development and Settlement Project (CDSP) IV states that the project will undertake three feasibility studies in areas where in the future development programs for chars might take place. It further states that these future areas have to be located within the overall study area, essentially the central, dynamic part of the coastal zone of Bangladesh. This area is bordered in the east by the outfall of the Muhuri River and the Chittagong coastline. In the west, the border is formed by the Tetulia River which is on the west of the island of Bhola. In the north the area follows the coastline of Feni, Noakhali and Lakshmipur Districts. After a rigorous process of selection, the BWDB and the Development Partners (Government of The Netherlands and IFAD) decided to take up Cluster of Chars (Char Pollabi, Char Banani, Char Akram Uddin, Char Alauddin, Char Khondakhar) in the district of Noakhali as the first of the series of anticipated three feasibility studies. The report on this cluster of chars was completed in January 2015. Subsequently, for the second series of feasibility studies three island chars in the Lower Meghna: Dhal Char, Char Kola Toli and Char Mozammel have been selected. The chars are located in Noakhali District and Bhola District. The present report represents the study on Dhal Char. The Terms of Reference can be found in Annex 1. For a map of the cluster of all three chars, see Figure 1.1 and for the map of Dhal Char see Figure 1.2.

The main objective of the study is to assess the technical, economic, social and environmental feasibility of developing the chars in the study area. The aim is to present the feasibility study report to the Government of Bangladesh and to development partners (international donor agencies) in order to ascertain whether the proposed development plans are feasible out of a policy point of view and subsequently to secure funds and technical support necessary for the implementation of the proposed package of interventions.

1.2 Methodology

The overall coordination of the feasibility study was in the hands of the Technical Assistance (TA) team of CDSP IV, under responsibility of the Project Management Committee (PMC), chaired by the Project Coordinating Director (PCD) of the Bangladesh Water Development Board. The Terms of Reference for the study were drafted by the TA team and approved by the PCD and PMC. The study is financed by funds from the TA-budget.

The responsibility of actually undertaking the study has been split up. The major part has been sub-contracted to a consortium of a Bangladeshi firm and institute: Development Design Consultants Ltd. (DDC) and the Institute of Water Modelling (IWM). The DDC/IWM consortium covered water management, internal infrastructure, agriculture, livestock, fisheries, forestry, environmental impact and the cost-benefit analysis. The TA-team itself took up the task to prepare the parts of the study on the social- and livelihood/NGO component, and the parts on land settlement, governance and social impact. The report of DDC and IWM, and the reports of the TA-team form Appendices to this Main Report. This Main Report integrates all different sections and is a great deal shorter than the combined original reports. It provides a comprehensive presentation of the main findings.
The methodology of preparing the reports basically followed four phases: establishing base-line conditions and constraints; identification of interventions; analysis of impact; formulating the overall proposed plan. The information was obtained through both primary and secondary data collection. The DDC/IWM report gives an overview of all field surveys that have been undertaken. The study was carried out in the period from mid-February to December 2015.

1.3 Study area

1.3.1. Main characteristics

The emergence of Dhal Char in the Lower Meghna River started already some 70 years back. It is located north-west of Hatiya island. The char is spread over two Upazilas and two Districts. Of the total area of 2,210 ha, 1,740 ha (79%) forms a part of Hatiya Upazila of Noakhali District, and 469 ha (21%) is part of Monpura Upazila of Bhola District. For a map of Dhal Char, see Figure 1.2.

Land levels range from 1.5 m to 3.5 meter, with an average of 2.75 m PWD. The largest part of the char (77%) is used for crop production. Nearly 20% is under forest (mainly mangroves), while between 2 and 3% is covered by water bodies; less than 1% is used for infrastructure and roads.

1.3.2. Population

At the time of the study, 253 households were settled in Dhal Char. Total population amounted to 1,417, which means an average house hold size of 5.6. The male: female sex ratio was 129:100. Nearly 36% of the population was younger than 15 years, 34% was between 16 and 34, 21% between 35 and 59 and 9% was older than 60- years. Of the population of over 5 years, 45% was illiterate.

About 28% of the households migrated to Dhal Char before the year 2000, mainly from Lakshmipur District and Hatiya Upazila in Noakhali District. In the period 2001-2005 another 12% arrived, while 48% migrated between 2006 and 2010. The other households (12%) came between 2011 and 2013.

1.3.3. Occupational pattern, income and expenditures

Of the population 76% are directly involve with farming: the largest percentage of household heads (52%) are farmers, 20% are sharecroppers and 4% earn an income with daily labour on farms. The remaining 24% are equally distributed over non-farm daily labour, small trade/business and other occupations. No household reported that fishing was the main occupation.

Income wise, 4% of the households reported to belong to the lowest category of less than Taka 12,000 per year (mainly daily labour and fishermen). Another 4% earn between Taka 12,000 and 24,000 (daily labour, livestock holders, salaried staff). The middle income groups form 36% with an income between Taka 24,000 and 60,000 (farmers, small traders/businessmen) and 24% between Taka 60,000 and 120,000 (business and remittances from overseas as source of income). The households with the biggest incomes (32%) with more than Taka 120,000 are predominantly dependent on foreign remittances.

Over 60% of households report that food is their biggest expenditure item (see also next section). Other large expenditure categories are agricultural inputs, clothing, medical treatment, social/ religious purposes and household goods.

1.3.4. Food security status

The group of the population with the least food security (food for less than three months a year), forms 16% of the population; 60% has an adequate supply for six months and another 8% for nine months. The remaining 16% has enough food throughout the year. No household in Dhal Char produces a surplus of food. The households with the least food security have to purchase 85% of their consumed food from the market, for the group with the highest food security this is only 2%.

1.4 Time frame

1.4.1. Lead time to implementation

The current intention is that CDSP IV runs till September 2018. This would mean that the next phase, CDSP V, will not start before the end of 2018. This means that the possible implementation of the package of interventions proposed in this study will start roughly two and a half years after the study has been completed. In this period a number of important variables might change. Factors that will have a significant effect are, for instance, the expected growth in the number of households and overall population and the extent of sedimentation. Also the inflation of in particular construction costs has to be taken into account.

1.4.2. Long term time frame

Due to the dynamic nature of the natural environment in coastal areas, in particular the central part formed by the Meghna estuary, the feasibility studies of CDSP have taken a time frame of 20 years, ten years shorter than the often used 30 years period. This basically means that the cost benefit analysis is based on the assumption that the interventions initiated by the project will have an impact for 20 years (for instance that infrastructure will function for 20 years) and that benefits accrued to project interventions are limited to the same 20 year period. As far as the impact of climate change is concerned, a time horizon till 2050, 34 years from now, has been adopted. This is done out of caution. The longer period provides a hedge against developing insights into climatic changes.

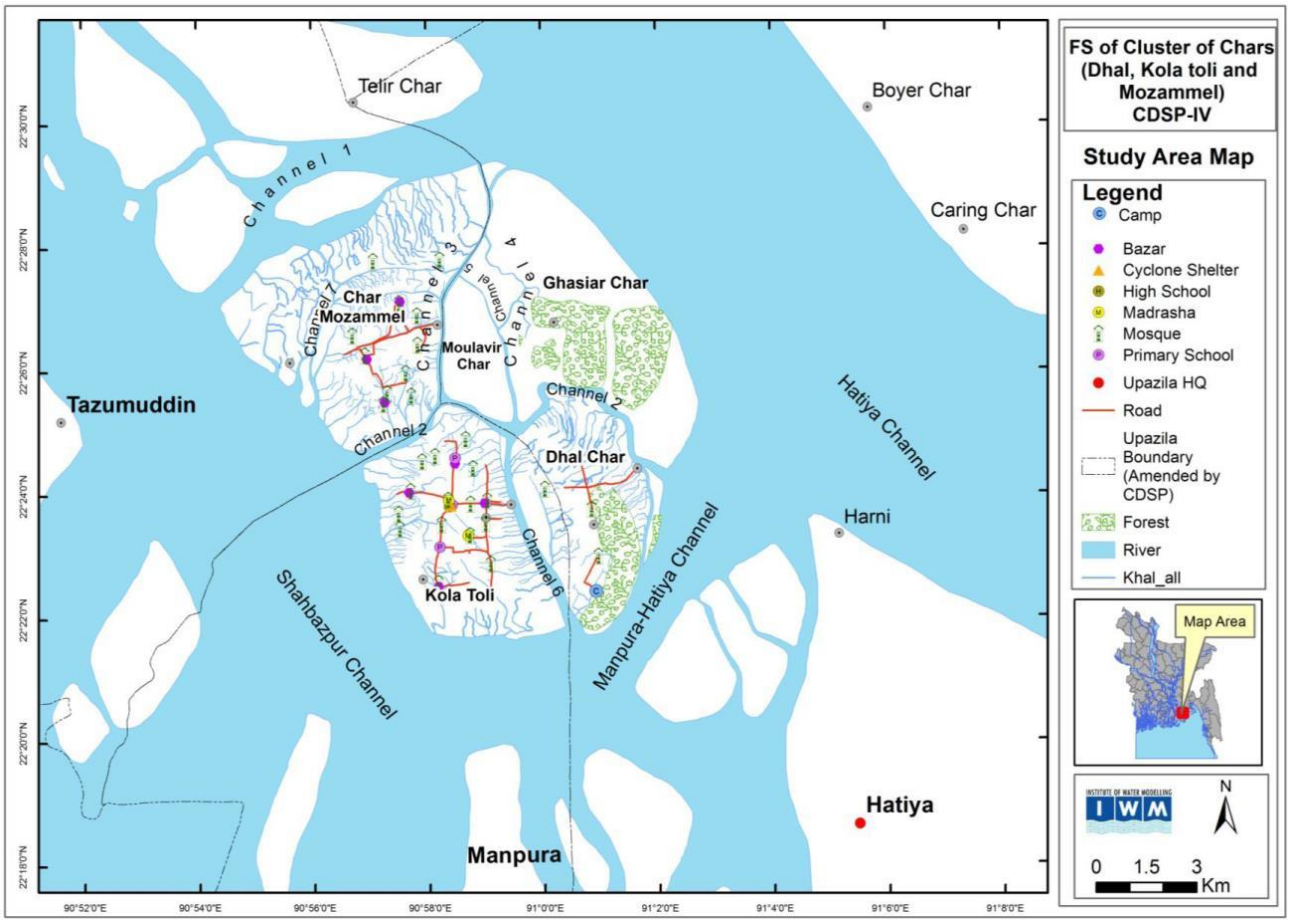

Figure 1.1 Overview of the study area of three chars: Char Kola Toli, Dhal Char and Char Mozammel

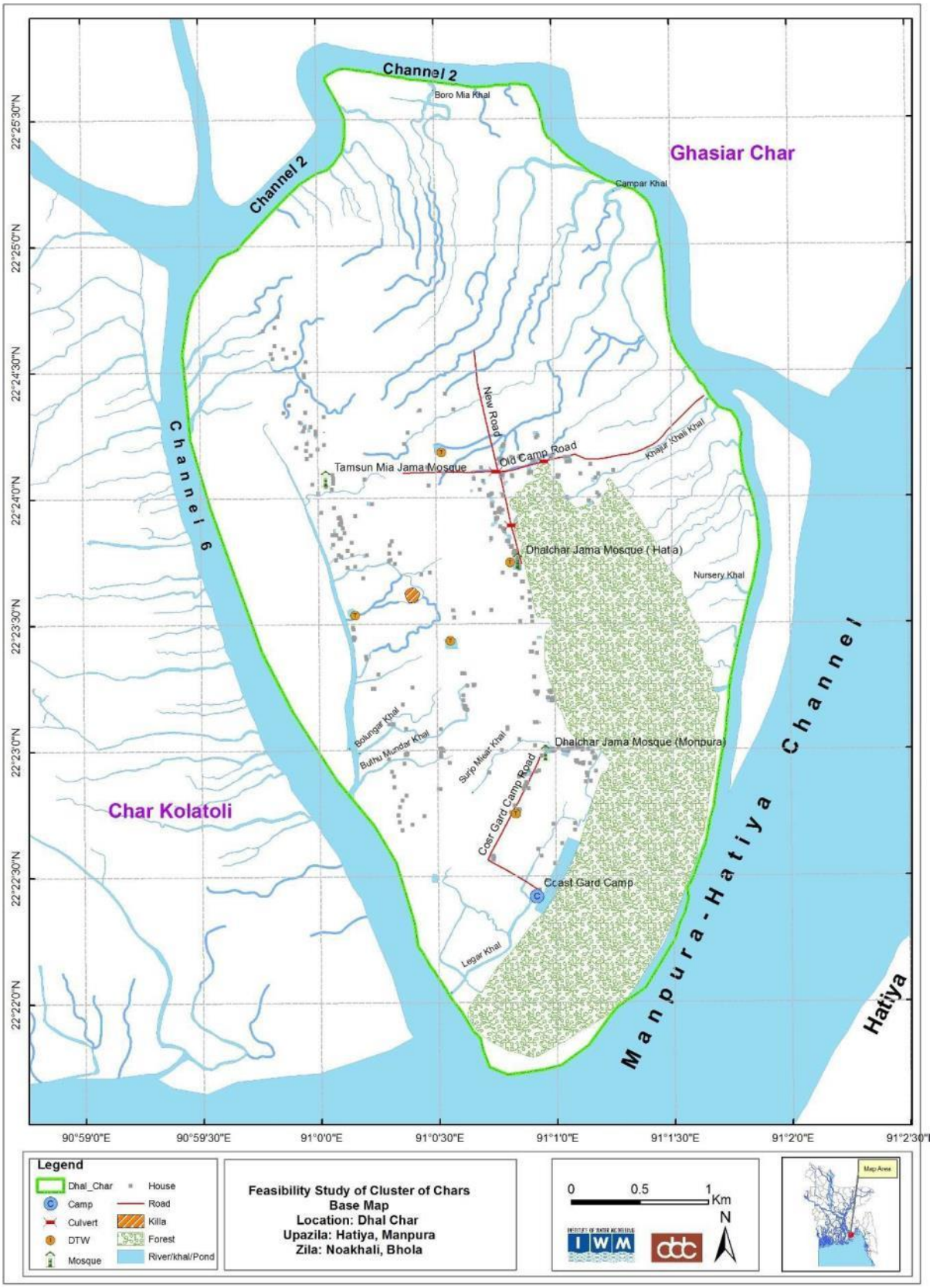

Figure 1.2 Map of Dhal Char

2. Water management

2.1 Introduction

Water management is a crucial factor in CDSP projects because it is directly related to vital aspects of people's livelihoods as safety, food security and further economic development. It is certainly the case for Dhal Char, with its vulnerable location in the Lower Meghna. That is why water management is dealt with so early in this feasibility study. It sets the stage for the possibilities for development in other fields such as agriculture, livestock, fisheries and forestry, all of great importance for livelihoods of char settlers.
This chapter starts with explaining the present situation (in 2.2) in terms of a number of essential variables. It continues with assessing the options for a future scenario in order to come to a water management plan (2.3), taking into account the consequences of climate change. The chapter closes with an overview of the costs of the proposed water management interventions and of the benefits they will generate (2.4).

2.2 Present situation and constraints

2.2.1. Main features of present situation
- Area and land levels: The gross area of Dhal Char is 2,021 ha. Land levels vary from 0 to 3.5 m PWD. About 24% is lower than 2.50 m PWD, while the biggest portion (62%) is between 2.50 m and 3.00 m PWD. The remaining part of around 14% has a level between 2.5 and 3.5 m PWD. Approximately half of the area is between 0 and 2.68 m PWD (the mean high water level at monsoon time, the level that indicates the land is mature, in the sense that no further siltation will occur).

- Rainfall: The two nearest stations where rainfall is measured are at Hatiya (covering 65% of the study area) and at Ramgati. Average annual rainfall over the last 50 years for Hatiya station was 3,079 mm. The maximum daily rainfall (2.33 year return period) was 176 mm, with 3 days and 5 days consecutive rainfall of 309 mm and 392 mm respectively. For Ramgati average annual rainfall was 3,706 mm, maximum daily rainfall 140 mm, with consecutive 3 days and 5 days rainfall of 302 mm and 411 mm.

- Tidal characteristics: The tidal range during monsoon level varies from -0.80 m to 3.5 m, and during dry season from -0.50 to 2.75 m. The mean high water level (MHWL) during spring tide in monsoon time is 3.20 PWD and during neap tide about 2.20 m. MHWL during monsoon time can be taken as 2.68 m.

- Inundation: In the present condition, only 3 % of the area of Dhal Char is flood free during the monsoon season; 39 % has an inundation between 0.30 m and 0.90 m, while the largest part of the char (54 %) has an inundation between 0.90 m and 1.80 m. In the dry season most of the char is flood free, the low lying sections of the char become inundated at spring tide.

- Drainage: The char is inundated twice per day during high tide, in particular in monsoon time. The water comes from all sides, but only stays for 2.5 to 3 hours. There is no stagnant water. This quick run-off makes the char flood free during low tide.

- Salinity: Average water salinity levels are higher in the dry season than in monsoon time. Influence from sea salinity is highest during winter, the period with low discharge from the Ganges-Meghna-Brahmaputra river system, and drops when upstream flow increases in May. In January salinity varies from 8 to 10 ppt, with a peak of 14 ppt at spring tide. In the months of March and April, and the first part of May, salinity rises to 15-18 ppt, but then falls sharply to 4-7 ppt when the pre-monsoon rains set in. In June salinity drops to a concentration of below 1 ppt.

- Stability: Stability of the area is an essential variable for a decision to start a significant development program. Based on satellite images, a char adjacent at the eastern side to Dhal Char, covered 660 ha in 1996 and shrank to 73 ha in 2015, due to erosion. The images also show that Dhal Char itself is not so much erosion prone, except for the southern part along the Hatiya-Monpura channel. But the erosion in

that part fell sharply from 40 m a year between 1996 and 2008 to 19 m a year between 2008 and 2015. Although the gross area of Dhal Char reduced between 1996 and the present day, the conclusion seems justified that the char is stable enough to propose development work.

- Rate of sedimentation: To come to an estimate of the rate of sedimentation, field tests were done (measuring cross sections of khals) and a desk study was undertaken. A 10 year model-study of IWM/ Unesco-IHE concluded that average annual sedimentation rate in the study area was 4 cm. However, field test, only based on one year, gave higher outcomes. In a low lying area a rate of 10 cm was shown and in more raised areas between 4 and 9 cm.

