Re-excavation: A Major Step in Wetland Restoration in the Floodplains

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Since restoration of wetlands constituted a major intervention under the project, restoration through re-excavation has been considered a tested and proven natural resource management technique in maintaining and enhancing both qualitative as well as quantitative values and resources of the degrading wetland habitats of Bangladesh. Re-excavation is important for restoring the currently derelict water channels to facilitate fish migration as well as ensuring winter refuge for aquatic biodiversity. Gradual and unabated siltation in the Bangladesh wetlands systems has tilted the functional balance of the ecosystem. With ever-expanding invasion of the water hyacinth and other aquatic vegetation, siltation is taking place at an alarming rate. As a result, deeper areas of canals and beels have risen, leading to the loss of countless perennial water bodies. This particular trend of environmental degradation has far-reaching and manifold impact on the erstwhile bountiful floodplain wetlands ecosystem, livelihoods of wetlands communities, agricultural production systems and biodiversity.

To address the above mentioned critical issues perceived in the backdrop of the indispensability of our wetlands in the life of the local communities, the SEMP project personnel and the project area grassroots together had identified a number of sites in the three floodplains sites for re-excavation through participatory processes. The overall objectives of the re-excavation were to improve the environmental quality of the degraded canals/beels/rivers for proper functioning of migratory routes of fish and other organisms, increase the crop production by facilitating irrigation and thereby effect
socio-economic uplift of the local communities, especially the women and the disadvantaged.

IUCN Bangladesh in collaboration with Bangladesh Centre for Advanced Studies (BCAS) and Nature Conservation Management (NACOM) has carried out the re-excavation work in the Madhumati floodplains, Padma-Jamuna and Brahmaputra-Shitalakshya as implementing a part of an activity component called Community Based Floodplain Resource Management under the Sustainable Environment Management Programme (SEMP). IUCN Bangladesh in association with NACOM accomplished re-excitation work in the Bahadurpur canal located in Gopinathpur, Harirampur Upazila, Manikganj District and Boka beel canal of Boka beel area located in Singrail of Trishal Upazila, Mymensingh District. BCAS restored degraded canals and kuas in the Chanda beel and Kadambari-Chowari bari beel complexes located in Mukusudpur Upazila of Gopalganj district and Rajoir Upazila under Madaripur district respectively.

The re-excavation work was undertaken with the active participation of the local communities through involving their Village Environment Committee (VEC), Floodplain Resource Management Committee (FRMC) and Village Resource Management Committee (VRMC) members, fishermen, farmers, officials of Bangladesh Water Development Board (BWDB), Local Government Engineering Department (LGED), local govt. bodies and other stakeholders. Thus, the community wanted the silted canals/beels to be re-excavated. To begin this process a local committee was formed in different intervention areas. The local stakeholders of different levels were incorporated into the committee. Consultation meetings were held before and after the formation of each of the aforementioned committees. Most of the earth cutting workers were paid for their services. Men and women, young as well as old, were actively involved in the re-excavation. In addition, some of the local work groups were also involved in the earthwork.

There were two types of excavation suggested by the communities. One type is suggested with a view to restore the fish migration channels. The other type was suggested for establishing fish sanctuary and conservation sites by excavating beel bottom. So far 6.63 acres of canals and beels has been re-excavated containing an amount of 47126 m³ earthworks which estimated an amount of Tk.15,55,490 in the Padma-Jamuna and Brahmaputra-Shitalakshya floodplain. Therefore the average cost of re-excavation was Tk 33.00/m³ in these sites. On the other hand, 7.59 acres of degrade canal, beel and kua has been re-excavated which is estimated to be 59,512 m³ earthworks in the Chanda beel and Kadambari beel under Madhumati floodplain. So, the average cost of re-excavation was Tk 39.51/m³ in these sites.
The major effect of re-excavation on the local socio-economic situation has been evident in an increase of the agricultural land availability for seasonal crops, which, in turn, has enhanced food security as well as employment opportunity for the locals. The re-excavated canals have got back their erstwhile connectivity and biological productivity which had been lost due to siltation and other anthropogenic pressures. The project opened the original migratory routes of fish and other organisms and maintained some micro-sanctuaries essential in maintaining the proper functioning of the local ecosystem. These excavations has not only increased and facilitated normal flow of water in canal but also increased livelihood opportunity, increased and conserved aquatic biodiversity, ensured better agricultural production and eased up water transportations. The local communities have been managing the re-excavated ecosystems based on ensuring equal access and benefit to the community people.

Ainun Nishat
Dhaka
Country Representative
November 2005
IUCN Bangladesh Country Office
This publication is based mostly on the primary information drawn from the project activities implemented during the re-excavation work. The Sustainable Environment Management Programme (SEMP) consisted in multidisciplinary and participatory project activities and it involved many communities across the country, both in the haors and the floodplains during implementing the activities relevant to re-excavation. Our sincere thanks go to the farmers, fishermen, labourers, and volunteers from different villages of the project areas, who had been actively involved in the SEMP ecosystem restoration efforts. Their active involvement and collaboration made it effective while identifying the causes of wetland degradation, and finding the constraints to strategizing and restoration of the degraded canals and beels were undertaken. The communal traditional knowledge contributed greatly to the development of rehabilitation strategies. The untiring efforts of the data and information collection teams working at different project sites are acknowledged with thanks. We appreciate the active assistance provided by Olena Reza, Md. Tofayel Ahmed, Md. Abdul Karim, Md. Idris Hossain Khan and Dulal Roy of BCAS during the data collection and information gathering activities.

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Rashiduzzaman Ahmed
Task Manager
Dhaka
SEMP Components 2.2.1/A & B
November 2005
IUCN Bangladesh Country Office
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ABBREVIATIONS, ACRONYMS AND LOCAL TERMS

*Amon* Rice planted before or during the monsoon beginning in July/August and harvested in November

*Aus* Rice planted during March-April and harvested during July-August

*Baar* An oxbow lake or wetland formed in an abandoned arm of a river

*BCAS* Bangladesh Centre for Advanced Studies

*Beel* A saucer-shaped depression, which generally retains water throughout the year

*Bhita* Purposefully raised ground for vegetable cultivation

*Bigha* Unit of land measurement (1 Acre=100 decimals = 3 bigha=43560 sq.ft)

*Boro* Winter rice planted in December-January and harvested before the onset of monsoon in April-May

*BWDB* Bangladesh Water Development Board

*Chora* Narrow perennial stream in hilly areas

*Dangha* Ponds with low embankments all around in Padma-Jamuna floodplains

*Dighi* Big fresh water pond

*Durga Puja* Major religious festival of the Hindus

*Ejma* Common property resources

*FRMC* Floodplain Resource Management Committee

*Ghop* Low-lying floodplain area with some perennial waters

*GoB* Government of Bangladesh

*Haor* A back swamp or bowl-shaped depression located between the natural levees of rivers, which may comprise a number of beels

*HYV* High Yielding Variety

*IRRI* International Rice Research Institute (here HYV of rice developed and introduced by IRRI)

*IUCN* The World Conservation Union or International Union for Conservation of Nature and Natural Resources

*IUCN* IUCN Bangladesh Country Office

*Jalmahal* Section of river, individual or group of beels (depression), or individual pond owned by the government but leased out for fishing. They are also called Jalkar, or revenue earning fishery.

*Jheel* A fresh water marsh

*Kanda* Ridges that are higher than the haor basin but lower than homestead land

*Katha* Pile of branches of trees dipped in the water bodies for attracting fish

*Khal* Bengali term for a drainage channel usually small, sometimes man-made

*Khas* land Public lands and water bodies not registered in the name of any individual or corporate body, regarded by land administration officials as belonging to the state
<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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<tr>
<td>Kheya</td>
<td>Raft made from locally available material, usually used for short distance transportation in waterways</td>
</tr>
<tr>
<td>Kua</td>
<td>Deeper sites in the flat agricultural fields that retain water during the dry months</td>
</tr>
<tr>
<td>LGED</td>
<td>Local Government Engineering Department</td>
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<tr>
<td>Majhi</td>
<td>Boatman</td>
</tr>
<tr>
<td>Mandha</td>
<td>Trough like depression in the floodplain</td>
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<tr>
<td>MBRC</td>
<td>Madaripur Beel Route Canal</td>
</tr>
<tr>
<td>Mela</td>
<td>Village fair</td>
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<tr>
<td>MoEF</td>
<td>Ministry of Environment and Forest</td>
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<tr>
<td>NACOM</td>
<td>Nature Conservation Management</td>
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<tr>
<td>NEMAP</td>
<td>National Environment Management Action Plan</td>
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<tr>
<td>NGO</td>
<td>Non Governmental Organization</td>
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<tr>
<td>NRM</td>
<td>Natural Resource Management</td>
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<tr>
<td>PAPD</td>
<td>Participatory Action Plan Development</td>
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<tr>
<td>PIC</td>
<td>Project Implementation Committee</td>
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<td>PMU</td>
<td>Project Management Unit</td>
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<tr>
<td>PRA</td>
<td>Participatory Rural Appraisal</td>
</tr>
<tr>
<td>Pukur</td>
<td>Freshwater pond created artificially for domestic use and aquaculture</td>
</tr>
<tr>
<td>Robi</td>
<td>Dry season (Oct-Mar) crop</td>
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<tr>
<td>RRA</td>
<td>Rapid Rural Appraisal</td>
</tr>
<tr>
<td>Sardar</td>
<td>Head of labourers</td>
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<tr>
<td>SEMP</td>
<td>Sustainable Environment Management Programme</td>
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<tr>
<td>TAPP</td>
<td>Technical Assistance Project Proposal</td>
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<tr>
<td>Thana</td>
<td>The lowest tier of administration</td>
</tr>
<tr>
<td>UNDP</td>
<td>United Nations Development Programme</td>
</tr>
<tr>
<td>Union</td>
<td>Lowest administrative unit in the rural areas</td>
</tr>
<tr>
<td>Parishad</td>
<td>Least administrative unit in the rural area</td>
</tr>
<tr>
<td>UNO</td>
<td>Upazila Nirbahi Officer-Chief executive of an Upazila (sub-district)</td>
</tr>
<tr>
<td>Upazila</td>
<td>Sub-district</td>
</tr>
<tr>
<td>VEC</td>
<td>Village Environment Committee</td>
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<tr>
<td>VRMC</td>
<td>Village Resource Management Committee</td>
</tr>
<tr>
<td>Waqf</td>
<td>Property vested with religious institutions viz. mosque, religious schools, orphanage etc.</td>
</tr>
<tr>
<td>Zamindar</td>
<td>Landlord. The word 'Zamindar' has for some time been used for a peasant who owns land.</td>
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1. INTRODUCTION