2.2.2. Major constraints

The major features of the area as summarized in 2.2.1 and views from the population point to the main water management related bottlenecks in Dhal Char. Land levels are relatively low. A sizable part of the char is still in a development phase, with around 50% with a land level lower than MHWL in monsoon time. Only a fraction (3%) of the area stays flood free in monsoon time. Salinity levels of water show a great range from less than 1 ppt in June to nearly 20 ppt in the beginning of May.

2.3 Impact of climate change

For assessing the impact of climate change on the physical conditions of the chars in the Lower Meghna, especially the Representative Concentration Pathways (RCP) of the IPCC have been used. Projections of precipitation for the year 2050 show dramatic increases in rainfall during the monsoon season, in particular in the months from July to October, ranging from nearly 17% more precipitation in July to nearly 27% in September. The increase in wind speed in 2050 is project to be 8%.

The feasibility study has assumed that global sea level rise will be 24 cm in 2050, relative to 2015, based on IPCC scenarios (RCP 8.5). The likely rate of land subsidence is taken as 10 mm a year (same assumption is used by the Coastal Embankment Improvement Project). The sedimentation rate for the study period is estimated to be 4 cm a year, based on field tests and a Unesco/ IHE model study. The relative mean sea level rise for 2050 (35 years from now, beyond the 20 year time horizon of this study) is estimated to be - 1 cm (or 0 cm). This is the product of global sea level rice of 24 cm, plus land subsidence of 35 cm, minus sedimentation of 60 cm (4 cm for a period of 15 years).

The abovementioned assumed changes in a number of essential variables have been an input in the drainage model applied for the study. This model supported the selection of planning options and the designs of the water management related structures.

2.4 Water management plan

2.4.1. Planning options

The study area is vulnerable to tidal inundation, storm surges, salinity, and consequences of climate change, in particular sea level rise. After analysis of primary and secondary data and discussions with various stakeholders, four potential options were identified for addressing these vulnerabilities and for developing Dhal Char. Essential criteria in the selection were the current land levels and the Mean High Water Level during monsoon time. Beyond MHWL in monsoon time no significant sedimentation of the area will take place. The four options are as follows:

- Option 1: Leaving the char unprotected

Allow natural sedimentation to raise the land levels up to the MHWL in monsoon time (2.68 m). No construction of embankment and water control structures. Development efforts will be focused on limited growth of productive sectors as agriculture, fisheries and livestock, on social forestry, on development of internal infrastructure (road network, tube wells for drinking water and sanitary latrines, cyclone shelters) and on further enhancement of livelihoods with the assistance of NGOs.

- Option 2: Construction of polder after maturing of char

Construction of a polder, if indeed the land levels have achieved MHWL in monsoon time through natural sedimentation: If this can be achieved within the project period, embankments and water management structures can form a part of the future project. In addition, same internal infrastructure and socio-economic interventions as in option 1.

- Option 3: Acceleration of land level increase through dredging

Raising of land levels to MHWL in monsoon time through mechanized sand deposition (dredging surrounding rivers and pumping fill material on the land); after MHWL is reached construction of

embankment with water control structures; development of agriculture, fisheries and livestock and social forestry in a protected area; other development activities as in option 1.

- Option 4: Make one polder of three island chars
Same approach as in option 3, increasing land levels by dredging, but establishing one polder with the two other study areas (Char Kola Toli and Char Mozammel) by building cross dams between the chars and subsequently build an embankment around all three chars. Further development program as in option 3.

2.4.2. Selection of options
Due to the impact of climate change (resulting in a relative mean sea level rise of 0 cm in 2050, see 2.3 above), the inundation of the char will not worsen in the long the run, if the char is indeed left unprotected for such a long time (as in option 1). Under option 2, it is the intention to protect Dhal Char as soon as land levels reach MHWL in monsoon time. It is estimated that this process will take about 8 years, which means that construction of a polder would be within the timeframe of a new project (roughly 2019 to 2025). Option 2 is therefore realistic in terms of inclusion in a project that would succeed CDSP IV. This option is in principle technically feasible. That means that option 3 (accelerating increase of land levels by deposition of dredging spoil) does not need to be considered for Dhal Char, because it will have the same results as option 2 but will be more expensive due to the costs of dredging and deposition of the spoils on Dhal Char. Option 4 would result in one polder protecting three chars (a different result than option 2) after increasing land levels through mechanized deposition of dredging spoils. This is probably technically feasible, although there are a number of unresolved issues. It is however doubtful whether this option will fulfil financial and economic criteria, because of the costs of dredging.

Summarizing the assessment of the options: Option 1 is obviously technically feasible but would worsen the water management situation over an extended period. Option 2 is technically and probably financially and economically feasible and is within the time frame of a new project. Option 3 can be ignored in case of Dhal Char. Although it is quite uncertain whether option 4 is financially and economically feasible, this option can as yet not been discarded.

2.4.3. Proposed interventions
- Option 1: No water management interventions are planned under this option. The char will stay unprotected to allow further sedimentation. Excavation of existing channels is proposed (with a total length of 14.1 km) to further accelerate drainage after tidal flooding. There are no serious water logging issues at the moment.

- Option 2: To protect Dhal Char a sea facing embankment of 3.9 km, an interior dyke of 15.81 km, seven one-vent drainage sluices and re-excavation of channels are required. Also two buildings for Water Management Groups will be built. See Figure 2.1 for the proposed alignment of the embankment. This option can be implemented roughly after eight years from 2023 onwards, when land levels have reached 2.68 m. In the first few years of a new project sedimentation will continue, and no actual implementation works will be undertaken as far as water management is concerned. All preparations as design and tender documents have to be done in these first years.

- Option 3: Since the required land levels will be reached without additional measures, this option does not need to be considered.

-Option 4: Interventions under option 4 are not serving Char Kola Toli only, but also Char Mozammel and Dhal Char. For this option nearly 11 million cubic meters of dredge filling is required (for Char Kola Toli and Char Mozammel). A sea facing embankment of 19.6 km and internal embankments of 29.73 km are required, plus two cross dams. Water control structures with in total 27 vents have to be constructed. In all three chars drainage channels will be re-excavated.

2.5 Cost estimates and benefits

2.5.1. Cost estimates

- Option 1: Re-excavation of khals would cost Taka 168.2 lakh.

- Option 2: The cost estimate amounts to Taka 3,757.42 lakh. Details are given in table 2.1.below.

Table 2 - 1 Cost of proposed water management infrastructures (option 2)

Sl. No.	Project Infrastructures	Length / No/cum	Unit	Rate (Lakh Tk.)	Amount as per schedule rate 2013
1.	Drainage Sluice				
	1.1. 1 Vent dr. Sluice (1.5 x 1.8 m)	4	No	170	680.00
	1.2. 1 Vent dr. Sluice (0.9 x 1.2 m)	3	No	137	411.00
2.	Embankment				
	2.1 Sea dyke	3.9	Km	150	585.00
	2.2 Interior dyke	15.81	Km	120	1897.20
3.	Re-excavation of channel, 14.1 km	112151	Cum	150	168.22
4.	Construction of WMG Building	2	each	8.00	16
Total					3,757.42

- Option 3: This option is not relevant for Dhal Char.

- Option 4: Total costs of option 4 for water management related infrastructure would be Taka 64,370.5 lakh. These costs also cover the structures in Char Kola Toli and Char Mozammel.

Table 2 - 2 Cost of proposed water management infrastructures (option 4)

Infrastructure	Option 4	Option 4
Dredging	11 mln. M3	20,824.00
One vent sluices	27 nos.	34,320.00
Sea dyke	19.6 km	2,940.00
Interior dyke	29.73 km	3,567.60.
Cross dams	2 nos.	2,100.00
Re-excavation of khals	52.5 km	570.90.
WMG building	3 nos.	48.00.
Total		.64,370.5

Further analysis, in particular the economic and financial assessment, will focus on options 1, 2 and 4.

2.5.2. Benefits

There are a number of economic benefits if a polder is established in Dhal Char:

- an increase in the value of agricultural production through a higher cropping intensity and increase in yields;
- an increase in production of homestead gardening;
- a higher production of livestock products;
- the creation of an additional stream of income through aquaculture in individual ponds and higher production in big community ponds ;
- the creation of income for the settlers as a result of the social forestry activities; and
- a stimulation of general economic activities caused by the above mentioned production increases and supported by the improved transport network.

Economic benefits are accrued especially in the productive components (agriculture, .livestock, fisheries, social forestry) and in the social livelihood program and will be highlighted in the respective chapters (Chapter 5 to 9). Apart from these economic factors, the safety of the population and their property is obviously an essential impact of constructing an embankment.

3. Internal infrastructure

3.1 Existing infrastructure

3.1.1. Communication network

There is no adequate road network within the char. There are only five earthen roads, with a total length of 4.877 km (see table 3.1. below).

Table 3 - 1 Summary of existing roads

Road	Road Type	Length (Km)	Remark
Dhal Char Mosque Road	Existing kacha Road	0.689	Not in good condition
Old Camp Road	Existing kacha Road	2.377	Not in good condition
Coast Guard Camp Road	Existing kacha Road	0.115	Not in good condition
Coast Guard Camp Road	Existing kacha Road	1.151	Not in good condition
New Road	Existing kacha Road	0.545	Not in good condition
Total earthen roads		4.877	
Old Camp Road	Pucca road	2	HBB on earthen rd.

Old Camp Road has a stretch of 2 km of pucca road, on top of existing earthen road. The roads are not up to standard and should be improved. These roads are linked with households, mosques etc. with the boat/ ferry ghat.

The earthen roads are in a bad condition. Movement in the monsoon season is problematic, because most of the roads are inundated during high tide. Motor cycles and bicycles can only be used during the dry season. The roads are shown in Fig 1.2.

3.1.2. Water supply and sanitary facilities

There are only two deep tube wells in Dhal Char. These wells are the main source of drinking water for the 253 households. There are a few ponds. Sanitation facilities in the char are almost non-existing. Most of the households are using a kacha latrine. A very limited number of households is using single pit latrines.

3.1.3. Other infrastructure

There are no cyclone shelters. The area has 15 mosques, five bazars, six primary schools and madrasas.

3.2 Proposed internal infrastructure

3.2.1. Overview

The following internal infrastructures (Table 3.2) have been identified as required for Dhal Char. The estimated number of households-related infrastructures has been determined on the basis of the current number of households plus a future increase. This proposal is based on the expectation that in future the number of households will further grow to about 1,100 due to the possibilities of land settlement. This number does not take into account the possible migration to Dhal Char of currently absentee land lords (see next Chapter, section 4.3).

Table 3 - 2 Proposed internal infrastructure for Dhal Char (options 2 and 4)

SL No	Infrastructure	Length/ Number	Unit
1.	Rural Road (Type R-2)	8.366	Km
2.	Pacca Road	2	Km
3.	Box Culvert	2	No.
4.	Pipe Culvert	6	No.
5.	Cyclone Shelter	4	No.
6.	Deep Tube well	90	No.
7.	Single Pit Latrine	1,500	No.

8.	Public Toilet	2	No.
9.	Community Pond	3	No.
10.	Rainwater Harvesting Sch.	5	No.
*11. **	Market	2	No.
*12. **	Graveyard	1	No.
*13. **	Secondary School	1	No.
*14. **	Satellite Clinic	1	No.

*Consideration for provision of land for future use

For option 1, the proposed infrastructure would be less extensive due to the fact that the number of additional households would be much less: no pucca road, two pipe culverts, two cyclone shelters, 10 tube wells, 400 single pit latrines, three rainwater harvesting schemes. In addition, and one killa would be included, primarily to bring cattle to safety in case of floods.

3.2.2. Multi-purpose cyclone shelter

Cyclone shelters not only serve the safety of the settlers, they can also be used for other purposes such as school and place for community gatherings. Usually the planning of cyclone shelters is based on 500 households per shelter. This would bring the required number of shelters to three, given the expected growth to 1,100 households. One more cyclone shelter is included in the proposal with the aim to lessen the pressure on each shelter (about 300 families per shelter). If Dhal Char is left unprotected, two cyclone shelters would be sufficient.

3.2.3. Water supply and sanitary facilities

It is proposed to provide one deep tube well for an average of 15 families. For 1,100 families this would mean 74 tube wells. In addition all cyclone shelters, mosques and public toilets should have a tube well. Hence the 90 tube wells that are taken up in the plan. As per public demand, voiced during field visits and meetings and following CDSP practice, the proposal includes some rainwater schemes for locations where deep tube well are not feasible.

One single pit latrine is to be provided for each family. This means around 1,100 latrines would be required. The plan has a provision of 1,500 latrines, giving a safety margin of 400 in case of further immigration in the char after it is turned into a protected area. A provision of two public toilets has also been taken up, to be installed near market places.

Under option 1, with less population, 10 additional tube wells and 400 latrines would cover the needs, with no provision for public toilets or rainwater harvesting schemes.

3.2.4. Rural roads and culverts

Rural roads will improve communication within the project area. The proposed roads and to be developed existing roads are R-2 type LGED standard: crest width – 3.7m; side slope 2:1; crest level 5.50 m PWD.

Table 3 - 3 Roads proposed for development and extension, Dhal Char (options 1, 2 and 4)

Existing Roads	Road Type (R-2)	Length (Km)
New Dhal Road	Earthen kacha Road	2.473
Dhal Char Mosque Road	Earthen kacha Road	0.689
Old Camp Road	Earthen kacha Road	3.477
Coast Guard Camp Road	Earthen kacha Road	1.727
Total length earthen roads		8.366

The proposal includes the provision of two box culverts and two pipe culverts for cross drainage. The road alignment has been set in such a way that the number of culverts is kept to a minimum. But the exact location of the roads and culverts will ultimately be decided after discussion with the settlers. See Figure 3.1 for the location of the roads. In options 2 and 4, a pucca road of 2 km will be improved (Old Camp road).

3.2.5. Ponds

It is proposed to construct three community ponds (for all options), as none of the existing pond in the area have adequate dimensions.

3.2.6. Cluster village

During field visits and meetings, the local people made it clear that they prefer to live in independent houses rather than living in a cluster village. As such, a provision of cluster village has not been kept.

3.3 Costs and benefits

3.3.1. Cost estimate

- Option 1: Costs for option 1 for internal infrastructure would total Taka 745.35 lakh.
- Option 2: Under option 2, total cost estimate is Taka 1,512.34 lakh.
- Option 3: This option has been discarded.
- Option 4: The estimate for internal infrastructure for Dhal Char only would be the same as option 2, namely Taka 1,512.34 lakh. For all three chars combined the amount is Taka 7,646.2.

Table 3 - 4 Cost estimate internal infrastructure for Dhal Char (options 1, 2 and 4), in lakh Takas

Infrastructure	Option 1	Options 2,4	Cost (Lac Tk.)	Total Cost Option 1	Total costs Options 2,4
Rural Road (Type R-2)	8.367	8.367 km	20.00	167.34	167.34
Box Culverts	2	2	35.0	70.00	70.00
Pipe Culverts	2	6	4.00	8.00	24.00
Multi-purpose Cyclone Shelter	2	4	200.00	400.00	800.00
Deep Tube well	10	90	1.00	10.00	90.00
Single pit Latrine	400	1,500	0.05	20.00	75.00
Public Toilets		2	13.00		26.00
Rain Water Harvesting Schemes	3	5	1.00	3.00	5.00
Community Pond	3	3	10.0	30.00	30.00
Pucca road		2 km	75		150.00
Market development		1	75		75.00
Killa	1		40.0	40.00	
Total				748.34	1,512.34

3.2.2. Benefits

The upgraded and expanded road network will contribute to the greater safety of the char population by enhancing the possibilities for them to go to safer places. At the same time the roads will stimulate economic activities and thus promote the general economic uplift of the area. Markets, workshops and shops will emerge, providing employment opportunities and income for the settlers. The cyclone shelters obviously increase the security of the population, while the possibility of establishing schools in the buildings increases the educational opportunities, especially for children. The deep tube wells will improve the health status of the population and will lessen the daily workload of the women. Sanitary facilities have a direct positive health impact. All these benefits have an indirect economic impact but are difficult to quantify in monetary terms.

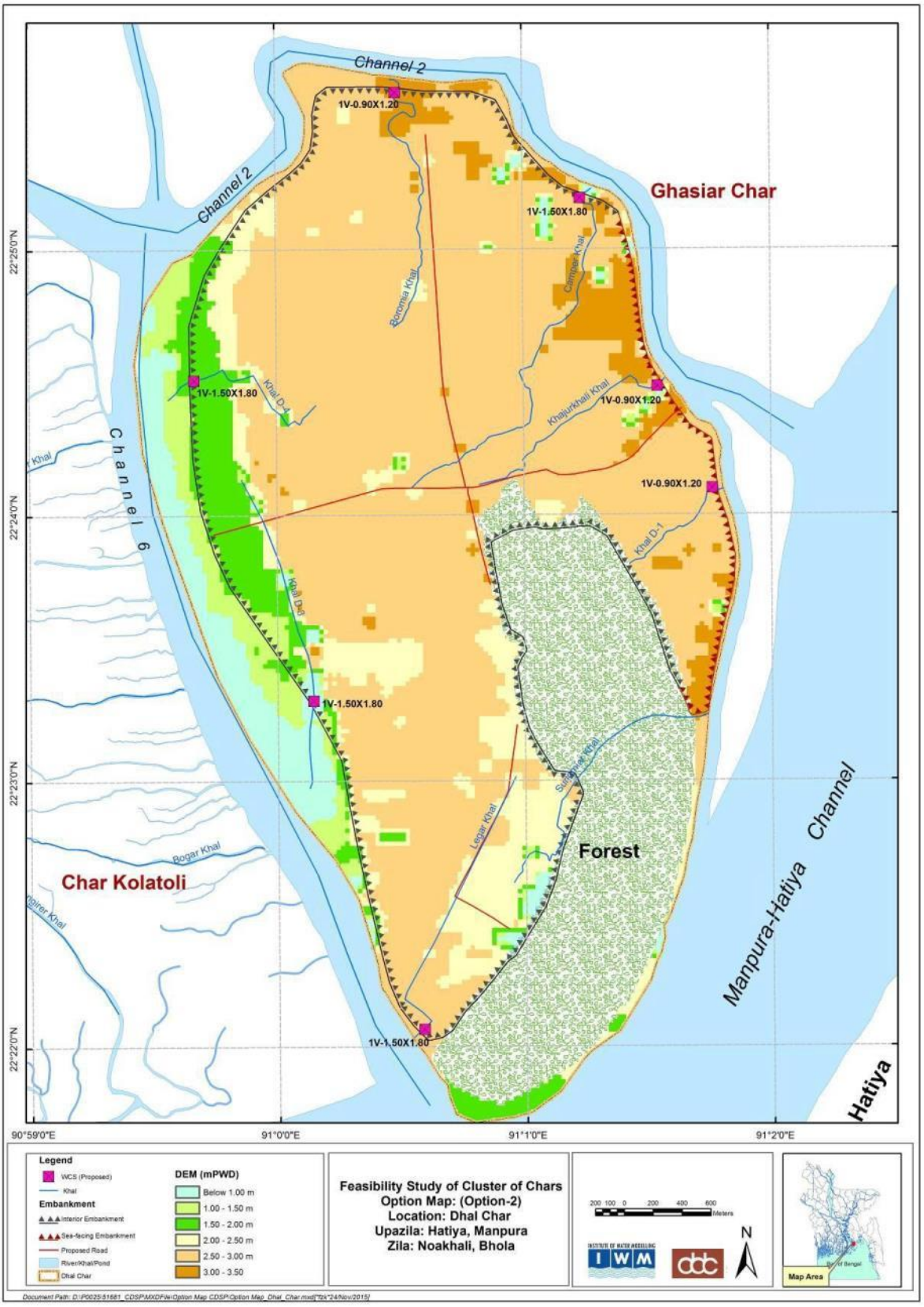

Figure 3.3 Proposed option 2, Dhal Char

4. Land settlement

4.1 Introduction

Land settlement is an essential component of the CDSP projects, right from the start of CDSP I in 1994. The ultimate aim of this component is to provide hitherto landless households with a title on the land in newly developed chars. Since that first phase a total of 26,933 khatians (land title documents) have been distributed by the Ministry of Land in the framework of CDSP. Monitoring exercises indicate that over a period of on average 12 years, 80% of the original settlers still lived in the area.

Providing a title directly contributes to the main objective of CDSP: improving the livelihoods of settlers in coastal char areas. It considerably broadens the asset base of the households. The legal security that the document gives to the settlers will stimulate them to invest in their newly acquired land, which will have a positive effect on the agricultural production. Being landowners, the social status of the households is enhanced and the self-confidence of the settlers is increased.

Families in these new chars come from different areas, often from locations where erosion occurred and land was lost. Or they migrated because they had to sell their previously owned land due to their distressed circumstances. In many cases, the migration to new lands will mean they are being controlled by powerful jotdars, often using or threatening with force by their bahinis.

According to Government regulations, newly emerged land has to be distributed to the landless (Policy for settlement of agricultural khas land of 1997), including a title on the land to a maximum of 1.5 acre per household. It is the task of the Government to apply the law and initiate and complete the process of land settlement (providing eligible households with a title). The Ministry of Land is one of the six partner implementing agencies of CDSP. In the project, innovative procedures are followed which brings the whole settlement process closer to the people, is more transparent, shorten the duration and make it far less costly for the settlers.

4.2 Present situation in Dhal Char

The total area of Dhal char is 4,992 acres (2,021 ha). The char is located in two Upazillas and two Districts: Hatiya Upazillas under Noakhali District and Monpura Upazilla under Bhola District. Dhal Char, Hatiya part is 3,931 acre (1,591 ha) and Dhal Char, Monpura part is 1,061 acre (430 ha), The present number of households is estimated to be 253 (probably around 215 in Hatiya part and the remaining 38 in Monpura part). There are several boundary disputes between Hatiya and Monpura Upazillas regarding Dhal char. Some court cases are pending in the High Court division and in local courts to ascertain the actual boundary lines. Because the local settlers from both Upazillas are having amicable relations despite the boundary issues, it is expected that the settlement process will not be hindered. Nevertheless, before settlement works starts there, the boundary issue should be resolved by an initiative taken by the District administrations of Noakhali and Bhola and the Ministry of Land.

Table 4 - 1 Status of land in Dhal Char

District	Upazilla	Mouza / Name of Chars	Area (in Acre)							
			Area under feasibility study	Locally Surveyed (Charcha Map)	Un Surveyed	Already Settled	Declared or illegal Shrimp Mahal	Forest Land	Misc. (Court case, etc)	Available for Settlement
Noakhali	Hatiya	Dhal Char (Controlled by Hatiya)	3,931	3,100.19	1,200	1,783	-	100	-	2,048
Noakhali District Total			3,931	3,100.19	1,200	1,783	-	100	-	2,048
Bhola	Monpura	Dhal Char (Controlled by Monpura)	1,061	-	1,160	-	561	500	561	-
Bhola District Total			1,061	-	1,160	-	561	500	561	-
Grand Total			4,992	3,100.19	2,360	1,783	561	600	561	2,048

The present status of the land is reflected in Table 4.1, giving the char, Upazilla and District wise information. It shows that the overall, gross area of Dhal char including parts of Noakhali and Bhola Districts is 4,992 acres. Since there is no Diara survey yet been conducted in the featured char, no mouza names have been fixed here by the concerned department.

Dhal Char, Hatiya, Noakhali part is 3,931 acres, where 1,783 acres have already been officially settled in the year 2000 and onwards. Another 1,159 settlement cases (around 2,000 acres of land) were initiated from Hatiya land office in the year 1959-1960, but the settlement process was never completed due to local conflicts and court cases. As much as 100 acres of land are under forest. So, the rest (3,931 – 1,783 – 100) 2,048 acres are available for landless settlement and development activities.
The 1,783 acres of land that have officially been settled were provided to 1,783 households, each receiving on average 1.00 acres. Out of 253 currently living families in Dhal Char, around 100 families are living legally here on their settled lands. The remaining around 150 families are living illegally. Most of the families who got official settlement here do not live in the char (in total 1,783 minus 100 is 1,683), possibly due to lack of drinking water, infrastructure, security and sea dykes. These absentee landowners are living in the khas land along existing embankments of the main land and of Hatiya. If development work starts here these people may come to the char to their settled lands for habitation.

Dhal Char part of Monpura, Bhola constitutes 1,061 acres, where no settlement activities have yet been initiated. Here 561 acres lands are being used as fish project, however without any legal validity. Around 50 families are living here seasonally in the harvest season. In addition, 500 acres lands are under forest. It can be concluded that the present situation in the Monpura part leaves no availability for settlement activities.

4.3 Meeting supply and demand

The demand side for the available khas land essentially will consist of the demand for land by the households that are already settled in the area and have no khatian (around 150). In addition, there will be demand from government agencies for land needed for development of public infrastructure as embankments, roads, cyclone shelters etc. Experience has learned that about 25% of an area is needed for such collective investments.

The available supply consists of 2,048 acres (all in Hatiya Upazilla), the size of the khas land at the moment. There are no claims from the Forest Department. Applying the rule of 25% requirement for infrastructure would leave 1,536 acres for the allotment to landless families. To settle 200 households, giving 1.5 acres each according to the government khas land policy, 300 acres land will be needed. The remaining 1,236 acres can be distributed to (1,236: 1.5) 824 landless families who are currently not living in the char. This would mean that a sizable land settlement program for (150 + 824) 974 landless families can be undertaken in the study area. This would bring the total number of households to around 1,100. This number does not include the possible migration to Dhal Char of currently absentee landowners.

4.4 Proposed interventions

The following interventions are proposed as part of the land settlement program in Dhal Char.

- Diara (newly accreted land) survey of the char should be conducted immediately by the Directorate of Land Records and Survey (DLRS). District administrations of Noakhali and Bhola should take immediate steps in this regard.

- Before settlement works starts, the boundary issue of Dhal Char will have to be resolved through an initiative taken by the District administrations of Noakhali and Bhola under supervision of the Ministry of Land.

- Court cases related to boundary disputes in Dhal char have to be monitored closely. If there is any injunction or status quo imposed by the court in the settlement process, this should be addressed and should be resolved before settlement work starts.

- As it was done in previously CDSP-phases, a plot-to-plot survey should be undertaken in order to define the demand for land from the already present settlers. If available resources would allow, it could be considered to start this survey in the CDSP IV period. That would give a clear overview of the situation before the proposed new project would start.

- It is important that the Ministry of Land takes the decision to apply the CDSP-procedure for the settlement process in the proposed project. This procedure contains fewer steps, is therefore shorter, and is more transparent, closer to the people and also less costly for them.

4.5 Costs and benefits

4.5.1. Costs

The implementation of the land settlement component of the proposed project will be the responsibility of the Ministry of Land. NGOs however could assist in informing the settlers about their land rights and about the settlement procedures. The Ministry of Land has to make staff available for the implementation, belonging to offices at different levels of the Ministry. The Ministry might appoint additional staff for the purpose, for the project period as it was done in CDSP III and CDSP IV. So extra costs would be involved, which can be covered under the GoB project budget of the Ministry of Land.

The plot-to-plot survey will bring extra costs as well. With a view on the size of the project area and the experiences to date, it can be estimated that about Taka 6 million is required for the survey. Under the responsibility of the Ministry of Land a number of households have to be resettled, because they have settled in areas where infrastructure will be built. Costs involved with the resettlement can roughly be estimated to be Taka 1 million. Total estimated costs of the land settlement component are therefore Taka 7 million, or Taka 70 lakh.

4.5.2. Benefits

It is difficult to translate the benefits of the land settlement efforts into a particular amount in Taka. Experiences have shown that the provision of land titles contributes to an economic and social transformation of the communities concerned. The security that they indeed own the land, will lead to extra

investments in the land and presumably to higher production levels. There will be less sharecropping arrangements in favour of more own cultivation. Immaterial benefits are the enhancement of the social status and increase in self-confidence. As can be witnessed in areas where CDSP has been operational, prices of land will considerably go up, further strengthening the asset-base and making it easier to obtain loans, if needed.

5. Agriculture

5.1 Introduction

In Dhal Char, more than three quarters (76%) of the households are directly dependent on agriculture (as farmers, sharecroppers or daily farm labour). Of the land in the area, 77% is used for crop production. This makes the agricultural sector by far the most important one in the char. The proposed package of water management interventions is expected to have a positive influence on the agricultural sector, including homestead gardening. In option 1 (leaving the char unprotected for the time being) agriculture will benefit from improved extension services, input supply and possibilities for marketing (also by the enhanced road network). In options 2 and 4 (constructing a polder) the impact will be much more significant. An embankment will protect crops from tidal flooding, increase the availability of fresh water and over time decrease the salinity of the soil.
In this chapter, the current situation is presented (5.2) and for both basic water management options a future scenario is described (5.3). The chapter ends with an assessment of the costs of the proposed actions as well as the benefits.

5.2 Present situation

5.2.1 Cropping pattern, cropping intensity and total production
In Dhal Char, three cropping patterns are practiced: rabi crops alone, rabi followed by aman rice (with a fallow period in between), and aman rice alone. No kharif-I (or aus) crops are grown. The dominant cropping pattern is transplanted aman rice alone which covers about 1,222 ha (or 78.5%) of the area, followed by rabi-fallow-aman pattern covering 335 ha (21.5%) of the area. Rabi alone covers 233 ha (15%) of the area. Thus, the total of areas under rabi and aman rice is 568 ha (233+335) and 1,557 ha (1,222+335) respectively. Total annually cropped area is 2,125 ha. This is 136.5% of the net area, and is known as cropping intensity.

Rice yields reported by the farmers are probably a little inflated, possibly due to non-adjustment for the moisture content of the grains and or error in weighing; the reported yield ranged from 2.35 to 2.96 t/ha (Table 5.1) as against the average yield of 1.9 to 2.2 t/ha of these varieties in the region. Yields of the rabi crops, on the other hand, are lower except those of grass pea, which is little higher than the standard yield of the crop elsewhere in the country. Yields of sweet potato, potato and radish are far below the normal. Production of rabi crops is seriously constrained by drought and high soil salinity and hence farmers are reluctant to invest more in this crop. Fertilizers are used in highly sub-optimal doses and seldom they take plant protection measures and do weeding.

5.2.2 Homestead gardening
Most homesteads of the char are not well developed. The size of the homesteads varies from 3 to 40 decimals with a mean of 11.6. About 92% households have a small ditch in the homestead which is really a borrow pit constructed during raising the plinth level of their houses. This ditch is source of water for domestic usage and for watering of homestead gardens. Many of the houses (64%) have a homestead garden, with an area varying from 0.5 to 10 decimals. The garden is used for raising homestead crops such as beans of various kinds, egg plants, tomatoes, amaranths and other leafy vegetables. Some of the homestead gardens have fruit trees (such as banana, custard apple, papaya) and trees for timber (mahogany). Reported average annual income from homestead production is Taka 675 from vegetables, Taka 630 from fruits and Taka 930 from timber.

Table 5 - 1 Area, yield and production of field crops by season

Rabi				Kharif-II			
Crop/Variety	Area (ha)	Yield t/ha	Prod. (ton)	Variety	Area (ha)	Yield t/ha	Production (ton)
Chilli	135	1.886	254.6	Rajasail	1495	2.347	3,508
Grasspea	108	2.450	264.6	Kalomota	62	2.963	184
Mungbean	54	4.325	233.6				

Felon	27	5.150	139.1				
Linseed	27	0.888	24.0				
Sweet potato	108	3.333	360.0				
Potato	27	7.083	191.2				
Radish	54	2.039	110.1				
Egg plant	27	24.710	667.2				
Total	567		2244.4		1557		3,692

5.2.3. Present status of extension services, use of inputs, credit supply and marketing

The Department of Agricultural Extension (DAE), the lone public sector organization for providing extension services in the country, comes once in a while to demonstrate new varieties of rice to the farmers. It became clear during group discussions that farmers' participation in such demonstrations was low. DAE never demonstrated any advanced agricultural production technologies having potential in the chars.

There are no registered dealers of input supplies in Dhal Char. However, some farmers act as sub-dealers on behalf of registered dealers located at Upazila headquarters. Most farmers use rice seeds from their own harvest and buy non-rice seeds from the local dealers. Agriculture is not practiced in a very intensive manner, with sub-optimal use of fertilizer (urea and TSP) and pesticides.

Many farmers depend on the money lenders, mostly from Hatiya, to obtain credit for agricultural purposes. The borrowers have to pay 40 kg paddy after harvest of aman crop for every Taka 1,000 loan disbursed in any time of the year.

There is no storage facility in the char. Farmers sell their products, mainly rice, just after harvest to the middlemen coming from Hatiya to Dhal char. Other products are sold in the local markets for consumption.

5.2.4. Constraints

From the household survey and group discussions it transpire that the five major constraints in agricultural production are high soil - and water salinity, tidal flooding, deficit in information and knowledge, land ownership (lack of titles on the land) and the practically non-existence of extension services and credit facilities.

5.3 Development plan for agriculture

5.3.1. Overview of suggested interventions

Out of an agricultural point of view, the following measures should be taken to improve the situation in the sector:

- Protecting the area by embankments: The creation of a polder would result in gradual reduction of the soil salinity and increase the availability of fresh water. On a greater area rabi crops could Tidal flooding in the monsoon would be prevented and water levels could be controlled. This is expected to boost aman production, among others by introduction of high yielding rice varieties and the cultivation of an aus rice crop, as can be seen in older CDSP areas. Protection of the char is part of options 2 and 4 (option 3 has already been discarded for Dhal Char).
- Enhance drainage capacity: This is a part of the option to construct a polder, but also, but with much lesser impact, of the option of leaving the char unprotected (re-excavation of drainage channels). This will benefit standing aman crops. It will enhance the possibilities for rabi crops due to the fact that the soil will dry faster after harvesting aman rice. It has to be mentioned that water logging is not seen as a major issue in Dhal Char.
- Introduction of modern agricultural technologies: These technologies would cover improved crop varieties suitable for coastal areas such as HYV rice, modern cultivation methods (land management geared toward reducing soil salinity, rice-fish culture, and an integrated crop-livestock system.
- Providing individual land titles: This is a part of the proposed package (see chapter 4). After receiving their land title, farmers are expected to be more inclined to invest in agriculture.
- Construction of community ponds: Well-located community ponds with proper dimensions could boost the rabi crop production significantly. This is a part of the proposed internal infrastructure (see chapter 3). Another option would be to design and construct control devices in internal khals, for storage of water. Using groundwater for irrigation is no option in coastal areas.
- Strengthening extension services: As mentioned earlier, DAE only provides extension services to a limited extent. The number of available staff, the difficult communication with isolated char islands, combined with inadequate logistical supplies are factors that influences DAE's capability to be effective. To overcome this problem it is proposed to engage suitable private sector organizations, in collaboration with DAE. These private institutions, possibly an NGO, should introduce adapted extension methods, for instance the methods applied by IRRI in chars of Noakhali mainland. This method, as with the Farmer

Field School approach, focuses on self-motivation of farmers, with beneficial consequences for adoption of modern technologies.

5.4 Costs and benefits

5.4.1. Costs

Table 5 - 2 Cost estimate for agricultural support services

Item	Cost (Tk. Lakh)
Demonstration Farm	10.00
Preservation of Seeds(Purchase of container & Training)	5.00
Training on Extension Activities	15.00
Establishment	5.00
Workshop /Seminar	5.00
Total	40

The amount of Taka 40 lakh has been taken up in the costs for options 1 and 2. Options 3 has been discarded earlier, while for option 4 (for all three chars), an amount of Taka 160 lakh has been included.

5.4.2. Benefits:

If the proposed project interventions are indeed implemented, increase in cropping intensity and production is expected to be as presented in Table 5.3. In options 2 and 4, benefits are predominantly generated by a higher cropping intensity and an increase in yields. More land will be cultivable due to the water control structures and the gradual reduction in soil salinity. Introduction of modern crop varieties are facilitated.

Table 5 - 3 Expected future production and cropping intensity (options 1, 2 and 4)

Crop/cropping intensity	Time	Options 2, 4		Option 1	
		Area (ha)	Production (ton)	Area (ha)	Production (ton)
Rabi	Present	567	2244	567	2244
	4 years after	820	4313	737	3037
	8 years after	1084	7446	765	3291
Rice	Present	1457	2928	1457	2928
	4 years after	1756	6518	1557	4671
	8 years after	1756	7792	1557	5542
All crops	Present	2024	5994	2024	5994
	4 years after	2576	9170	2294	7708
	8 years after	2840	13160	2322	8833
Cropping intensity (%)	Present	136			
	4 years after	165			
	8 years after	182			

The construction of a polder in Dhal Char options 2,4) would lead to an annual net incremental income of Taka 1,225.38 at full development, which is from year 10 onwards. For option 1 this would be Taka 490.15 lakh. Also homestead cultivation will benefit from the improved support services. Under all options, total value of homestead production could rise from Taka 0.55 lakh now to nearly Taka 1.5 lakh, giving a net annual incremental income of Taka 0.89 lakh, soon after inception.