Bangladesh is a land of wetlands where most people are directly or indirectly dependent on the wetland resources. These wetlands are the numerous perennial and seasonal water bodies known locally as haors, beels, jheels, baors, khals, pukurs and dighis. Rivers, canals, beels, jheels and haors are open water bodies. The beels are usually connected to the adjacent rivers by one or more drainage channels, locally known as khals. The beels are usually natural depressions or backlands of old riverbeds; but tectonic subsidence is also regarded as one of the causes of the origin of these basins. Floodplain wetlands are amongst the most fertile and productive ecosystems and important breeding grounds for fisheries.

The floodplain beels are crucially important for the socio-economy of the people of Bangladesh, whose living conditions are inextricably linked to the productivity and sustainability of the floodplains. These beels are also very rich depositories of vegetation, aquatic plants, reeds and algae. In addition, they constitute suitable habitat conditions for a large number of fin-fish, prawns, crabs, turtles, molluscs and birds etc.

The floodplains have lately been most adversely affected by the various impacts of the burgeoning human population. In the Ganges-Brahmaputra floodplains alone, approximately 2.1 million hectares of wetland has been lost to flood control, drainage and irrigation
development. Withdrawal of water at the upstream is causing increased siltation, resulting in major adverse impact on the key wetlands. The beels are being drained and embankments built to save crops from flash floods. Apart from these changes in land use patterns, a decline in fish and migratory birds has also been observed. Swamp forests that once had enjoyed extensive coverage, are now on the verge of extinction (UNEP 2001).

Livelihoods in general, or, the national economy on the other hand, is dependent on the continued productivity of floodplains natural components such as, fish resources, biodiversity and agro-based production systems. Without vigorous and urgent action to prevent further degradation of these natural resources, increase in food production, biodiversity conservation, economic development and environmental development cannot be sustained. Success of any conservation programme ultimately depends upon the users of the resources who are the key to sustainable development and hence need to be fully involved in every implementation activity in which they are beneficiaries.

In order to raise the quality of human life depending on wetlands resource base, the Government launched the Sustainable Environment Management Programme (SEMP). This programme includes the component Community Based Floodplain Resource Management (2.2.1/B), or CBFRM project which is being implemented by IUCN-The World Conservation Union, Bangladesh in association with Bangladesh Centre for Advanced studies (BCAS) and Nature Conservation Management (NACOM). It is envisaged that it will contribute to achieving the overall objective of the National Environment Management Action Plan (NEMAP). Restoration of degraded wetlands was one of the most important objectives of this project. One way to achieve this was to re-excavate the degraded or silted canals and water reservoirs with a view to improving water holding capacity, water flow and connectivity, as appropriate. By re-excavating the blocked canals, migration routes would be opened for aquatic organisms and adverse effects of water-logging would be possible to address. With the active support and involvement of the local communities and the local Government bodies, IUCNB along with BCAS and NACOM have implemented some re-excavation activities at different project sites. To prevent and reverse the trend of wetland degradation, IUCNB initiated and actually implemented crucial re-excavation of degraded canals, beels and kusas with a view to restoring the migratory routes for fishes and other aquatic resources and conserving the depleting biodiversity, in addition to enhancing navigability and drainage in some cases. The initiative is contributing to achieving the SEMP objectives through furthering the process of identification and field validation of key environmental issues of conserving and improving the existing biodiversity, thwarting environmental degradation, promoting sustainable development and raising the quality of human life as an integral part of the overall national strategy of development and environmental uplift.
2. PROJECT SITES

The project sites were so selected as to represent average floodplains of Bangladesh having all their natural attributes. Three major floodplain sites were selected under the IUCNB-SEMP component (2.2.1/B). The site selection criteria for the CBFRM (Community Based Floodplain Resource Management) project were developed basing on the benchmarks delineated in the SEMP Project Support Document (PSD). The specific sites were selected by considering their physical, hydrological, social, biological, management and general criteria.

2.1 Padma-Jamuna Floodplain

The project area in this floodplain includes Arua Union of Shibalya Upazila and Gopinathpur and Kanchanpur Unions of Harirampur Upazila in the district of Manikganj, Bangladesh. The GPS coordinates of Arua (Arua Union Council Office) is latitude 23°45’47” N and longitude 89°51’53” E and area is about 9.62 km². Arua Union has 24 villages and a population of around 13,800, while Gopinathpur Union has nine villages and the area is about 9.75 km² with a population of about 13,000. The area of Kanchanpur Union is about 3.45 km². It has seven villages and a population of around 7,250. All the sites are situated in the lower reaches of the Jamuna basin and at the confluence of the Jamuna, Padma and Ichhamati Rivers (Map 1).