6. Livestock

6.1 Introduction

The livestock sector accounts for 1.78% of the national GDP, while the share of livestock to the agricultural GDP amounts to 14.08%. In unprotected chars as Dhal Char these percentages are probably higher, given the relatively low agricultural yields and the ample availability of grazing land. Livestock products are an important protein source in the food diet. The importance of draught power is decreasing, but cattle is continued to be used for tillage, in char areas possibly more so than in well-developed agricultural settings. Large and small ruminants are considered as an important barrier against risk. Livestock, in particular poultry raising, provides a reliable source of income for landless - and small farmer households. In the estuarine context, in many areas large herds can be observed, owned by large and influential; farmers, using the graze land in unprotected char areas.

This chapter deals with the present situation first (6.2) and continues with possible future development of the sector in Dhal Char (6.3), indicating proposed measures. The chapter concludes with highlighting the costs and benefits of the suggested interventions.

6.2 Present situation

6.2.1. Livestock population

Based on data of the household survey, it appears that livestock rearing is an important economic activity in Dhal Char, as it is in other coastal chars as well. Nearly half (48%) of all households have cattle (cow of bull/bullock), with an average number of seven animals. Cattle are of local breed and weak in productivity and health. None of the household have a buffalo, although a huge number of buffaloes were found grazing in the field, owned by large farmers from the main land. Forty percent of households are rearing goat and 24% sheep, with an average of ten and three animals respectively.

Over 92 % households were found rearing chicken and 84% rearing duck. Average number of chicken and duck per house hold is 7 and 8; 12% households are rearing pigeon, with an average of 37 birds per family. All the households have chicken of indigenous breed. No one is involved with commercial chicken rearing. At farm level, a small farmer operating about one acre of land typically owns two heads of cattle, two or three goats and about ten poultry (chicken, duck and pigeon). Extrapolating the sample results to all 253 households, gives the following overview of the total number of animals and their current value in Takas (see Table 6.1).

Table 6 - 1 Livestock population and value in Taka

Type of Livestock	Estimated total animal / bird in the village	Average Value per unit (Taka)	Value of animal/ bird (Taka)
Cow	597	7,288	4,350,936
Bull/ Bullock	91	15,000	1,365,000
Buffalo	0	0	0
Goat	304	1,696	515,584
Sheep	587	1,706	1,001,422
Chicken	1,741	203	353,423
Duck	1,639	226	370,414
Pigeon	1,133	191	216,403

Livestock owner obtain cash through selling products as milk and eggs, through sale of live animals. They also save on expenditures by consuming produce from their own livestock, by using them as gifts, and by using dung for manure and fuel. On average, annual income of a livestock holding household from milk is

Taka 12,000, from eggs Taka 4,000 and from live cattle Taka15,000, from live goat/ and sheep Taka 8,000 and from chicken and duck Taka 4,000.

6.2.2. Support services and marketing

Mainly due to staff shortage and difficulties with communications in the estuary, the Department of Livestock Services (DLS) is hardly active in Dhal Char. Livestock holders are to a very limited extent exposed to extension messages and services as vaccine supply, breeding and artificial insemination.

The marketing system of livestock products is not organized. Milk marketing is usually done through middlemen. Individual farmers sell their milk etc. directly to the vendor. A litre of milk is sold at Taka 40-50. The vendors transport the raw milk to a nearby bazaar on the mainland. There the milk is processed into final products as ghee, cheese, curd. Also the sale of live cattle is channelled through tradesmen. Eggs are much harder to sell than a few years ago. Large commercial poultry farms on the mainland fulfil the demand of the cities

6.2.3. Constraints

Data from the survey indicate that major constraints reported by households are the lack of information or knowledge gap (30.6%), theft (25.8%), disease (21%), poor genetic quality (12.9%), shortage of feed (4%) and marketing of livestock products (4%). In group discussions, housing of animals was mentioned frequently as an issue as well.

6.3 Possibilities for future livestock development

6.3.1. Measures addressing the constraints

- Extension services: Instead of solely relying on the services of DLS, it is recommended to engage an NGO to develop semi-skilled manpower (Livestock Field Workers and Poultry Workers) within communities. After training, in which DLS could play a role, these workers can render extension services on husbandry practices, primary animal health care and immunization.
- Treatment of diseases: It is recommended to instruct the NGO to appoint a veterinary doctor who can organize weekly mobile clinics (also in the adjacent chars), assisted by the NGO workers. An arrangement with DLS should be entered into to channel the supply of drugs and vaccines through this veterinarian and these workers and to establish a cool chain.
- Training of farmers: A Livestock Farmer Field School method of training of livestock owners should be introduced with the assistance from DLS. Such a system would create linkages between the settlers and DLS staff. The aim is to develop skills and to reduce the knowledge gap.
- Supply of fodder: In case the project area will become a polder, free grazing facilities will be reduced. On the other hand the cropping intensity will be increased (under options 2 and 4) and this will make available more crop residues for the cattle population. As a result the growth rate will be higher till the optimum herd size is stabilized. Availability of fodder can be stimulated by including more leguminous and salt tolerant fodder crops (such as cow peas and grass peas) in the farming system. Plantation of trees with protein rich leafs, promotion of urea treatment of straw and use of molasses blocks are additional measures to improve the nutrition of animals.
- Improved marketing: It is critical that livestock rearing households organize themselves in groups in order to make collective bargaining possible, to reduce the risk of being exploited by the middlemen. The groups can establish direct contacts with sellers of inputs and with buyers of livestock products. They could control the quality of the livestock workers and maintain contact with DLS. They also could introduce milk chilling vats (running on solar power or diesel), which would facilitate the sale of products to more distant markets.
- Shelter: A community livestock shelter and a killa (in case of option 1) might be considered.
- Drinking water: Simple collective rainwater harvesting devices could address the shortage of drinking water for buffaloes and cattle. In case tube wells are established (a part of the proposed infrastructure package), animals could be allowed to use water from a number of shallow wells.

6.4 Costs and benefits

6.4.1. Costs

The core of the proposed development program is formed by an improvement of extension- and support services. NGOs are expected to take play a major role in these efforts. The costs of the involvement of NGOs are already included in the cost estimated of the social- and livelihood component (see Chapter 9). For additional support services an amount of Taka 40 lakh has been earmarked for options 1 and 2 and Taka 130 lakh for option 4 (all three chars). In the estimates for internal infrastructure (Chapter 3), a provision is made for a killa.

6.4.2. Benefits

The growth of the livestock sector in estuarine areas us expected to be higher than the national growth rate because of the specific environmental environment and the availability of natural resources as grazing grounds. The lack of a range of other employment opportunities is a factor as well. This growth can be stimulated further if the proposed measures (see 6.3.1) are indeed introduced, as is shown in Table 6.2 below. The projected growth is expected to stabilize after about six years.

Table 6 - 2 Estimated livestock population growth rate

Type of Animal	Growth Rate (%) in isolated char (option 1)	Growth Rate (%) in isolated char (options 2 and 4)
Cattle	1	2.5
Buffalo	1	2.5
Goat	2.5	3
Sheep	2.5	3
Chicken	3	5
Duck	4	5

Of course the projected growth rates are rough but at the same time reasoned estimates. If these rates are applied on the current livestock population, the future scenario would be as represented in Table 6.3.

Table 6 - 3 Estimated livestock population growth in Dhal Char (options 2 and 4)

Type of animal	Est. annual growth rate (%)	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Cattle	2.5	688	705	723	741	759	778	798	818	838	859
Buffalo	2.5	0	0	0	0	0	0	0	0	0	0
Goat	3	304	313	323	332	342	352	363	374	385	397
Sheep	3	587	605	623	641	661	680	701	722	744	766
Chicken	5	1741	1828	1919	2015	2116	2222	2333	2450	2572	2701
Duck	5	1639	1721	1807	1897	1992	2092	2196	2306	2422	2543

Net annual benefit at full development, after 10 years, is estimated to be Taka 31.84 lakh.

7. Fisheries

7.1 Introduction

Bangladesh wide the fish production is n on the rise, currently representing 3.7% of GDP and 22.6% of the agricultural part in GDP. It gives employment to over 17 million people and has become a vital component of the country's export. Equally, aquaculture in ponds and fisheries in canals, rivers and in the Meghna estuary are important activities for the char population. These activities are a source of income and (partial) employment. Fish forms a welcome source of protein in their diet. Many of the settlers in the new chars were fishermen before and they like to work again in their old trade. Wild fisheries and aquaculture is essential in improving livelihoods in the context of coastal chars. In Dhal Char, no household spends a majority of time on fisheries.

This chapter first looks into the present situation of fisheries in Dhal Char (7.2.) and shifts then to possibilities for development, within the framework of the water management options presented in Chapter 2. The chapter concludes with the costs of the proposed development measures, and with the benefits (7.4.)

7.2 Present situation

7.2.1. Closed water fisheries

Closed water bodies are basically ponds and ditches. They can be considered a by-product of house building. They form the borrow pits of making raised homestead platforms for a house, courtyard and garden. Total area of ponds and ditches in Dhal Char is estimated to be 9 ha. These water bodies produced 1.4 metric tons (MT) of fish, which means about 150 kg per ha per year. The household survey indicated that 27% of households use a pond for fish production. Total catch from ponds and ditches is negatively influenced by tidal floods and storm surges.

7.2.2. Capture fisheries in khals, floodplains and outside study area

Open, wild inland fisheries is practiced in khals (total area of 40 ha) and on floodplains (3 ha). These open water bodies are stocked with wild sources during tides and floods. Wild fisheries in khals amounted to a production of about 4 tons of fish, with an additional 0.3 MT for floodplains. This means that yield per ha for both khals and plains is around 100 kg. About 45% of households use khals and floodplains as their primary fishing ground. Another 35% of households said that the Meghna estuary was their most important fishing ground.

7.2.3. Total current fish production

The total annual marketable fish production of Dhal Char, including fish caught in the estuary, is estimated to be 9 ton. The average price for big fish was Taka 213 per kilo and for small fish Taka 88 per kilo.

7.2.4. Constraints

Fisheries in Dhal Char face a series of impediments. The number of ponds is limited, which constraints the aquaculture production. Ponds are damaged and fish gets lost by tidal surges, overtopping the little dykes protecting the ponds. Extension services are scarcely available. Staff of the Department of Fisheries hardly ever visit the char. Supply of inputs, such as fry and fingerlings, is highly inadequate. Most inputs carry a high price. There is a lack of credit facilities. Transport of fish for marketing is difficult due to lack of a proper road network and supply of ice. Fish from the area is sold to traders, while catch from the estuary is brought to the market in Steamer Ghat, near Boyer Char on the main land.

7.3 Development plan

7.3.1. Consequences of water management interventions

The ultimate selection of water management option has obviously consequences for the possibilities of further development of the fisheries sector. If the char will be left unprotected (option 1), enhancement of

fisheries has to be mainly achieved through improved extension services, input supplies and marketing facilities. Inland fisheries will further benefit from re-excavation of khals.

In case a polder will be constructed in Dhal Char (options 2 and 4), open fisheries in khals and on floodplains will be affected. On the one hand, fish can no longer enter freely into the khals and plains because of the embankment and regulators (which can be mitigated by making fish friendly structures). But on the other hand khals will be deepened by re- excavation, increasing the volume of water available for fish. Fish production through aquaculture will increase because the ponds will be flood free. The improved physical environment will encourage pond owners to adopt more intensive methods of culture. Fishing in the Meghna estuary will not so much be affected, although boats can no longer be taken inland for shelter and repairs. In option 4 (one polder covering three chars), a lake will be created in between the chars, and in between cross dams. This lake will be a source of considerable size for open water fishing.

7.3.2. Development of aquaculture based fisheries
As just mentioned, protection of the area (options 2 and 4) will stimulate further development of aquaculture. Introduction of improved methods of pond management will however require extension efforts and better input supplies. Semi-intensive or intensive models differ with traditional models in matters of stocking fingerlings and use of other inputs, such as fertilizers and feed. Prescribed number of fingerlings and quantities of inputs need to be applied. The distinguishing feature of the intensive method of production is the higher rate of stocking and the application of prepared feed. In a protected area, average annual production rate of household ponds can be increased enormously from the present 150 kg/ha to 2,000 kg/ ha using intensive methods of fish culture. This increase in yields and the addition of community ponds, would lead to an overall production of 22.5 MT per year (compared to the present production of nearly 1.4 MT). It is estimated that about 20% of ponds in Dhal Char could be brought under prawn (golda) culture, a very valuable product. In case of option 4, the earlier mentioned lake could add a further 612 MT of fish production.
But also in the case that the char is left as it is to allow further sedimentation (option 1), pond aquaculture can produce more due to improved extension services and input supplies. The increase in yields would be a much more modest 10-20%, from 150 kg/ha a year to 165-180 kg/ha, or from a production of 1.4 MT to 1.55 MT per year.

7.3.3. Development of fisheries in open water bodies
Khals will be re-excavated for improvement of drainage systems. If a polder is constructed (options 2 and 4) the re-excavated khals will retain water during the dry period covering December to April with the support of water control structures. This will create a better habitat for increasing natural fish production in the khals, provided no serious obstructions are made to movement of brood fish and shrimp species through the structures. Khals can even be used for aquaculture, if intelligent use is made of the water control structures and with support of rather simple devices as khattas from branches of trees to divide khals into sections. In such a way, khals can be stocked with fish and prawns. It is expected that khal-fisheries production will increase from present level of 100 kg/ ha/ yr to 800 kg/ ha/ yr in case peripheral embankments are built. But fisheries on floodplains will disappear. The net positive annual production result is estimated to be nearly 28 MT per year, from 4.4 MT to 32.5 MT.
If Dhal Char is left unprotected (option 1) an increase of 10-20% can be expected, from 110 to 120 kg/ha per year. This expectation is based on the improved extension services and the larger volume of khals as a result of re-excavation. Fisheries on floodplains will continue. The net result would be an increase of 1 MT from 4.4 MT to almost 5 MT per year.

7.3.4. Extension services and marketing system.
As is proposed in the case of livestock, a NGO might be engaged to take care of extension services and training. This can be successfully done if a fruitful cooperation with the Department of Fisheries is established, for instance in the fields of training and input supplies. Demonstration ponds should be used as one of the methods of dissemination of good practices. Experiences in CDSP and the Greater Noakhali Aquaculture Extension Project should be utilized. The NGO should be asked also to assist households in organizing groups so collective bargaining with middle men can be initiated for the sale of fish and procurement of input supplies. It is proposed to erect a hatchery in nearby Char Kola Toli that could secure the sustained supply of good quality fish fry.

7.4 Costs and benefits

7.5.1. Costs
The additional costs of better extension services are in fact taken up in the budget for the social- and livelihood program, since the NGOs are expected to take the lead in this respect. For additional support

services Taka 35 lakh has been included in the overall cost estimate in case the char is protected (options 2); option 3 is not further being considered). The support posts for all three chars under option 4 are estimated at Taka 105 lakh. The cost of the proposed hatchery is not included in the overall project cost estimate, because it is assumed that this hatchery will be established by the private commercial sector.

7.5.2. Benefits

The additional fish production under the various options has been explained in 7.3.2 and 7.3.3. In option 1 there will be very modest benefits, which have not been taken up in the cost-benefit analysis. For options 2 and 4, net incremental benefits for open water bodies are estimated to be Taka 38.96 lakh from 8 years onwards. For closed water bodies this would be Taka 25.36 lakh.

8. Social forestry

8.1 Introduction

The benefits of forestry development can broadly be divided into three groups: greater safety, improved ecological conditions and a better economic situation for the char settlers. These beneficial functions of forestry make forestry development an essential element of any development package, especially for a vulnerable area as Dhal Char, being an island char.
There is ample empirical evidence that plantations along the coast have enhanced the protection against storm surges and tidal bores. Devastation of infrastructure and loss of lives have been much smaller in areas with a forest belt. Houses on homesteads with trees suffer less damage from storms. Coastal forests, in particular mangroves, further stabilize the newly emerged areas. They stimulate biodiversity and conserve coastal ecosystems. Trees have a dampening impact on soil erosion, while organic matters are contributing to the fertility of coastal soils. Forests provide timber for building houses and fuel for cooking purposes. In addition, trees give fruits for human consumption, medicinal herbs, and fodder for animals. By participating in social forestry activities, settlers generate an extra stream of income.

8.2 Present situation and constraints

8.2.1. Present coverage of forest in the study area
Dhal Char was brought under mangrove afforestation in 1978. This mangrove forest still exists and has currently a size of 1,200 ha. Apart from these mangroves, the char is not protected by any greenbelt around it, so it is for a great part open to natural hazards like cyclonic storms and water surges. The present coverage of vegetation can mainly be found in the homesteads and there are some scattered trees on public grounds. A survey showed that nearly all people are interested in further tree plantations.

8.2.2. Constraints for forestry development
The lack of a title on the land that people now occupy makes people reluctant to invest in more trees on their homesteads. Grazing of cattle is another impediment: more forests might imply loss of grazing grounds, while ruminants damage young trees. There is a huge demand for fuel wood (mainly cow dung and straw are sources of fuel). Shortage of seeds is a constraining factor. The char is not very old, so there is a crisis of mother trees as a source of seeds. Seeds are to be collected from nearby Monpura or from the main land.

8.3 Proposed interventions

8.3.1. Following the social forestry approach
The government has enacted specific Social Forestry Rules in 2004, amended in 2010. Essential elements in the social forestry approach are the participation of local people in planning and implementation of forestry development activities, the formation of Social Forestry Groups as institutions to realize such participation and agreements between governmental agencies and the Social Forestry Groups on sharing of the benefits of forestry development. The social forestry approach adds a fourth benefit of forestry development. It provides employment to the people, and it enhances their self-confidence and self-esteem by acquiring skills and knowledge. Social forestry can contribute to the homogeneity of communities.