Map 1. The SEMP project sites in the Padma-Jamuna Floodplain, Manikganj. (Source: CNRS, GIS Unit)

The area represents a typical floodplain ecosystem of Bangladesh. In Arua, open agricultural fields are surrounded by villages housing clusters of homesteads. Every year, the open land
experiences both aquatic and terrestrial phases. The most depressed part of Arua Union forms a beel called Arua beel, which retains water perennially. Gopinathpur Union is also characterized by the presence of an extensive wet area, called Gopinathpur beel, which retains water during the dry months, excepting when the water is drained out for cultivation of boro rice in winter. Gopinathpur beel basically represents the old course of the Padma River. All the nine villages of the union surround the beel, except the open southern rim that looks out on the Padma.

The soil of this area is mainly alluvial. Sandy soil is encountered near the riverbank that supports some dry area plants. Traditionally, deepwater amon is grown in most of the areas during the flood season. Since the mid-1960s, high yielding varieties (HYV) of paddy have been introduced to be cultivated extensively now through the dry season. However, in the recent years, there has been a decline in the cultivation of HYV paddies. Other winter crops, including horticultural crops, are also grown extensively in the agricultural fields and homestead gardens. Some horticultural commodities are grown commercially throughout the year in the bhitas.

The area is mainly fed by local rainfall during April-May, subsequent irrigation needs are met by the Ichhamati River and monsoon rainfall. The river water enters the floodplains as early as early June through the connecting canals. Further inundation of the area occurs due to the over-spills from the Padma. The area is deeply flooded with a flooding depth in the range of 0.7-3.3 m in Arua, and 1.3-4 m in Gopinathpur. The peak flooding occurs in late August to early October. The flood water starts receding from mid-October, and by November most of the floodplain area dries out. The central part of Arua beel, covering an approximate area of about 280 acres, retains some water during the dry season. Gopinathpur beel, however, retains more water covering a relatively extensive area (approximately 900 acres).

The main vegetation cover in the project area consists in the homestead gardens; the roadsides as well are green. Rice is the main crop of this area. Agricultural fields harbour varieties of lower plants, mainly the herbs (creeping, floating, emergent, submerged etc.) in the wet season. Permanent water bodies like ponds, along with their margins support a wide range of aquatic plants with diverse life forms.

2.2 Brahmaputra-Shitalakshya Floodplain

Boka and Nali beels are two wetlands which had been selected in this floodplain for carrying out SEMP activities. Boka beel, located in Trishal Upazila of Mymensingh District, is a deeply flooded floodplain system in the Brahmaputra River basin, representing a segment of a dead river (Map 2). The project area consists of six villages, namely Shingrail, Kanthal Hodderbhta and Balarpar villages of Kanthal Union, and Bailor Mathhibari, Bharadoba and Charpara villages of Bailor Union. The intervention area is about 16.49 km², populated by around 11,200 people.
The beel is connected by a canal to a nearly tertiary river, Pagaria, which in turn is connected to the Brahmaputra River. The river acts as both feeder and drainage canal. The beel is also connected to the adjacent floodplains by three feeder canals. The central part of the beel is about 20 acres, which retains water perennially. In the dry season, the water depth is about 0.5 m, but the depth varies from 1 to 4 m in the rainy season. The initial flooding occurs in late May due to local rainfall. Subsequently, flooding is caused by backwater spilled by the river as well as the monsoon rains. The peak flooding occurs in August-September, when the maximum flooded area could measure about 1000 acres. The water recession starts in the middle of October, and major portions of the floodplain surface by November. There are about 30 excavated pits (locally called khada or kanda) now scattered in this area. Many of these hold water in dry season and act as a refuge for resident fish species of the floodplain.

The second project site in the Brahmaputra-Shitalakshya floodplain is Nali beel of Kapasia Upazila, Gazipur District (Map 2). A part of Nali beel has been included in the SEMP, which has five villages, namely Mashak, Fulbaria, Palashpur, Durgapur and Kamra of Durgapur Union. This project area covers an area of about 11.36 km², with a total population of around 12,000.

Nali beel is an extensive network of interconnected individual beels, locally called ghop, representing an extensive low-lying floodplain area in the locality with some perennial waters in individual ghops. The beel is surrounded by a number of hillocks, on which the homesteads are located, consisting in the village lines. The Lakhia River, a tributary of the Brahmaputra, flowing on the east of Durgapur Union is connected to Nali beel by two canals.
Most parts of the beel get drained during the dry months of the year, leaving about 30 acres of the perennial waters. The first seasonal flooding of the beel is caused by local rainfall during April - May. Complete inundation of the floodplain occurs by mid-July due to local rainfall and floodwaters from the Brahmaputra spillovers, by when connection between the river and floodplain is established. Peak flooding here occurs in August - September, and the area experience to a depth of 0.6-2.7 m. The floodwater starts receding between late September and early October.

The soil of Boka beel and Nali beel is alluvial; but in Nali, it is slightly reddish and acidic in nature. The cultivation of the traditional amon variety of rice has fallen out of practice greatly in the recent years; now it is grown only in small plots of land in the peripheries of the floodplain during monsoon. Improved varieties of boro are grown extensively during the pre-monsoon period. Horticulture is practiced more or less widely in the area.

Plant diversity has degraded extensively over the last two to three decades in the area. Wetland trees, like hijal (Barringtonia acutangula) and karoch (Pongamia pinnata), which were once abundant are now almost lost. Homestead vegetations are important in the Boka beel area. Although there is no designated forest in the Nali beel area, some forested areas can be seen dominated by sal (Shorea robusta).

There has been serious degradation in the local biodiversity and in the environment as reflected in the situation in the beels and canals, reduction in natural vegetation, reduced fish production and low occurrence of wildlife and other animals and plants.

2.3. Madhumati Floodplain

Chanda beel (situated between latitude 23°08' and 23°15' N and longitude 89°51' and 89°59' E) is one of the most important beels in the Madhumati River floodplain ecosystem in the south central region of Bangladesh and it is home to most of the villages under the SEMP project (Map 3). It is an important wetland among the inland open water system. The beel lies within the Madaripur-Gopalganj peat basin and is surrounded by a number of important roads on three sides except the east, which is bounded by the Madaripur Beel Route Canal (MBRC). The Kadambari-Chowaribari Beel complex is also situated in the Madaripur-Gopalganj beel depression to the east of MBRC. The project site in these beels covers 31 villages, eight unions (Ujani, Kasalia, Nanikhir, Satpar, Jalirpar, Khalia, Kadambari and Rajoir) three Upazilas (Mukudpur, Gopalganj Sadar and Rajoir) and two districts (Gopalganj and Madaripur).

The water level of the beel is mainly governed by the water level in MBRC, but seasonal rainfall also contributes. The physical and hydrological features and the dynamics of this floodplain differ significantly from those of other wetland ecosystems in the country. Seasonal variations from predominantly aquatic to predominantly terrestrial environment are the results of large annual
fluctuations in river water levels and flooding. During the monsoon (from June to October), the Chanda beel area remains inundated, experiencing water depths up to three metres. The beel is connected with the adjacent MBRC and the adjacent Kumar River by sixteen canals. In the wet season, the beel harbours a number of species of finfish, several species of prawns, bivalve molluscs, gastropod molluscs, frogs, turtles and aquatic snakes. The beel also supports a large variety of aquatic plants. Similar diversity could also be seen in ecologically sensitive Kadambari and Chowaribari beels.

Map 3. Chanda Beel and Kadambari-Chowaribari Beel complex- project sites of the Community Based Floodplain Resource Management Project (SEMP) in the Madhumati Floodplain. (Source: BCAS, GIS Unit)

In October, the water starts receding from the beels, and by December most of the beels become dry, leaving some natural trenches and artificial ditches as perennial water pockets, locally known as kuas are dug by the landowners to allow the fish and prawns take refuge therein while the water recede, for subsequent harvesting. During the dry season, the land is basically used for agriculture, especially for rice cultivation. In some parts of the beel, a layer of peat is found. Low quality peat, which has some commercial value, is available in the beel area. The layer of peat is soft at a depth of 10 feet, but is found petrified in the form of logs at a depth of 30 feet or more. The local people extract it for use as fuel. The ecology is massively influenced by the alternation between aquatic and terrestrial phases (BCAS 1997).
3. RATIONALE

Major siltation is going on along the banks of the various beel route canals and deeper parts of the beel areas. This heavy siltation blocks the canals mouth and subsequently, whole segments of the canals, resulting in reduced natural biological production of many wetland flora and fauna. Unplanned sluice gate/embankment/dam, roads, conversion of land and land use practices cause of water congestion and diversion of the waterways. This water congestion results in the loss of seedbed for transplant amon and boro crops due to inundation caused by early flood that reduces land fertility and habitat quality of different wetland flora and fauna.

Proper functioning of the local ecosystem warranted the re-opening of the original migratory routes of fish and other organisms and the establishment of some micro-sanctuaries. On the other hand, the local communities were longing for these re-excavations in order to increase crop production. The farmers were facing difficulties in growing crops in the appropriate seasons because of stagnant water in the beel as well as unwanted flooding. If the canals, beels, etc. were re-excavated optimally, water could enter and exit in a controlled and beneficial manner. Finally, by allowing the water to enter the beels earlier, the fish could be allowed to start breeding earlier, increasing the fish population all the while.

Besides, during the Participatory Action Plan Development (PAPD), the local stakeholders had pointed at the need for undertaking the re-excavation activities while thrashing out and identifying the problems which warranted redress, as well as the local benefits and environmental improvement that would ensue from such interventions. Kua re-excavation has been found beneficial to increasing natural fish production in the different beel complexes and canals. This re-excavation activity also supports conservation of aquatic flora and fauna species.