The Forest Department should apply the social forestry approach in Dhal Char as well. Social Forestry Groups (SFG) have to be formed (see also Chapter 10). The Department is expected to enter into agreements with these SFGs determining the sharing of benefits. For different type of activities (as for example agro-forestry, road/embankment/khal plantations, and foreshore plantation) different sharing arrangements will be applicable. For strip plantations along roads etc. for instance, the distribution of benefits would be Forest Department 10%, land owning government agencies 20%, SFG-members 55%, Union Parishad 5% and Tree Farming Fund 10%.

The coastline of Dhal Char is not suitable for additional mangrove plantation. The proposed program will therefore be limited to plantation on and in front of embankments, along road- and channel sides, on homesteads and on grounds of public institutions.

8.3.2. Plantation on embankment
If the option is chosen to construct an embankment (option 2), it will have a length of 19.71 km (3.9 km sea facing and 15.81 km interior); for option 4 the total length will be 49.33 km (19.6 km sea facing and 29.73 km interior, for three chars) There will be five rows of plantation on the riverside, with arhor at the top, and dhaincha at the toe. On the land side, three rows will be planted, arhor as highest. A range of around 20 species are suitable for embankment plantation on the other rows. Among them: jhaw, mahgani, gamar, neem, rajkoroi, sissoo, arjun, hybrid acacia and jam.

8.3.3. Foreshore plantation on mounds
The planting will be done outside the embankment. It will protect the embankment and will create work and income for households settled close to the embankment. Plantation will be done on mounds (10x2.25x0.9 m.), with a spacing between seedlings of 1.5 by 1.5 m. Total area to be planted will be 20 ha (option 2). Suitable species include jhaw, kat badam, hybrid acacia and others.

8.3.4. Roadside plantation
The proposed network of rural roads will have a total length of 10.4 km (for all option 1, 2 as well as 4, see Chapter 3). It is recommended to have two rows of plantation at each side of the roads, one of them being arhor. There are many species suitable for roadside plantation, such as: jhaw, mahgani, gamar, neem, rajkoroi, silkoroi, raintree, sonalu, sissoo and arjun.

8.3.5. Plantation along khals
Total length of canals is 20.1 km. Each side of the canal will be brought under strip plantation, again with arhor as a fence for the other seedlings. Selection can be made from a wide assortment of species, among them pitali, raintree, gamar, sonalu, arjun, jam, kat badam, babul, khoye babul and kadam. Khal plantation will be done under all options.

8.3.6. Agro-forestry on homesteads
The homesteads, including the banks of ponds and ditches, will have a combination of vegetables and fruit- and timber trees (under all options). A large number of species are suitable for the homestead, for instance am, jam, kanthal, kul, dewa, piara, lebu, coconut, mahgani, jhaw, raintree and bamboo. The Forest Department will support the NGO staff involved with homestead plantation with facilitating supply of seedlings and support to demonstration of plantation methods.

8.3.7. Plantation on grounds of public institutions
Around public institutions as schools, madrasas, mosques, markets and cyclone shelters, trees will be planted by the Forest Department, with seedlings supplied by the Department. Suitable species are, among others, mahagoini, jhaw, sissoo, rain tree, arjun and neem. A spacing of 2m by 2 m. is recommended.

8.4 Costs and benefits

8.4.1. Costs

Table 8 - 1 Plantation costs only for Dhal Char (in lakh Takas), option 2 and 4

Embankment plantation	33.29
Foreshore plantation	128.13
Roadside plantation	9.83
Canal bank plantation	15.54
Homestead plantation	0.47
Public/community Institutions plantation	0.12
Total amount (Million Taka)	187.38

Added to these costs of plantation (Tk 187.38. lakh) should be costs for capacity building and mobilization (Tk. 4.60 lakh). Total costs would amount to Tk. 191.98 lakh.
In case of option 1 (no protective embankments), only costs for road side plantations, Taka 9.83 lakh has been budgeted for in the overall cost estimate.

8.4.2. Benefits

Revenue will be generated by sale of wood and fruits of plantation trees. The program participants, members of SFGs, will provide labour in the nursery and during plantation on basis of benefit sharing arrangements. In addition to these financial benefits, the people and the area will benefit from the forestry development program as proposed here, because of the function of forests in char areas related to safety, social relations and the ecology, as described earlier in 8.1.1.
It is expected that most revenue can be obtained in the period from five years to 15 years after plantation. Estimated annual incremental income in that period amounts to Taka 5.352 lakh in case the char is left unprotected (option 1) and to Taka 135.2 if a polder is established.

9. Social and livelihood component

9.1 Introduction

9.1.1. The need of a separate component

Many of the proposed interventions with regard to water management and productive sectors will have a significant impact on the social and livelihood situation of the char settlers. Still it was felt that an additional component specially geared towards social needs not addressed directly by the other components (as for instance health, education, disaster-preparedness) was warranted. This component could also support activities that have already been dealt with in other chapters (such as livestock, fisheries, drinking water and sanitation). Following the practice in CDSP IV, it is proposed that this social and livelihood component is implemented by NGOs.

9.1.2. Present situation

In Dhal Char only one NGO has been operational from outside the char (Muslim Aid), working on rural roads and distribution of sanitary latrines. Compared to the demand from the settlers for social services, this is quite insufficient. There is no Micro Finance Institution (MFI) working in the area.

There are no health care related government services. In terms of provision of health care, there are actually only the medicine shops. But the sellers have had no training in treatment of human diseases or family planning, immunization or nutrition. There are no government or NGO schools. There are a few madrassas with usually only students that live nearby. There is no organization involved with legal and human rights. The same can be said about disaster preparedness. As already indicated in other chapters, there is only a marginal involvement from government institutions in productive sectors as agriculture, livestock, fisheries and forestry.

9.2 Strategy for NGO support

9.2.1. Objectives

The social and livelihood component would have as main objectives: providing essential services to support poverty reduction, both in an economic (productive) and social sense (such as health, education, disaster management and household-level climate change adaptation), that cannot be provided by government agencies at this early stage of development of Dhal char. NGOs can provide the following services: delivering micro-finance services, which will enable poor people to take advantage of the improved environment and infrastructure; supporting the activities of government implementing agencies, such as for water and sanitation, where the NGO can form tube well user groups and organize the installation of latrines; promoting human rights and legal awareness, especially for women.

9.2.2. Subjects to be covered

The social and livelihood support program has been divided into the following sub-components:

a) Group formation, micro-finance and capacity building
b) Health and family planning
c) Education
d) Water and Sanitation
e) Homestead agriculture and value chain development
f) Poultry and Livestock
g) Fisheries and aquaculture
h) Legal and human rights
i) Disaster management
j) Awareness on environment and climate change

9.2.3. Number of NGOs

Based on the estimate of the current population and the expected migration of more settlers in the years to come (projected to be around 1,100), mainly because of the availability of khas land, it is the intention

to support the establishment of a branch office in the area. This office would be able to serve the whole population of Dhal Char. As far as the number of NGOs is concerned, the best solution would be to have one NGO that is operational in both Char Kola Toli and in Dhal Char.

9.3 Proposed NGO services for the study area

As indicated under 9.2.2, the proposed program will have 10 components. Below, the intended activities will be dealt with component wise.

9.3.1. Group Formation, Micro-finance and Capacity Building

As well as paying for the cost for group formation, it is proposed to fund capacity building of group members/clients and NGO micro-finance staff. Since micro-finance services in the project areas will be relatively new, it will be important for members to learn about micro-credit management, micro-credit discipline, rules and regulations, and to have basic knowledge of Income Generating Activities (IGA) management. Organizing women char dwellers into NGO groups will be the main institutional platform for offering financial services (savings and credit) and for delivering other services. Micro-finance and other development services are expected to continue even after the end of the project. Projections for group formation are based on an estimated population of 1,100 households in the project. It is assumed one woman from each household will become a member of a group formed around micro-finance. Assuming an average group has 25 members, a total of 44 groups will be needed.

As a regular activity, the NGO will mobilize group member savings and use a part of this fund to lend out as micro-credit to the group members. The selected NGO must be able to mobilize resources from institutions like PKSF, the major institutional lender for micro-credit in the country. Capacity building will focus on both NGO staff as well as on the members of the groups.

9.3.2. Health and Family Planning

The findings of review of the health and family planning aspects during the preparatory missions in the project area as well as experience of the on-going CDSP IV project reveal critical health and family planning challenges and concerns of the char dwellers. Activities will focus on training, especially Health and Family Planning Facilitators (who will form the backbone of the component) and Traditional Birth Attendants (15 in each NGO branch); clinical services (each branch will have a clinic manned by a Medical Assistant); distribution of medicines, contraceptives and TBA-kits; awareness raising and linkages with other health programs, in particular the vaccination program.

9.3.3. Education

Human resource development is at the core of Bangladesh's development efforts and access to quality education is critical to poverty reduction and economic development. In the previous phases of CDSP there was no arrangement to implement an educational program. Children of school going age cannot go to school due to lack of available educational institutions and were deprived from at least primary education. A high rate of illiteracy is hindering development initiatives. In the study area there are no government or NGO schools. Among others, activities will include establishment of non-formal schools, supply of logistics (books, pencils etc.), provision of advance money for housing, appointment of one teacher for each school, and training for NGO-staff. The aim is to establish 15 non formal primary schools under the branch in Dhal Char.

9.3.4. Water and sanitation

It is proposed to install 90 DTWs in the project area (see Chapter 3). Also, every household will receive a latrine under the project, both interventions to be implemented by DPHE. The role of the NGO will be to assist DPHE to: (i) select sites for DTW installation, select and form Tube-well User Groups (TUG), collect their contributions, train representatives of user-groups on repair and maintenance of tube-wells; (ii) facilitate distribution and installation of latrines; and (iii) provide training to NGO staff (the NGO staff will provide training to the members of the tube well user group on health and hygiene).

9.3.5. Homestead agriculture and value chain development

While DAE will implement a component aimed at developing field crops, the NGO will focus on homestead agriculture (fruits and vegetables). They will also promote tree (fruit and timber) nurseries operated by NGO group members and promote planting of trees around homesteads. The focus of the activities will be promotion of new and improved varieties and of modern technologies through training and high value crop demonstrations. An Agriculture Coordinator will be appointed in the NGO branch office. Training of farmers, demonstrations and dissemination will be the main activities. In respect of value chain development, crop and non-crop products will be identified through rapid assessment of their potential for creating employment, and increasing sales and income. The products could be high value new

vegetables, fisheries and livestock, any non-crop processed food and non-food items with good potential in the area. The intention is that the branch implements one value chain development activity each year for five years. A lump-sum amount of Tk100,000 is allocated for each value chain development project.

9.3.6. Livestock

In previous CDSP phases, livestock development did not form a part of the project. The Danida supported Regional Fisheries and Livestock Development project (RFLDC) was operational at the same time and in the same areas, and took care of the livestock sector. Because the Danish program has ceased to exist, it is proposed to make the NGO responsible for livestock development, including poultry. Important activities will be conducting a baseline survey; selection and training of Poultry Workers and Livestock Field Workers; training of farmers and extension services (on rearing of cattle, sheep goats and poultry, animal diseases, fodder cultivation etc.); supply and preservation of vaccines (to be collected from the Department of Livestock Services and other available sources) and medicines. See also Chapter 6 for more information on the livestock sector. The NGO will have one specialized staff member.

9.3.7. Fisheries

As in the case of livestock, it is proposed to entertain fisheries activities, in particular aquaculture, through the NGO. Major activities will be making a baseline survey; selection and training of farmers; distribution of inputs. The training will focus on selection of species and feed, pond management, raising and distribution of fingerlings and demonstration. The NGO will appoint a fisheries coordinator. Chapter 7 gives more information on fisheries.

9.3.8. Legal and human rights

Experience in CDSP-IV areas shows that settlers lack good knowledge about property rights, especially about land rights and about family laws (marriage law, registration etc). That places settlers in a vulnerable position regarding getting ownership of land, the most valued asset. Besides, women rights issues within the family and rights issues in the wider society need to be addressed. The objective of the sub-component is to inform the group members and the community about several critical laws, human rights issues through training and other awareness raising activities. Apart from group members, male household members will be trained on legal and human rights issues. This activity will benefit from links to agencies that promote human and legal rights. With regard to the land rights and procedures to obtain a land title, close cooperation will be pursued with the Ministry of Land. Training of group members will be the most important intervention. In groups that have received training, a Law Implementation Committee will be formed. Two Legal and Human Rights promoters will be selected for the NGO branch.

9.3.9. Disaster management

The remote coastal project area is specifically vulnerable to natural disasters as cyclones and storm surges. The emphasis will be on awareness on preparation for disaster situations, disaster management and mitigation issues. Training, followed-up by refresher courses, will be imparted to selected group members. NGO-staff will be trained as well. A relation will be developed with the Union Disaster Management Committee and the Red Crescent by having annual meetings. Each branch will have a coordinator for this sub-component.

9.3.10. Awareness on environment and climate change

Its location in the exposed coastal zone makes Dhal Char especially vulnerable to climatic risk (see also Chapter 2). An essential strategy to mitigate the consequences of this global phenomenon is to assist local communities in adaptation to the gradually evolving changes in circumstances. The situation fully justifies efforts to raise awareness about climate change and the environment. The focus will be on training of selected (about 10%) group members that can form a skilled cadre with the task of dissemination of knowledge and information to the community. Some rather basic measures will be promoted such as improved cooking stoves, raising of plinths, strengthening of houses and planting of protective trees on the homestead.

9.4 Costs and benefits

9.4.1. Costs

Table 9 - 1 Summary of budget for social and livelihood program, Dhal Char

Sl No	Sub- components	Total
A	Supervision and management cost	
A.1	Supervision and management cost for branch office	5,508,570
	Total A: Supervision and management cost	5,508,570
B	Group formation and microfinance	
B.1	Support for group formation	1,239,500
B,2	Beneficiary capacity building MF group members only	6,037,288
B.3.	Beneficiaries risk fund (credit insurance)	100,000
	Total B: Group formation and microfinance	7,376,788
C	Program activities	
C.1	Health and family planning	9,632,347
C.2	Water and sanitation program	2,632,522
C.3	Disaster management program	2,514,152
C.4	Legal and human rights	2,415,196
C.5	Value chain development	250,000
C.6	Homestead agriculture	3,103,338
C.7	Education	16,178,409
C.8	Climate change and adaptation	5,434,102
C.9	Poultry and livestock program	5,201,103
C.10	Fisheries development	2,193,060
C	Total of program activities (3 to 10)	49,554,228
D	Grand Total (A+B+C)	62,439,586

9.4.2 .Benefits

It is expected that the social- and livelihood component will lead to both social and economic beneficial results for the settlers in the study area. Because the groups to be formed by the NGO consist exclusively of women, the proposed activities will in particular support the improvement of the status of women. The training in legal and human rights can further strengthen their position. The health- and education sub-components will improve the health status and will increase the access for children to primary education. The support from the NGO for the formation of Tube well User Groups and the training in hygiene subjects will also contribute to better health conditions. The support in selection of sites will facilitate the installation of tube wells, which will lessen the burden of women in their daily task of collecting water. The attention for disaster management will enhance the physical security of the people in emergencies, and can be seen as complementary to other measures such as the establishment of cyclone shelters, improved road network and the protective embankment.

The economic benefits are generated by the involvement of the NGO in homestead agriculture, fisheries and livestock, and in the income generating activities for women. Households will generate more income through these activities, and this will contribute to the general economic uplift of the char.

10. Governance

10.1 Introduction

In the subsequent CDSP projects, it was recognized that improving livelihoods of households in vulnerable areas as the chars in the exposed coastal zone, cannot be achieved by one type of intervention undertaken by one institution. To be effective, it needs a multi-sectoral and multi-institutional approach. This is completely in line with the Coastal Zone Policy and the Coastal Development Strategy, adopted by the Bangladesh government.

This chapter will focus on the governance aspects of such an approach. It deals with the organizations that would be involved in the further planning and implementation of the package of activities as proposed in this study report. These organizations are positioned at different levels: national, local and field level. The next section dwells on the proposed future involvement of national stakeholders and the coordination among them. The local government bodies can be found in 10.3 and the community based organizations in 10.4.

As in most of the coastal char areas, there are no significant institutions in Dhal Char. The fact that the char is an island in the Lower Meghna, and thus rather remote, makes it cumbersome for national institutions to be effective. Actually, their presence is hardly felt. In 1978 the Forest Department started with afforestation of the char, but ultimately had to withdraw because the illegal encroachment of settlers. None of the other national technical oriented agencies important for CDSP, like BWDB, LGED, DPHE and DAE are active in the char. Also the Ministry of Land did not implement any activities. No diara map has been prepared, no land titles were distributed. Only one NGO, from another char, was involved in some road construction and installing of tube wells and latrines.

10.2 Future involvement of national government agencies

10.2.1 Bangladesh Water Development Board (BWDB)

BWDB will be entrusted to construct all water management related infrastructure, like embankments, drainage channels and information centres for Water Management Organizations (WMO). It will be the responsibility of BWDB to form, train and register, and provide support to WMOs. This has to be done in accordance with National Water Policy and the Guidelines for Participatory Water Management (GPWM), including the Participatory Water Management Rules of 2014. In order to establish the WMOs as leading CBOs, BWDB needs to make effective efforts to develop their capacities in discharging their due responsibilities as laid down in aforementioned government documents. There is no doubt this will be a challenging task for BWDB. Experience gained over the years in previous CDSP phases has learned that in practice much of the work involved falls on the shoulders of the technical assistance team, not so much on those of the BWDB staff.

10.2.2 Local Government Engineering Department (LGED)

Like the current arrangement in CDSP, LGED has the mandate to construct much of the internal infrastructure such as the proposed rural roads, culverts, cyclone shelters and community ponds (see Chapter 3). LGED will extend their cooperation to WMOs in developing relevant maintenance plans for the new infrastructure. LGED will be responsible for major maintenance works, also in older CDSP areas. For earth work, LGED will engage LCSs as much as it is feasible under the local circumstances.

10.2.3 Department of Public Health Engineering (DPHE)

The responsibility of DPHE will be to construct the infrastructure related to water and sanitation, like deep tube wells, toilets, rain water harvesting schemes and public toilets (described in Chapter 3). DPHE will involve contractors as well as LCSs where feasible. DPHE will work closely with NGOs that are organizing and supporting Tube well User Groups. DPHE will install tube wells in locations selected by the settlers with the assistance of the NGO. The NGO will also collect contributions from households for the installation costs.