To implement this particular intervention, IUCN Bangladesh in association with BCAS and NACOM had taken step to re-excavate canals, beels and kucas in wetlands for improvement of wetland ecosystem at different project sites in the floodplains. Habitat restoration will be further bolstered when people should refrain from effecting total dewatering of the water body and allow aquatic organisms including fish larvae to continue their life cycle therein through the dry season. During monsoon, dispersal of the aquatic resource base from these managed habitats should be enhancing the favourable conditions for sustainability. The following contexts were considered while selecting the project site.

3.1. Socio-economic backdrop

The association of humans and wetlands is ancient, since the first signs of civilization are traced to celebrated wetlands of the world, which provided man with all his basic amenities. In the days of yore, agriculture had been started in the floodplains where river systems sustained
some of the earliest settlements. In the early stages of settlement, fishing and cultivation of deepwater broadcast *amon* and *aus* were the main activities of the wetland people. With the beginning of domestication of cattle, the floodplains provided the grazing grounds for the livestock. Aquatic plants have since been harvested for consumption as food both for human and cattle. Fishing activities had also been started since to sustain communities. To meet one of the basic demands of the local communities in the Madhumati floodplain site, re-excavation activities were undertaken and implemented. Such wetland restoration activities have been envisaged to create and enhance job opportunities, income from agriculture and fisheries and also to effect changed land utilization practices for more productivity.

3.2. Livelihood setting

People of the floodplains depend heavily on the water bodies viz. *beels* and their surroundings and associated natural resources like land, water, fisheries, forestry, crops, trees, poultry, livestock, fuel, food, fodder, wetland vegetation, medicinal plants, etc. In other words, the floodplain is the base for livelihoods of the vast majority of the local inhabitants, especially the poor, the underemployed or unemployed there. Any degradation and loss of access to natural resources debar them from exploiting their livelihood potential. That is, any kind of wetland degradation or natural disasters in the wetland affect the poor and the malnourished most. Re-excavation activities in the floodplains have been aimed at ensuring local food security by enhancing crop production. Access to different kinds of fruit tree plantation, medicinal plants as well as woody plantation activities should also support the local poor’s livelihood. Fish resources have reportedly increased and average protein intake has been enhanced. The locals are now trying to meet their fuel needs, taking advantage of the plantations raised along the banks/rims of the re-excavated ecosystems or subsystems.

3.3. Water Management issues

Since neither the Government nor any local development organisation in the past had considered managing wetlands in an integrated manner, the wetlands in the Madhumati floodplains had been suffering multifarious degradation due to reckless use of wetland resources and loss of water bodies. A major threat to the floodplains in Chanda and Kadambari-Chowaribari *beel* complex is siltation and the resultant loss of perennial water bodies. Many erstwhile perennial wetlands have seasonal due to unabated siltation. The resident communities wanted immediate steps taken to abate siltation. Water resources properly harnessed here can be used for a number of purposes viz. irrigating agricultural crops, supporting fisheries, etc. Water stored during the monsoon in seasonal reservoirs may be utilised in the dry months. Proper management can take care of both early flooding and uncontrolled recession resulting in scarcity. Water logging can be addressed by creating or recreating the necessary connectivity through restoration of canals and natural drainage and thus regulating water flow.
3.4 Biodiversity context

The widespread shrinking of wetlands everywhere is a major manifestation of environmental degradation in Bangladesh. The Padma-Jamuna, Brahmaputra-Shitalakshya and Madhumati floodplains happen to be important wetlands of Bangladesh; the all have unique biodiversity elements, rendering various different rivers, canals and beel complexes rich in floral and faunal biodiversity and associated resources. This rich biodiversity had been fast depleting before the SEMP interventions at the project floodplain sites due to loss of connecting water channels with feeding rivers. Siltation is the major cause for the lost connections and loss of expanse of perennial water bodies. Canals also lost their original layout due to blocked canal mouths and similar lack of maintenance. The rate of siltation of the canals and the kusas inside the wetland areas is alarming. Consequently, both diversity and density of fishes and other aquatic resources are decreasing, resulting in loss of suitable nesting and feeding grounds for water birds, fishes, etc.

The local communities in the project area identified that unabated siltation has been raising the deeper parts of the wetlands (beel beds) and that they regard that as one of the major threats to the sustenance of floodplain habitats and fisheries productivity at the same time. Through increasing the water availability there, aquatic fauna and flora resources should also increase. Alongside, the terrestrial fauna and flora will increase as well. These will result in enhancing the creation and restoration of habitat for wildlife. Native as well as migratory birds will be able to take shelter in the deeper beel areas, where human disturbances will be low.

3.5 Agricultural context

Most inhabitants at the project site are dependent on agriculture and fish resources for their livelihood. The Madhumati floodplains soils are subject to sedimentation composed of clay soils rich in organic matter and the vast flooded areas of these wetlands are covered by crops. But due to lack of proper drainage system and due to accelerating siltation, some parts of the beels in question have been rendered unfit for cultivation, resulting in the loss of agricultural production. The lost fertility of the land at the project site has given rise to a number of environmental problems viz. decline in the growth of aquatic vegetation and increased mortality of fishes. Because of the stagnant water in autumn, robi crops like onion, pulses (kheshari, musuri, tilmug, etc.), ground nut, vegetables (taro, cabbage, cauliflower, small cucumber), and cash crops (tobacco, water melon, bangi, maize, sweet potatoes, turmeric,) etc. are not possible to raise. Again, severe water crisis occurs when the communities need water to irrigate boro rice. To facilitate the paddy and vegetables production and to increase the yields through ensuring smooth supply of water for irrigation, re-excavation of the silted canals, beel beds and kusas is essential. More agricultural lands will be possible to bring under cultivation, when all the re-excavation work necessary is accomplished; diverse agricultural practices should also be possible when such re-excavation will be possible to be undertaken and completed as required.
4. OBJECTIVES

4.1 General objective

The main thrust of re-excavation at the project sites is to rehabilitate and restore the floodplain wetlands through active participation of the local communities, leading to a process of sustainable environment management. The overall objective also includes reversal of the degradation trends of wetland natural resources as well as biodiversity conservation and enhancement.

4.2 Specific objectives

- Open/construct and ensure maintenance of the migratory routes for fish and other aquatic organisms.
- Create a micro-sanctuary with a view to providing shelter for the brood fish stock and other aquatic fauna.
- Ensure optimum water flow between the different canals and beels system for the improvement of wetland ecosystem processes.
- Drain excessive water in order to increase the land availability for seasonal agriculture.
- Ensure water supply for irrigation in the crop field during the dry season.
- Maintain inflow and recession of water when needed seasonally, so that fishery resources should be enhanced.
- Enhance livelihoods support by ensuring increased agricultural yields and fish products.
5. SITE SELECTION FOR RE-EXCAVATION

The project area is characterized by land-water interfaces. This complicates the understanding of the various living forms that use wetlands as habitats, for feeding, roosting, resting, nesting, breeding, niche, protection, etc. These living beings include both terrestrial and aquatic species of plants and animals. Each species, however, depend on another. Also, it is necessary to understand how human activities other than product extraction may affect the floodplain ecosystem as it has to continue with its functions—ecological and economic. Besides, the basic characteristic of the floodplains, meaning its alteration of dry and wet phases, is very much evident from the annual cycle. Increased water flow through river channels as well as rainfall during the monsoon lead to the inundation of the low-lying land areas, rendering vast masses into huge, shallow water bodies. This inundation lasts at least four monsoon months, but due to poor drainage, parts of the flooded area remain under water all the year round. Re-excavation plans developed on the consensus among the community members about fish and aquatic biodiversity conservation, particularly during the dry season when all the water bodies including major sections of the internal canals also are dry out either naturally or due to dewatering for fish. Re-excavation should also ensure practicing sustainable harvesting from the khas, without dewatering, leaving the larvae and fry population to regenerate as well as increase the wetlands natural resources at the project sites.

Project personnel in consultation with the local stakeholders selected the re-excavation sites within the Chanda beel complex located in Mukudpur upazila under the Gopalganj district and Kadambahri-Chowaribari beel complex located in Rajoir upazila under Madaripur district.

Various factors were considered while selecting the canal and beel sites for re-excavation work. The two project intervention areas have significant physical and hydrological characteristics by which they can easily be identified separately. The Chanda beel complex is a part of the Madhumati-Kumar River floodplain, receiving water from the Madhumati river one of the distributary of the Padma River. Impoxtant roads surround the beel complex on three sides of Chanda beel, which now have no enough natural water connections left excepting a few ineffective sluice gates. The rest side of the beel is bounded by the MBRC. The water level in the MBRC actually governs the water level of the Chanda beel.

There are a few natural canals which connect the MBRC and the Chanda beel. Land use survey conducted in the region revealed that there existed 25 such canals, 16 of which are located in Chanda beel complex and the remaining 9 major canals are in Kadambahri-Chowaribari wetlands. Gopalganj and Madaripur divisions of the Bangladesh Water Development Board (BWDB) leased out some of these canals. The major canals were thus leased out till 1994-1995 and afterwards, such leases were stopped and the jalmahals were occupied by the local
fishermen. The Ranapasa is one of the major canal connecting the MBRC and the Chanda beel. It is one of the vital routes through which the monsoon water enters into the beel and recedes after the flooding season is over. But due to various anthropogenic as well as natural causes, the canal had been silted up, losing its connection with the MBRC. The Ranapasa canal is so conveniently sited that the stakeholders concerned decided that if it could be reopened, every part of the beel would be benefited. The 11 km long canal in question originates at Ujani on the Kumar River, runs through the beel and ends near Sanpukuria village on the MBRC. The canal is vital to maintaining the wellbeing of the Chanda beel complex. Due to siltation, a segment of about 2 km in the downstream of the canal had got totally blocked, of which the BWDB with Jalirpar Union Parishad re-excavated 1 km in 1999 but another 1 km remained unaddressed. The above considerations were taken into account by the project personnel and the local communities while selecting the Ranapasa for re-excavation.