10.2.4. Ministry of Land (MoL)
The concerned District and Upazila administration will implement the land settlement program on behalf of the Ministry of Land. The following the process and procedures practiced in CDSP projects will preferably be followed. Accordingly, information dissemination meetings will be organized in Dhal Char to inform the settlers about the steps to be taken in the settlement process. The NGO will be involved in providing information on the land rights of the population. The Ministry of Land will initiate a plot to plot survey to make an inventory of the actual situation and to identify the households that are landless and indeed qualify to participate in the official settlement. Those settlers will subsequently follow the other phases in the procedure that is ultimately aimed at distribution of titles on maximum 1.5 acres of land. More information on land settlement in Dhal Char is given in Chapter 4.

10.2.5. Department of Agricultural Extension (DAE)
Low productivity of crop land is typical for new char areas. Lack of information on suitable crop varieties and on modern cultivation technologies are factors that impede improvements in production. The task of DAE will be to provide extension services and training for farmers. In order to reach out to remote areas as the island chars in the Lower Meghna, DAE will have to make sufficient field staff available and provide its staff with the required logistical support. The Department will, with NGO assistance, form Farmers Forums (FF). Extension efforts will apply the Farmer Field School methodology, with a high degree of participation from the farmers. DAE can play a vital role in developing the capacities of FFs in developing backward and forward linkages with other market forces at local levels.

10.2.6. Department of Forest (FD)
The Forest Department will be responsible for all plantation activities, such as mangrove plantation on mudflats, plantation along embankment (if that option is chosen) roads and khals and on the terrain of public places as cyclone shelters, schools and mosques (see chapter 8). It will in a sense restart its presence in the char by applying the social forestry approach. Social Forestry Groups will be formed. The Department will have the task to form, train and support these groups. The Department will work closely together with the NGO on homestead forestry.

10.2.7. Departments of Livestock (DLS) and Department of Fisheries (DoF)
The Department of Livestock and the Department of Fisheries will not belong to the group of abovementioned six implementing agencies of the proposed project. They will however provide assistance by providing support to the NGO working in Dhal Char. This support will take place at Upazila- and Union level and will evolve around facilitating provision of input supplies and extension.

10.2.8. Coordination
Based on the experience of successive CDSP I, II, III and on-going IV phase, a sort of “best practice” with regard to successful coordination and cooperation among the different implementing agencies have emerged over the years. Based on the principle of common planning and sectoral implementation, an integrated development model has evolved that has proven to be successful. A core feature is to have one overall project concept paper as an umbrella, followed by individual development project proformas (DPPs) for each of the individual partner agencies. An Inter-Ministerial Steering Committee (IMSC) forms the policy level forum, while the Project Management Committee (PMC) is the regular coordinating platform for implementation and for review all progress, problems and bottlenecks. Different phases of CDSP demonstrated the success of this coordination model particularly at national- and project level. There is scope of exploring ways to improve the coordination among different partner agencies at the level of the Union Parishad. Strengthening coordination with Union Parishads requires capacity development, which has to form a part of the total proposed package of activities.

10.3 Local Government Institutions

10.3.1. Present situation
Dal Char is located in two Disttricts: Noakhali and Bhola. It is part of Shukh Char Union under Hatiya Upazila of Noakhali, and also of Monpura no. 1 Union of Monpura Upazila of Bhola. The mouza names are Dhal Char and Dampir respectively. Noakhali District has extensive experience with CDSP, but CDSP has not yet been operational in Bhola District. The administration of Bhola District and the Upazila and Union administrations are not familiar with the integrated development approach of CDSP. It is necessary that workshops are organized to inform administration staff members and elected Parishad members about the concept of integrated development and the way it is practiced in the context of CDSP. Also the history of CDSP and its achievements should be on the agenda of these workshops.

10.3.2. Future scenario

In future char development programs, strengthening of the local government institutions, in particular the Union Parishads, will need to be one of the important institutional development interventions. In case of Dhal Char it is the UP of Shukh Char Union and of Monpura no. 1 Union. The UPs are expected to provide and coordinate support to the WMOs, and to be involved in the annual maintenance program for their area. The UPs have an important role in developing the linkage between WMOs and other field level institutions (WMOs, FFs, SFGs, TUGs, microfinance groups etc.), government implementing agencies, and NGOs and other service providers. UPs are indeed pivotal in assessing the local needs and planning of activities in consultation with other stakeholders, and in monitoring the progress.

10.4 Field level Institutions

10.4.1. Present situation

Apart from a number of mosque and market committees, there are at present no field level groups in Dhal Char. So there is no institutional capacity at field level to plan for and participate in a multi-sectoral development effort as is proposed in this report. It is therefore absolutely vital that such capacity is established and fostered in order to make the program successful. The sections below describe which field level institutions should be formed. This is largely based on the experiences of CDSP's ongoing and previous phases.

10.4.2. Water Management Organizations (WMOs)

Participatory water management will be the focal feature for the proposed char development program. In turning this concept into practice, "Guidelines for Participatory Water Management (GPWM)" as approved by the Ministry of Water Resources (MOWR) in 2001 and the "Participatory Water Management Rules-2014" will be the guiding documents. During the field level consultation with local people, they expressed their interest on the formation of water management organizations.

It is proposed to form two Water Management Groups in Dhal Char, based on a preliminary assessment of hydrological boundaries. This number can later be adjusted. Following the 2014 rules, 55% of all households have to be registered in the WMGs. It is the intention to have at least 50% female members in each WMG, and 30% in the management committees.

10.4.3. Tube Well Users Groups (TUG)

Tube Well Users Groups will be formed in collaboration with NGOs for all deep tube wells. The members of the TUG will be exclusively women, with an average of 15 in each group. It is earlier proposed (see Chapter 3) that around 90 deep tube wells will be required for Dhal Char, which means that about the same number of TUGs will have to be formed.

10.4.4. Labour Contracting Societies (LCS)

Labour Contracting Societies maybe engaged for earth work for construction of roads, markets etc., as an alternative to contractors. LCSs can also be involved in all sorts of maintenance works and in the production of single pit latrines, as experienced in CDSP IV. The concept of LCS is to form a group of poor people from the area who are mainly dependent for their livelihood on manual labour. If it is socially acceptable in Dhal Char, then women LCSs can also be formed as was practiced in CDSP III and IV. According to the procedure, LCSs can be treated as D-class contractors by the public implementing agencies and the necessary work orders can be issued without inviting any tenders. The size of the LCS may vary, based on the nature and volume of works to be implemented. It has been demonstrated in many government projects that a LCS can be an effective vehicle to provide project benefits directly to poor sections of the population, by creating additional income and employment. In the GPWM and PWMR it is mentioned that at least 25% of earth works will have to be executed by engaging a LCS. In CDSP, LCSs are generally organized by the WMOs. LCSs will be engaged by the implementing agencies, in particular by BWDB and LGED, and to a lesser extent by DPHE and Forest Department.

10.4.5. Farmers Forum

The group approach will be followed in all agricultural extension activities in line with the DAE policy. A Farmer's Forum is a group of settlers whose main occupation is farming and who are interested in new technologies, and willing to participate in all agricultural activities (crop production, demonstration, field days and exposure visit/motivational tour). The size of each Farmer's Forum will be around 45 members on average, and women participants will be at least 40% of the members. It will be decided at a later stage exactly how many FFs will be formed in Dhal Char. But based on the current population, it can be estimated that about six Farmer's Forums will be required.

10.4.6. Social Forestry Groups (SFG)

In order to ensure the community participation in the afforestation activities, a social forestry approach will be followed through which the settlers will be involved in planning, implementation, monitoring, maintenance and management of the plantation. For this purpose, Social Forestry Groups will be formed for every 2 km of roadside plantation, 1.5 km of embankment plantation, 10-20 ha of foreshore plantation and 20-30 ha of mangrove plantation. Each group will have around 20-30 members with roughly 70% men and 30% women.

11. Environmental and social impact

11.1 Introduction

In the previous chapters (2 to 10), an outline has been presented of the present situation and of the proposed measures (with two basic options: leaving the char area unprotected and protecting the area over time though a peripheral embankment). The chapters covered water management, internal infrastructure, land settlement, agriculture, fisheries, livestock, social forestry, institutions and NGO support. The present chapter dwells on the impact of the combined proposed interventions. In section 11.2 the impact on the environment is dealt with. In the last section (11.3) the influence of the proposed package of interventions on the social situation of the char dwellers is looked at.

11.2 Environmental impact

11.2.1. Methodology of assessment

Environmental assessment is a regulatory requirement (Environmental Conservation Policy, 1992, Environmental Conservation Rule, 1997). In carrying out the assessment, the standard code of practice was applied. The Guidelines of the Department of Environment and the Guidelines for Environmental Assessment of Water Management (FCDI) Projects of WARPO of 2005 were followed, while Technical Report no. 19 of CDSP-II was consulted.

The EIA started with review of available relevant literature, guidelines and other related studies and data sources. Field visits were undertaken by the study team to identify key environmental issues and to collect information on the Important Environmental Components (IEC). During field visits, consultations with different stakeholders such as governmental and non-governmental agencies as well as with the char settlers were held to identify important issues and concerns. Impacts of proposed interventions formed a part of the discussions. Consultations were conducted through Focus Group Discussions and interviews with key informants.

After field data collection, scoping, bounding and environmental assessment were carried out. The impact assessment was done with the establishment of scenarios for the two basic options: leaving the char unprotected and construction of embankment and drainage works. The EIA led to the identification of potential environmental impacts due to proposed activities and suggested feasible remedial measures included in the Environmental Management Plan (EMP).

11.2.2. Summary of the assessment

The EIA as presented here is based on option 2, the creation of a polder in Dhal Char. The assessment led to the identification of potential environmental impacts and suggested feasible remedial measures included in the Environmental Management Plan (EMP).

Leaving the char unprotected in the foreseeable future (water management option 1) will have a positive impact with regard to further sedimentation and thus higher land levels of parts the char. On the other hand, tidal flooding will continue and soil salinity will not be abated and quality of water, especially salinity, will not be improved either. Not protecting the char would be good for the status of flora, fauna and wildlife. But the environment for productive purposes, in particular agriculture and aquaculture, will not be enhanced, although wild fisheries will continue to be a source of income.

The EIA shows that the proposed options 2 and 4 (construction of a polder over time) will have positive impacts on most of the important environmental components including prevention of flood and salinity. Soil salinity will be reduced over time, while tidal flooding will be prevented. This will result in an improvement in land types and land use. Drainage will be improved as well and availability of fresh water in the char will increase. However, embankments will prevent further sedimentation of the char, and thus a further increase in average land levels. It will have a beneficial effect on flora, bur fauna and wildlife will

suffer. Possibilities for an increase of productivity in crop agriculture, homestead gardening, forestry and aquaculture will be significant. Wild fisheries will be negatively influenced. But it has to be mentioned that the environmental impact of dredging (option 4) has not been a part of the environmental assessment.

The conclusion is justified that neither of the options has such significant negative impact on the environment (but with uncertainty on the impact of increasing land levels by dredging), that the options should be discarded. Mitigation measures and monitoring are however necessary.

11.2.3. Mitigation measures and monitoring
An Environmental Management Plan (EMP) has been prepared with the following main elements (most of them meant for options 2 and 4, when a polder is created): compensation for land acquisition; standard construction practices to keep adverse impacts of construction activities to a minimum; appropriate site selection of embankment and other public infrastructure to minimize loss of agricultural land; increased use of mulches and organic fertilizer; further promotion of integrated pest management; appropriate O&M measures to combat siltation of khals and rivers; construction of fish friendly regulators.

Regular monitoring of the following variables is proposed: breaches in embankment; flooding, erosion/ sedimentation of channels; surface water quality incl. salinity; soil fertility and - salinity; groundwater table; crop production and damage to crops; fish production.

Cost of the environmental mitigation, enhancement and monitoring activities is estimated to be Taka 14.4 million per year.

11.3 Social impact

11.2.1. Introduction
Based on evidence in areas where CDSP has applied a similar approach in the past, the impact of the combination of CDSP-type interventions as proposed in this document on the socio-economic situation of the people in the areas concerned is considerable. Data collected through monitoring and other survey methods in CDSP I, II, III and IV areas justify the conclusion that those interventions will lead to a transformation in the social and economic circumstances. This transformation can best be summarized as more security and less vulnerability. There is no reason to suppose that this will be much difference in the area of Dhal Char.

11.2.2. Physical and legal security
Settlers will experience a greater physical security due to the construction of a protective embankment (options 2 and 4), cyclone shelters, foreshore - and mangrove protective belt. Roads will shorten the time to reach a cyclone shelter if a storm surge strikes the area. The physical security is further enhanced by the improved law and order situation, as has been the case in earlier phases of CDSP.
The official titles on land possession, to be provided through the land settlement program, will give security in a legal sense. At the same time this will encourage farmers to invest in their land, increasing the chances of higher production.

11.2.3. Economic and food security
The economic benefits, leading to more security in an economic sense, have been elaborated in other sections of this document (in particular Chapters 5 to 8). It can be added here that access to markets to sell the produce that is not consumed inside the area will be improved and will probably lead to better prices. Previous CDSP areas also show a sharp increase in the number of market places in the area itself, increasing the access to imported goods. This in many cases has also lead to lower prices of these goods because of lower transportation costs and competition. The upswing of local production and the greater accessibility will lead to an increase in employment opportunities.
A sample survey conducted among the households in CDSP I, II, III and IV areas shows that food security has improved significantly with an overall decline in the number of households that experience some periods of food shortage. Also the average number of months of food shortage has fallen. The most critical months are October/ November followed by July/August. This development is largely due to the increase in agricultural production in a broad sense and the increased employment opportunities.

11.2.4. Delivery of services
The general development of char areas have led, as was demonstrated in previous CDSP phases, to establishment of service delivery mechanism, from the government, from NGOs and from the private commercial sector. The government has expanded its presence in those char areas by introducing educational and health services as well as by maintaining law and order to a higher degree. The impetus

in economic development will stimulate banks to open branches, while shops will be established, for instance selling agricultural inputs.

11.2.5. Health and education
Although the CDSP type package of interventions do not have a specific orientation towards delivery of health and education services (it is limited to parts of the proposed NGO-program), the health and education situation will indirectly benefit from the proposed project. The cyclone shelters that will be constructed are multifunctional and can be used as school as well. It is common practice in char areas that primary schools are established in these shelters. It usually takes some time between completion of construction and completion of all the formalities to have a government school in the building. The proposed project could assist by facilitating this process. There are a few examples that cyclone shelters are used as health units.
Health of the settlers will be improved by the supply of safe drinking water through the provision of deep tube wells and by the provision of sanitary latrines. Also the greater variety in agricultural produce, especially vegetables, and the expected increased supply of fish and dairy products, will positively influence the health situation.

11.2.6. Social position of settlers
The institutional development efforts of the project through the establishment of a series of field level community based organizations will lead to a greater cohesion among the households. Helped by the economic uplift this will lead to more vibrant and resilient char communities. The project will strengthen the position of the settlers in the struggle over control of natural resources. The provision of a title on land is of course a prime example. The formation of Water Management Groups will enhance a fair and equitable way of using water resources. Social forestry activities promote equity in the sharing of benefits of public land. This will all lead to an increased self-confidence of the local people. This is further enhanced by the fact that settlers will no longer be controlled by jotdars or bahinis that were involved in the illegal settlement after migration into the newly emerged lands.

11.2.7. Gender issues
It is expected that the proposed project will have an impact on the lives of women in a practical sense, but at the same time will also improve their social position and status. The increased employment opportunities within their own areas will reduce the relatively high number of female headed households: seasonal outmigration will become less necessary, which means that men can stay more with their families. This should lessen the burden of work on women. They will also benefit in a practical manner by the fact that the number of tube wells for safe drinking water will be dramatically increased, shortening the average time women have to spent on collecting safe water. Through the envisaged training and credit facilities supplied by the NGO, combined with the general economic uplift, possibilities of employment for women will be enhanced. Women will have a greater possibility to create their own stream of income.
The proposed project will encourage an active and more equal participation of women in groups such as the Water Management Organizations (WMOs), Farmers Forum (FFs), Social Forestry Groups (SFGs) and Labour Contracting Societies (LCSs). The Tube well Users Groups (TUGs) and NGO's microfinance groups will consist exclusively of women. The experience in other areas have learnt that such participation will increase the ability of the women to speak out, both in their own households as in public forums. The khatians (land title document) will be signed by both the husband and wife (actually it is CDSP's policy to have the women signs first). This fully recognizes a woman's right on land. It will considerably strengthen their asset base and economic security, and indeed increase their bargaining power within their households.
Considering all these developments, it is justified to expect that the social position and status of women will be strengthened in case the proposed project is implemented.

11.4 Conclusion

The environmental assessment has indicated that the implementation of the interventions as proposed in this report, independent of which water management option is ultimately chosen, will not lead to a significant negative impact on the environment in the area. However, in case of option 4 the environmental impact of dredging has not been assessed. In order to mitigate any adverse influences, the Environmental Management Plan has to be made a fully integrated part of further project documents. The proposed program would have an important and favourable impact on the social and economic situation of the char settlers.
The assessment makes clear that on essential issues as physical and economic security, health and education, delivery of services, and gender, the proposed interventions will have a positive influence, often in a significant manner. Empirical evidence from areas where previous CDSP phases were

operational, reinforce such expectations. In case the implementation itself has adverse consequences for families, for instance through loss of land and relocation because of infrastructure development, the compensation component of the EMP can provide support.

It is realistic to suppose that the proposed package of interventions can pass the required clearance procedure successfully

12. Costs and benefits

12.1 Overview of costs

Estimated financial costs have been mentioned at the end of the individual chapters on each of the components. Of the four originally considered options, one (option 3) has been discarded for Dhal Char. Table 12.1 shows an overview of all the costs for the remaining options 1, 2 and 4. In option 1, the char would be left unprotected. Option 2 would allow further sedimentation in the first project years and then start protecting the area by establishing a polder. Option 4 is about increasing the land levels in a mechanized manner, by depositing dredging spoils on the land. This option aims at making one polder of all the three study chars: Char Kola Toli, Dhal Char and Char Mozammel. This option consequently includes the costs of all three chars.

Option 1 would cost Taka 1,755.6 lakh, option 2 Taka 7,285.5 lakh and option 4 Taka 58,074.9 lakh (for three chars). As the table shows, costs of land settlement and of the social- and livelihood program are included.

Table 12 - 1 Comparison of costs of options 1, 2 and 4 (in lakh Takas)

	Option 1	**Option 2**	**Option 4**
Dredging			20,824.0
Water management	168.2	3,757.4	13,546.5
Forestry	9.8	192.0	1,172.8
Agriculture	40.0	40.0	160.0
Livestock	40.0	40.0	130.0
Fisheries		35.0	105.0
Internal infrastruct.	748.3	1512.3	7,646.2
O&M during constr.		33.9	126.4
Engin. and adm.	12.6	112,7	952.2
Land settlement	70.0	70.0	500.0
NGO program	624.4	624.4	6,856.4
Contingencies	94.1	958.7	6,242.2
Total costs	1,807.4	7,376.4	58,261.7

12.2 Economic benefits

12.2.1. Overview of benefits

The benefits of the project interventions have been identified and quantified as far as possible for economic analysis. A distinction is made between social and economic benefits. The social benefits are, among others: the increased physical security for the settlers by the construction of embankments and cyclone shelters, a great increase in access to drinking water and sanitary facilities; increased legal security by issuing of land titles to the char population.

- an increase in the value of agricultural production through a higher increase in cropping intensity (especially for options 2 and 4) and higher yields;
- an increase in production of homestead gardening;
- a higher production of livestock products;
- the creation of an additional stream of income through aquaculture in individual ponds and higher production in big community ponds (in particular for options 2 and 4, with a protected area);
- the creation of income for the settlers as a result of the social forestry activities; and
- stimulation of general economic activities caused by the above mentioned production increases and supported by the improved transport network.

These economic benefits have been considered in the benefit stream of the project for the economic analysis.

In addition to the direct economic benefits, a number of interventions will lead to an indirect impact on the economic circumstances. These influences are hard to quantify. Potential benefits are envisaged from improved road communication within the project area and between the project area and the wider region, resulting in lower prices for agricultural inputs and higher farm gate prices. It will boost up economic activities, employment and services in the area. It is likely that obtaining land titles will make the settlers more inclined to invest in their own land. Production increases in different sectors, supported by the improved transport network, will stimulate general economic activities in the project area. This development process through forward and backward linkages will bring additional benefits. Such benefits are difficult to translate into monetary terms.
In the next section in Table 12.2, a summary is provided of the value of the benefits for each of the sectors. The incremental annualized benefits are given. As can be seen, an element of indirect benefits is reflected in the table, under the heading commercial gains.

12.2.2. Summary of annual net benefits

For Dhal Char, annual net benefits are estimated at Taka 1,501.31 lakh at full development stage in case the area is indeed protected (the proposed option 2, as well as option 4, only for Dhal Char), see table 12.2.

Table 12 - 2 Summary of Annual Incremental Net Benefits (in lakh Takas)

Sectors/Sub sectors	Benefits	Remark
Agriculture	1,225.38	Major benefits will start to accrue from 5th year and full benefits at 10th year.
Homestead Gardening	0.89	Throughout the project life
Open Water Fisheries	38.96	Full benefits at 6th year
Close Water Fisheries	25.36	Full benefits at 8th year
Livestock	31.84	Full benefits at 10th year
Social Forestry	135.2	Annualized benefit. Benefits will accrue through year 5 to year 15 of rotation period.
Commercial Gains (3.7%)	43.68	Commercial gains due to multiplier effects
Total Benefits	1,501.31	

12.3 Comparison of costs and benefits

12.3.1. Economic and financial analysis
The economic indicators are computed to judge the economic viability of the proposed package of interventions. These indicators include Net Present Value (NPV), Benefit Cost Ratio (B/C Ratio) and Economic Internal Rate of Return (EIRR). Following the normal practice in CDSP projects, the costs of social infrastructure have not been taken into account in the economic analysis, neither the costs of the NGO-program. The analytical results of economic analysis (at 12% Discount Rate) for the different options are given in table 12.3:

Table 12 - 3 Results of Economic Analysis

Option	EIRR (%)	NPV (Lakh tk.)	B/C Ratio
Option-1	35.24%	984.46	3.55
Option- 2	19.79%	1428.42	1.56
Option- 3	Not considered		
Option-4	9.56%	-3567.71	0.83

The results indicate that both option 1 and 2 are economically viable, as they secure a rate of return that fairly exceeds 12%, the opportunity cost of capital as presently used by all sectors of the economy in Bangladesh. Net Present Value (NPV) for option 1 and option 2 are Taka 1,004.02 lakh and Taka 1,465.11 lakh respectively and negative for option 4.

The economic analysis of projects is generally based on uncertain future events and imperfect data. Also certain risks are inherent in project planning and implementation. So a sensitivity analysis of the Base Case EIRR has been conducted for option 2, being the option with most benefits for the settlers and an option with an acceptable EIRR, based on variations in the level of costs and benefits, implementation and gestation periods due to various uncertainties and risks involved in the project investment. The findings of this sensitivity analysis are summarized in Table 12.4.

Table 12 - 4 Results of Sensitivity Analysis for option 2

Variables	**Variance**	**EIRR**	**NPV (Lakh Taka)**
Base Case	-	19.79%	1,428.42
Costs increase by+20%	20%	16.48%	920
Total benefits decrease by -20%	-20%	15.77%	635
Costs +20% and benefits -20%	both	12.67%	127
Fish benefits decrease by -20%	-20%	19.53%	1,381
Agriculture benefits decrease by -20%	-20%	16.76%	816
Forestry benefit decrease by - 20%	-20%	19.40%	1343.04
Livestock benefits decrease by - 20%	-20%	18.06%	1173.53

The results of sensitivity analysis presented in Table 12.4 above, show that option 2 is critically sensitive only to one variable: increase in project costs by 20% and decrease in benefits by 20% occurring simultaneously. Based on the EIRR and the results of the sensitivity analysis it can be concluded that option 2 is economically viable.

To assess whether the proposed investments are financially sustainable, a financial analysis has been carried out on the basis of market prices and interest rates (see Table 12.5).

Table 12 - 5 Results of Financial Analysis

Option	**FIRR (%)**	**NPV (lakh tk.)**	**B/C Ratio**
Option-1	18.44%	577.15	1.61
Option 2	12%	-136.58	0.97
Option 3	Not considered		
Option 4	4.58%	-15939.45	0.54

Financial Internal Rate of Return (FIRR) is 18.4 % for option 1 and 12.00 % for option 2, and these are respectively above and equal to the opportunity cost of capital in Bangladesh (12%). FIRR (4.6%) for option 4 is much below 12%. Both option 1 and option 2 would be financially sustainable. The costs of

the social- and livelihood/ NGO program and of the land settlement activities have not been included in the calculation of the FIRR. However, the cost of support services for agriculture, livestock and fisheries have been taken up.

12.3.3. Conclusion

After the economic and financial analysis, option 4 can be discarded because in both cases it does not meet the require criteria. Option 3 was not taken into consideration from the start, because Dhal Char will have reached satisfactory land levels within the assumed time limits of a future project. Both the remaining options (1 and 2) are economically viable and financially sustainable. Option 1 shows higher scores on both accounts than option 2.

However, given the conditions in which people have to live in Dhal Char and the multitude of vulnerabilities they have to cope with, combined with the clearly expressed priority the settlers give to protection of the char, it is recommended to implement option 2. A detailed cost estimate of this option can be found in the next section.

12.3.4. Estimate of project costs (financial) for the recommended option

As table 12.6 shows, total investment costs for option 2 (establishment of a polder after land levels have reached MHWL in monsoon time by natural sedimentation), amount to Taka 6,682.1 lakh. The costs of land settlement (Taka 70 lakh) and of the social- and livelihood program (Taka 624.4 lakh) have to be added. Overall project costs for this option are thus Taka 7,376.5 lakh. This equals Euro 8,210,044 or US$ 9,161,613 at the exchange rate of 19 September 2016.

Table 12 - 6 Detailed Project Cost (Financial) for option 2

Expenditure Accounts by Years -- Base Costs (BDT Lakh)	Base Cost						
	1	2	3	4	5	6	Total
I. Investment Costs							
A. Dredging	-	-	-	-	-	-	-
B. Water Management Infrastructure							
1. Drainage Sluice							
1 vent Sluices	-	-	-	327.3	436.4	327.3	1,091.0
2 vent Sluices	-	-	-	-	-	-	-
3 vent Sluices	-	-	-	-	-	-	-
Subtotal Drainage Sluice	-	-	-	327.3	436.4	327.3	1,091.0
2. Embankment:							
Sea dyke	-	-	58.5	175.5	234.0	117.0	585.0
Internal dyke	-	-	189.7	569.2	758.9	379.4	1,897.2
Subtotal Embankment:	-	-	248.2	744.7	992.9	496.4	2,482.2
3. Re excavation of Channel	-	-	84.1	84.1	-	-	168.2
4. Construction of WMG Building	-	-	-	8.0	8.0	-	16.0
Subtotal Water Management Infrastructure	-	-	332.3	1,164.1	1,437.3	823.7	3,757.4
C. Forestry							
1. Mangrove Plantation	-	-	-	-	-	-	-
2. Foreshore Plantation	-	-	-	51.3	64.1	12.8	128.1
3. Embankment Plantation	-	-	-	10.0	13.3	10.0	33.3
4. Road side Plantation	-	-	-	2.9	3.9	2.9	9.8
5. Homestead Plantation	-	-	0.09	0.14	0.14	0.09	0.47
6. Public Instution	-	-	0.02	0.02	0.04	0.04	0.12
7. Canal Bank	-	-	-	5.1	5.1	5.3	15.5
8. Other Cost	-	-	1.2	1.2	1.2	1.2	4.6
Subtotal Forestry	-	-	1.3	70.6	87.8	32.3	192.0
D. Agriculture	-	-	10.0	10.0	10.0	10.0	40.0
E. Fisheries	-	-	8.8	8.8	8.8	8.8	35.0
F. Livestock	-	-	10.0	10.0	10.0	10.0	40.0
G. Internal Infrastructure							
1. Rural roads (Type R-2)							
Existing earthen road development	16.7	50.2	50.2	50.2	-	-	167.3
Pucca road	-	-	-	-	75.0	75.0	150.0
Subtotal Rural roads (Type R-2)	16.7	50.2	50.2	50.2	75.0	75.0	317.3
2. Bridge & Culvert							
Box Culverts	-	-	14.0	28.0	28.0	-	70.0
Pipe Culvert	-	-	4.8	9.6	9.6	-	24.0
Subtotal Bridge & Culvert	-	-	18.8	37.6	37.6	-	94.0
Subtotal Internal Infrastructure	16.7	50.2	69.0	87.8	112.6	75.0	411.3
H. Social Facilities							
1. Multipurpose Cyclone Shelter	240.0	400.0	160.0	-	-	-	800.0
2. Deep Tube well	13.5	27.0	36.0	13.5	-	-	90.0
3. Single pit latrine	15.0	22.5	18.8	18.8	-	-	75.0
4. Public Toilet	5.2	7.8	6.5	6.5	-	-	26.0
5. Rain Water Harvesting	-	-	2.5	2.5	-	-	5.0
6. Community Pond	-	-	15.0	15.0	-	-	30.0
7. Market development	-	-	37.5	37.5	-	-	75.0
8. Killa	-	-	-	-	-	-	-
Subtotal Social Facilities	273.7	457.3	276.3	93.8	-	-	1,101.0
I. O & M during Construction	-	-	-	-	21.6	12.4	33.9
J. Engineering & Administration	0.4	1.3	10.8	33.8	42.2	24.3	112.7
Total BASELINE COSTS	290.9	508.8	718.4	1,478.8	1,730.2	996.5	5,723.4
Physical Contingencies	5.8	10.2	14.4	29.6	34.6	19.9	114.5
Price Contingencies	-	13.0	55.9	196.2	329.2	249.9	844.2
Total PROJECT COSTS	296.7	531.9	788.6	1,704.5	2,094.0	1,266.3	6,682.1

Annex 1. Terms of Reference

Feasibility Study Cluster of Chars, Dhal Char

1. Introduction

1.1. Background

The Inception Report of CDSP IV states that the project will undertake feasibility studies in areas where in future char development programmes might take place. These future areas have to be located within the overall study area, essentially the central, dynamic part of the coastal zone of Bangladesh. This area is bordered in the east by the outfall of the Muhuri River and the Chittagong coastline. In the west the border is formed by the Tetulia River. In the north, the coastline of Feni, Noakhali and Lakshmipur Districts is followed. After a process of selection, the concerned authorities decided to take Dhal Char and Char Kola Toli as areas for the second in the series of feasibility studies. During preliminary visits to these chars it was discovered that Char Mozammel forms part of the same cluster of islands as Dhal Char and Kola Toli and has a similar pattern of habitation and activities, hence it was decided to include it in the study as well. Ghasiar Char and Moulovi Char are also in the same cluster, but the first one is protected forest area and the latter is under severe erosion. The assessment of the stability shall include the whole cluster of chars. Estimated total area of the 3 chars of the study area, i.e. Dhal, Kola Toli and Mozammel is about 5500 Ha, see attached map.

The three chars in question, Dhal Char, Char Kola Toli and Char Mozammel, are distinctly different areas, separated by rivers. The larger part of Dhal Char is located in Hatiya Upazila, Noakhali District, Chittagong Division, while a small part of Dhal Char and the whole of Char Kola Toli forms part of Monpura Upazila, Bhola District, Barisal Division and Char Mozammel is under Upazila Tozimuddin, (Dolichadpur Union), Bhola District. The chars have their own distinct physical characteristics and have different degrees of development. These Terms of Reference, and consequently the feasibility study reports themselves, will have three clearly separate parts, one devoted to Dhal Char, one to Char Kola Toli and another devoted to Char Mozammel.

1.2. Objectives

The objective of the feasibility study is to prepare a report which will be submitted to the concerned authorities for their consideration whether the required means will be made available to implement and facilitate the interventions recommended in the study. The study therefore has to fulfil the standard rules and guidelines applied by the Bangladesh government in such cases. The study will develop a set of interventions that will contribute to the overall objective of CDSP: to reduce poverty and hunger for poor people living on newly accreted coastal chars, which would be achieved via improved and more secure livelihoods.

1.3. Methodology

The preparation of the study should follow these general phases:

- establishing base-line conditions
- identification of possible interventions that will contribute to the abovementioned overall objective
- analysis of impacts and costs of the interventions
- formulating the overall proposed plan, setting priorities with regard to activities and time tables.

The preparation should adapt as much as possible a participative approach, especially with regard to the identification and prioritisation of activities. At different stages both the local population and the concerned institutions should be informed about the progress of the work. More methodological issues are included in chapter 2 on the detailed activities to be undertaken.

These Terms of Reference cover the overall feasibility study. However, a part of the study will be carried out by a Bangladeshi firm or institute, to be sub-contracted by the project, while another part will be done by the Technical Assistance team (TA team). Below, in the headings of the various sections on the subjects to be covered, it is indicated whether that section will be taken care of by the sub-contracted firm or institute, or by the TA team. Based on these overall Terms of Reference, specific Terms of Reference for the sub-contracted firm or institute and for the TA team are available. If required, the TA team can hire additional staff on a short term basis to support the study activities.

The duration of the study will be not more than 12 months.

2. Study area and activities

Dhal Char

A.1. Study area

Dhal Char is located in the lower Meghna, north west of Hatiya island. The larger part (around 80-85% is under Hatiya Upazila (Sukhchar Union), Noakhali District, the remaining part under Monpura Upazila (Monpura Union), Bhola District. It is a char island, with an estimated size of the mature part of 1,900 ha. The Forest Department started mangrove plantations in 1978. These mangrove trees (keora) are still present. Land levels vary from 2.5 meter to 4.30 meter, with an average of 3.40 meter (PWD). The char is thought to be stable, although some erosion occurred at the southern tip during two years of the last ten years.

Approximately 750 households are present in the area with a population of probably 3,750. Preliminary investigations show that 1,200 acre (486 ha) have been officially settled. The main sources of income are farming, fishing and livestock.

A.2. Activities

A.2.1. Main features of study area and population (sub-contracted firm)

An overall picture of the present physical features of the area and the current population in the area should be presented, including the following elements:

- short description of the development of the char since its emergence
- land levels and land use (see also under 2.2)
- total population, with number of households and average household size; this should be based on a sample survey of approximately 10%
- the sample survey should also contain questions on main occupations and sources of livelihood of the settlers, landholdings and land tenure system, law and order situation
- the survey should cover as well the status of food security in terms of the number of months that food is available for the different social strata

A. 2.2. Water management (sub-contracted firm)

The following tasks should be performed as far as water management (and related to that, land suitability) is concerned:

- Make *a basic topographic and drainage map* for the present situation, based on existing information available with CDSP IV and new topographic (land levels) and hydrographic (cross section khals) measurements. Observations during field visits and interviews will add to the

understanding of the area. This map should clearly identify the drainage units in the considered area, the drainage network, the depth-duration characteristics of the drainage congested areas (if any) and the origin and destination of the drainage waters. Design drainage discharges for each of the drainage units should be established. The scale of the map should be 1:15000, while the map should show contour-lines with contour-intervals of 10 cm.

- *Map the present salinity situation*: intrusion and duration of the presence of saline water for concentrations above a selected concentration for rice tolerance (e.g. 8 dS/m). Salinity intrusion is for local settlers a bigger problem than drainage congestion.
- Make *flood maps*: depth and duration of tidal flooding in critical periods for agricultural practices (for instance transplanting of T. Aman).
- In order to obtain a first impression of the groundwater situation, collect and analyse samples of water produced by the few existing tube wells.
- Based on the above maps and established drainage patterns and discharges: *identify bottlenecks and develop interventions* (such as, for instance, drainage works and possibly embankments), to overcome these bottlenecks. Give particular attention to the issue of salinity intrusion. Designing an optimal internal drainage system might include shifting the present boundaries with adjacent drainage units, shortening of drainage channels, and cutting across boundaries of drainage units (drainage from and towards other drainage units).
- Make an assessment of the stability of Dhal Char (accretion and erosion patterns); this assessment should cover the development over the last 20 years and a projection for the next 20 years.
- In case any embankment is proposed, the issue has to be discussed with the Project Coordinating Director, CDSP IV and Team Leader of the Technical Assistance team. If they agree to continue with the idea of embankment construction, type and height of embankments have to be established taking into account BWDB practices and experiences. Also the results of the latest relevant climate change studies have to be considered. If the impression obtained during a field visit is indeed correct, the main purpose of an embankment would be protection of life and property and combating salinity intrusion.
- Make a map clearly showing the location of the proposed interventions, including the drainage network
- Prepare drainage, salinity and flood maps for the situation with interventions.
- Based on the above information: make *land suitability maps*, indicating the potential for certain cropping patterns and corresponding yields. The practice of agricultural zoning maps applied in CDSP III and IV should be given attention.
- For each type of water management structure a conceptual design and drawing should be produced.
- A cost-estimate of all proposed water management interventions should be made (with reference to section 2.14 on cost/benefit analysis); this cost-estimate should take into consideration the increase in rates that is likely to occur in the period till actual implementation of the study recommendations.

A.2.3. Internal infrastructure (sub-contracted firm)

Although there is not much significant internal infrastructure present in the char, the study team should start with making an inventory and continue with preparing a plan for the development of public infrastructure for the char. The most important type of internal infrastructure for char areas are:

- transport related infrastructure as roads, bridges and culverts

- social and economic infrastructure such as multipurpose cyclone shelters, deep tubewells, sanitary facilities, community ponds, killas and, if required, clustered villages and markets.

The infrastructure should be planned for a population that can be expected in future. The size of the future population can be estimated by dividing the total area of *khas* land available for settlement of landless households by 1.5 acre, being the maximum allocation for each household.

- An estimate of the total numbers of each of the structures should be made. The location of all structures should be clearly identified on a map. The map should also show the proposed road network.
- For each type of infrastructure a conceptual design and drawing has to be produced.
- The costs of the proposed infrastructure should be estimated (see 2.14), taking into account increase in rates in the period until implementation will take place.

A.2.4. Land settlement (TA team)

The work on land settlement should focus on the issue of supply and demand: how much *khas* land is available for distribution among landless households, versus the demand for land from households that have already settled in the area, based on a maximum allotment of 1.5 acre per household. Initial information shows that in Dhal Char (Hatiya Upazila), for 1,200 acres settlement cases were initiated in 1959 and 1960, with 2.5 acres per house hold. However, titles were never issued due to a court case. Another 1,200 acres were officially settled in 2000-2001, with 1 acre per household.
The following activities have to be undertaken:

- report on the present status of land settlement; provide mouza-wise information on the total area of the mouza, the area that has already been officially settled, the area that is in process of settlement, and the balance of land that is available for future settlement; please note that experience in previous CDSP-projects have indicated that around 20-25% of land is required for public infrastructure, and thus can not be used for settlement of households
- there is an acute border issue between Noakhali- and Bhola district with the area in the Upazila; assess the nature of this conflict and recommend ways to solve the issue, and report on the impact of a land settlement programme in case the issue is not resolved
- determine the number of households already settled in the char that have as yet no official land title
- determine the possibility of providing the already settled households that have no legal land title with a plot of 1.5 acre
- assess the possibility of settling additional households that are as yet not present in the area.

In addition, a plan for future activities should be developed aimed at facilitating the settlement process. This plan will include an estimate of the involved costs (see 2.14).

A.2.5. Agriculture (sub-contracted firm)

For agriculture, the team is required to:

- map the existing cropping pattern, cropped area (cropping intensity) and yields for each of the crops grown in the field;
- describe the present status of homestead gardening
- analyse the present methods of cultivation, including an assessment of the status of the practice and adoption of modern technologies
- investigate salinity levels (ECE ds/m) of soil and water and their impact on crop production
- assess the status of present small scale (such as from ponds) irrigation practices and the future scope for irrigated agriculture
- analyse the support system, including the extension services currently provided and the supply of agricultural inputs
- assess the current practice of selling agricultural produce
- analyse the main factors hampering agricultural production, including at homesteads
- develop recommendations to make the cropping patterns more suitable to the char environment, and to increase the cropping intensity and yields; give attention to the possible impact of climate change on coastal agriculture;

- also formulate recommendations for homestead gardening
- make a projection of future cropping intensity and yields, taking into account the suggested interventions with regard to water management (see 2.2) and the interventions recommended in this section; while making this projection, makes use of information on results in previous CDSP areas, these are well documented in a number of CDSP-Technical Reports
- make an estimate of the costs of the recommendations for field agriculture and homestead gardening (with reference to the required cost/benefit analysis, see 2.14)
- determine the difference in production and value of that production between the situation before and after the proposed interventions (including the ones related to water management, if any, see 2.2) for field agriculture and homestead gardening (see 2.14).

A.2.6. Livestock (sub-contracted firm)

With regard to livestock activities in the area, the study will:

- *review the present situation of the livestock sector (poultry, small ruminants, cattle), including the role of livestock in the household economy*
- *analyse the production and marketing systems and identify the bottlenecks that impede further development of the sector*
- *describe the present status of diseases and their treatment*
- *prepare a plan with recommendations for measures to be taken in support of livestock activities in the char*
- *estimate the costs of the proposed measures regarding livestock development (see cost benefit/analysis in 2.14)*
- *make an estimate of the increase in livestock production and its value after introduction of the proposed measures (see 2.14).*

A.2.7. Fisheries and aquaculture (sub-contracted firm)

This part of the study has to focus on:

- an assessment of the importance of fisheries and aquaculture for the livelihood of settlers in Dhal Char
- an analysis of the current production systems (inland fisheries, marine fisheries, aquaculture in ditches and ponds)
- an analysis of the present marketing system (if applicable)
- the development of possible interventions to develop the sector, including the provision of extension services
- an assessment of the impact of the proposed water management interventions, if any (see 2.2) on fisheries and aquaculture
- estimate the costs of the proposed interventions (see cost/benefit analysis 2.14).
- make an estimate of the difference in fish production and its value between the situation before and after the proposed interventions (see 2.14).

A.2.8. Social forestry (sub-contracted firm)

Forestry has multiple functions in char development (stabilisation of land, buffer against tidal surges and storms, promotion of bio-diversity, income creation through involvement of local population). The following tasks have to be undertaken in the framework of this study:

- describe briefly the forestry situation since the emergence of the char area and elaborate upon the present status of forest in the char by making an inventory of the forestry coverage and the presence of any social forestry activities
- analyse the bottlenecks that have adversely influenced forestry development
- prepare a forestry development plan for the char area, including road plantation, plantation in homesteads, plantation on the grounds of public institutions, embankment- and foreshore plantation (if applicable); the plan should also assess the possibilities of mangrove plantations on land emerging in areas adjacent to or close to Dhal Char

- make an estimate of the costs of the proposed development plan (see cost/benefit analysis in 2.14)
- make an estimate of the additional production of forest products and its value due to the proposed development plan and of the extra stream of income for the local settlers from their involvement in social forestry activities (with reference to 2.14).

A.2.9. NGO component (TA team)

The proposed interventions in the study area should contain a social- and livelihoods support component, to be implemented by NGO's. This NGO programme will cover the following fields:

- Group formation, micro-finance and capacity building
- Health and family planning
- Education
- Water and sanitation
- Homestead agriculture and value chain development
- Poultry and livestock
- Fisheries and aquaculture
- Legal and human rights
- Disaster management and climate change (see also 2.13.)
- Climate change awareness.

The size of the programme should be based on the expected number of households that will be settled in the study area (will be determined in section 2.4). An estimate of the costs of the overall NGO component has to be made. The required overall cost/benefit analysis (see 2.14), has to include the estimated costs of the economic oriented activities (homestead agriculture, poultry and livestock, and fisheries and aquaculture).

A.2.10. Governance issues (TA team)

Governance related issues can be seen at three levels:

National government agencies: One of the striking features of CDSP is the fact that six governmental departments (BWDB, LGED, DPHE, Ministry of Land, DAE, Forestry Department) share the objectives of CDSP and closely cooperate and coordinate in undertaking activities. A key coordinating mechanism is the Project Management Committee (in which all six departments are represented). It is the intention that, in case the recommended interventions for Dhal Char are carried out, the implementation will follow the same arrangement. If proposed activities are beyond the purview of the six departments, the feasibility study team should suggest the modality of implementation. This will, for instance, be the case for the fisheries and livestock sectors.

Local government level: The study should describe the involvement of local government bodies in the proposed activities in Dhal Char. More specifically, these bodies are the Upazila Parishads of Hatiya and Monpura and the Union Parishads of Sukhchar (Hatiya UZ) and Monpura (Monpura UZ). The support of all councils would be vital for successful implementation of project activities and should be ascertained. The role of the councils in the activities should be defined.

Field level institutions:
- *An inventory should be made of the community based organisations that are already present and active in Dhal Char.*
- A plan should be prepared, with a view on the proposed interventions in sections 2.2 to 2.8, of either broadening and strengthening the existing institutions or forming new ones. For each of the types of the proposed institutions the number should be indicated, as well as the size in terms of specific number of members (gender specific)

- Also, for each the role and responsibilities should be spelled out. Special attention should be given to the involvement of the population in mangrove plantation and maintenance through the social forestry approach.
- Costs of all proposed interventions should be estimated (see 2.14).

A.2.11. Social impact and impact on livelihoods (TA team)

The feasibility study report will clearly indicate what the effect of the proposed intervention is on the social and livelihood situation of the char settlers. One of the main aims of undertaking project activities in Dhal Char is to contribute to a socio-economic transformation similar to what can be observed in other CDSP areas. This change in livelihoods is well documented (see for instance Technical Report no. 7 of CDSP III, December 2010, Impact of the Char Development and Settlement Projects I, II and III). In describing and analysing the expected effects in the study area, the following elements have to be highlighted:

- the economic benefits (see also section 2.14), including access to markets
- the diversification in income
- the employment opportunities
- the level of poverty and food security
- the access to social services
- the change in security and vulnerability of the settlers
- the position and status of women.

A.2.12. Environmental impact (sub-contracted firm)

A comprehensive Environmental Impact Assessment (EIA) is required for the development of Dhal Char. This EIA shall be in accordance with the government guidelines, provided in the WARPO Guidelines of 2005. Technical Report no. 19 of CDSP II, Guidelines for Environmental Impact Assessment of CDSP activities, also gives valuable information. The scope of the work should include:

- review of existing information and identification of environmental issues related to CDSP type of activities
- description of the relevant institutional, legal and policy framework
- collection of baseline data on the present environmental condition
- analysis of the key environmental issues, with a view on the interventions proposed in this feasibility study
- analysis of possible, more environment-friendly alternatives
- preparation of an Environment Management Plan, including a mitigation component
- preparation of an Environmental Monitoring Plan
- a cost-estimate of the Environmental Management Plan, of the mitigation measures and of the Environmental Monitoring Plan should be included.

In a concluding section, the EIA should clearly state
- the gains which justify implementation of the proposed interventions
- an explanation of how the environmentally adverse effects could be minimized
- provisions for proper follow-up surveillance and monitoring.

A.2.13. Impact of climate change (sub-contracted firm)

It is likely that climatic changes will have an impact on the situation on low-lying areas of coastal Bangladesh. The feasibility study should make an effort to provide insight in what this impact would mean for the proposed development activities in Dhal Char.

- The study should endeavour to reflect on, in general, the influence of climate change on the situation in Dhal Char. The latest widely accepted reports should be used for this assessment.
- More specifically, this section of the feasibility study report should dwell on the impact of climate change on the sustainability (durability) of the proposed interventions (especially with regard to water management, if any, internal infrastructure, agriculture, livestock, aquaculture and forestry).

- In addition, concrete consequences for, for instance, design parameters for structures, selection of crop- and fish varieties and similar issues shall be described. On the subject of climate change, a time horizon of 50 years should be applied.
- Recommendations will be formulated if any special measures should be taken to support the settlers in Dhal Char to cope with the consequences of climate change. This could be in the range of raising awareness, support for community based adaptation to special institutional arrangements to deal with natural disasters (see also 2.9).

A.2.14. Costs and benefits: financial and economic analysis (sub-contracted firm)

An analysis of costs and benefits should be made, paying attention to the following issues.

As far as the *cost* side is concerned, the major cost components in the proposed package of interventions are:

- costs of water management related infrastructure as excavation of drainage channels and (possibly) construction of embankments and sluices
- cost of construction of economic activities related internal infrastructure as roads, bridges, culverts, killas and community ponds
- cost of construction of social facilities (cyclone shelters, deep tube wells, sanitary facilities)
- operation and maintenance (O&M) costs in the period after project completion
- costs of recommended interventions as far as agriculture, livestock, fisheries/aquaculture and social forestry are concerned
- costs of the land settlement plan
- costs of institutional development measures.

As is normally the practice, the category of the abovementioned social infrastructure does not have to be taken into account in a cost-benefit analysis.

With regard to the *benefits*, a distinction can be made between social and economic benefits. For the *social benefits* see 2.11.

As *economic benefits* can be counted:

- an increase in the value of agricultural production through a higher cropping intensity and an increase in yields (see 2.5)
- an increase in production of homestead gardening (see 2.5)
- a higher production of livestock products (see 2.6)
- the creation of an additional stream of income through aquaculture in community ponds and possibly individual ponds (see 2.7)
- the creation of income for the settlers as a result of the social forestry activities (see 2.8)
- a stimulation of general economic activities caused by the abovementioned production increases and supported by the improved transport network (an effort should be made to quantify this benefit).

These economic benefits should form a part of the cost-benefit analysis.

Specific tasks that have to be performed are:

- make a selection of the costs that can reasonably be related to the economic benefits
- calculate the total of these economy related investment costs
- calculate the expected economic benefits
- make an estimate of the expected O&M costs
- make an estimate of O&M costs and of economic production in the present (without project) situation
- on the basis of these data calculate the Financial Internal Rate of Return (FIRR) and the Economic Internal Rate of Return (EIRR)

Please note that the methodology applied should be acceptable for the Bangladesh authorities. In this respect the Guidelines prepared by WARPO should be followed and conversion factors to come to economic costs and benefits as approved by WARPO should be used. The economic life of the proposed project should be assumed to be 20 years.

In CDSP, valuable reports have been published on the subject of cost/benefit analysis. It is strongly recommended to consult these reports while implementing this part of the assignment. See for instance

- Technical Report no. 26 (CDSP I), June 1999, The Costs and Benefits of Char Development
- Technical Report no. 18 (CDSP II), September 2005, Cost benefit analysis
- Feasibility study under CDSP III, Economic Analysis of Char Nangulia, Noler Char and Caring Char, March 2008.

3. Staffing and organisation

3.1. Guidance and monitoring of the feasibility study team

Supervision of the feasibility study and coordination with other government institutions and non-governmental organisations will be in the hands of the CDSP IV Project Coordinating Director (of BWDB) and the Team Leader of the Technical Assistance team. The study will be carried out in close consultation and with full cooperation of the CDSP IV project staff, both from the government implementing agencies and the Technical Assistance team. At least once a month meetings will be held to monitor progress and more often when deemed necessary.

3.2. Staffing of the team

The study will be carried out by a team of experienced professionals in the following areas (between brackets: maximum duration of their involvement, minimum educational requirement and reference to the description of their tasks):

- civil engineering/ water management and team leader (6 months / graduate engineer / see sections 2.2. and 2.3)
- hydraulic engineering and deputy team leader (6 months / graduate civil engineer / see sections 2.2 and 2.3)
- agriculture (3 months / master's degree in agriculture / see section 2.4),
- livestock expert (2 months / master's degree in animal husbandry and veterinary science / see section 2.5)
- fisheries/aquaculture expert (2 months / master's degree in fisheries / see section 2.6)
- social forestry (2 months / master's degree in forestry / see section 2.7)
- environment (2 months / relevant master's degree / see section 2.8)
- climate change (1 month / relevant master's degree or graduate engineering degree / see 2.9)
- economic and financial issues and deputy team leader (4 months / master's degree in economics / see section 2.10).
- socio economist/ sociologist (1 month / relevant master's degree / see 2.1).

All experts should have at least 15 years of experience in their respective fields and at least 10 years of experience in the coastal zone.

In addition to the abovementioned 25 person months of professionals, technical assistants can be employed for the study to a maximum of 25 months.

3.3. Timing and reporting obligations of the study team

The start of the study is 1 December 2014; the duration will be not more than 12 months.

The following reports have to be prepared:

- an Inception Report, not later than one month after start of the assignment; the report will elaborate on methodologies and activities and provide detailed working schedules
- an Interim Report, reflecting on the progress. It will contain the description and analysis of the present situation regarding all the subjects (including all relevant maps) and, if any, preliminary conclusions and recommendations; the Interim Report has to be submitted not later than four months after start of the assignment
- a Draft Final Report; to be submitted not later than ten months after the start of the assignment
- a Final Report, in the 12th month after start of the assignment.

All abovementioned reports should follow the structure of these Terms of Reference. The reports shall be delivered digitally (2 copies) and as hard copies (50 copies).

3.4. Responsibilities of the CDSP IV Technical Assistance team

The Technical Assistance team of CDSP IV shall furnish all relevant data, maps and other information available to the feasibility study team. The Technical Assistance team will provide such assistance as is reasonably required by the feasibility study team for the purpose of implementing the activities under this Terms of Reference. The Technical Assistance team will closely monitor the progress. To this effect monthly (at least) meetings with the feasibility study team will be held. Experts from the Technical Assistance team will join members of the study team during selected field visits.

3.5. Responsibilities of the feasibility study team

The Water Management expert shall be appointed as Team Leader of the feasibility study team and the hydraulic engineer and the socio economist as Deputy team Leader for respectively the technical and socio economical parts of the study. He or she will be responsible to the Project Coordinating Director and the Team Leader of CDSP IV for the discharge of responsibilities of the feasibility study team. No changes can be made in the composition of the feasibility study team, after the contract has been awarded. In case, due to unforeseen circumstances, a team member has to be replaced, this can only be done with the approval of the Project Coordinating Director and the Team Leader of CDSP IV.

The feasibility study team will open an office in Noakhali. Staff will be employed at that office throughout the study period. The team will regularly consult with the Technical Assistance team. As mentioned earlier, regular meetings (at least once a month) and joint field visits will be held.

Accurate and systematic records and accounts will be kept in respect of the services in such form and detail as is customary in the profession and shall be sufficient to establish accurately the cost and expenditures incurred for the services. Except with the prior written approval of the Team Leader and Project Coordinating Director of CDSP IV the Consultant shall not assign or transfer the contract or any part thereof nor engage any independent consultant or sub-contractors to perform any part of the services other than the nominated personnel listed in the contract.

The feasibility study team will deliver all materials, including digital versions of all maps and reports, to CDSP-IV upon completion of the assignment.