On the other hand, the Kadambari-Chowaribari beel complex is a part of adjoining Baghiai beel complex which has linkages with the Arial Kha and other rivers. Since Kadambari -Chowaribari beel is part of another larger wetland system, it does not have any distinctive canals to link with the rivers. However, the Baghiai beel complex has a number of such canals which still serve as the pathways for supplying water, excepting the monsoon months, to the whole beel complex. Kadambari beel complex (sited at a distance of 5 km east of Chanda beel) includes Kadambari beel, Malikuri beel, Vennabari beel and Dodhara beel area.

In both beel complexes, recession of floodwater starts in early of October and by end-December, the entire areas become dry except in some natural deep pockets and in shallow ditches or kuas dug by the landowners. Till recent past, there used to be varieties of fish species found in those wetlands. Many of the species are endemic and some used the beels as transit routes. The beels are also an important habitat for the threatened freshwater turtles and other wildlife. In the Kadambari-Chowaribari beel complex, four degraded/fallow kuas have been re-excavated viz. Dodhara Kua, Vennabari Kua and Kadambari Asram Kuas 1 and 2 in Rajoir upazila of Madaripur district.

5.1 Site selection criteria

Before a site was selected, the project staff visited the area and had discussions with the community leaders, fishermen, and local government officials for their views regarding the implementation of the project in their respective areas. According to the benchmarks established in the TAPP, sites for the component 2.2.1/B should be located in Gopalganj and Madaripur districts (Gopalganj Sadar and Muksudpur Upazilas of Gopalganj district and Rajoir Upazila of Madaripur district).
5.1.1 Physical and hydrological criteria

The site for implementing the component 2.2.1/B is located in a hydrologically and topographically defined depression of floodplain basin having characteristics of floodplain environment with diversity of aquatic and terrestrial habitats in the form of seasonal and perennial beels, canals, secondary rivers and seasonally inundated lands.

The Chanda beel complex is located in the south-eastern part of Muksudpur Upazila of Gopalganj district in the south-central region of Bangladesh. The project area is a part of the Gopalganj peat basin. Peat and muck occur frequently at different depths there. Soils of the comparatively deeper areas of the beels are usually dark grey in colour and clayey in content. However, these areas are covered by silt after each year’s monsoon inundation. The sites raised through silting contain sandy-clay soil, which is very fertile and excellent in drainage. Organic matter in soil is generally high with decomposed and semi-decomposed plant materials.

In the project area, substantial rainfall starts in April. The monthly average rainfall is the highest in June. The rainfall added to the early floodwater fed from the Kumar and the Madhumati rivers, causes the inundation of the beel area. The inundation pattern governs the pattern of households in the beel area. The deeper part of the beel area is similar to haor, where a village is established on a small mound of land. The homestead area is very limited and houses are built as congested clusters. In late September, the water starts receding along with the diminishing rainfall. In the area, the average lowest rainfall occurs in December.

The soil of the Gopinathpur beel area in Manikganj is mainly alluvial. Sandy soil is encountered near the riverbanks that support some xerophytic plants. Traditionally, deepwater amon is grown in most of the areas during the flood season and high yielding varieties of paddy are cultivated extensively during the dry season. In the recent years, however, there has been a decline in the cultivation of the high yielding varieties. Other winter crops including horticultural crops are now grown extensively in the agricultural fields and homestead gardens. Some horticultural commodities are grown commercially throughout the year in bhitas (purposefully raised land masses).

The Gopinathpur beel area is initially fed by local rainfall during April-May, subsequently by the overflowing water from the Ichhamoti river. The river water enters the floodplains in early June through the connecting canals. The further inundation of the area occurs due to the over-spill of the Padma. The area is deep flooded in the range of 4-15ft in Gopinathpur. The water starts receding in mid-October and by end of November, most of the floodplain areas dry out. Gopinathpur beel, however, retains water covering an extensive area, which is sometimes pumped out or used for irrigation and eventually the beel may dry up.
The soil of the Boka beel floodplain is alluvial and hence used extensively for agriculture. Earlier, indigenous deep water cultivated amon varieties used to be cultivated in the entire floodplain, except some perennial water areas. Presently, HYV boro crops are extensively grown during the pre-monsoon period and during the wet season, most of the beel area remains fallow. During this period, improved amon varieties are grown in the peripheral shallow water areas of the floodplain. Some horticultural crops are also grown in the areas attached to the homesteads.

The Boka beel area is flooded by 3-12 feet deep water. The initial flooding occurs there in late May due to local rainfall. Later, towards the close of the flooding season, inundation is caused by backing up effect of the water from the river and the late monsoon rains. The peak flooding occurs during August-September. Recession of water begins in mid-October and the most parts of the floodplain rise above water by November. Only a portion retains some water during the dry season. In addition, there are about 30 excavated pits in the floodplain and many of them hold water during the dry season, which act as a refuge for the resident fish species.

5.1.2 Social criteria

Access to natural resources and wetlands resources in particular for the grassroots people was a crucial consideration in the site selection process. The resource use and land ownership patterns prevalent in the area were considered favourable in terms of the management needs of the project. People from various professions including fishermen, farmers, wood and reed collectors, wildlife harvesters/ hunters, people associated with water transportation, etc. were found within the selected site. The Chanda beel project site covers 16 villages having a population of 16,745 people and 2,919 households. The Kadambari-Chowaribari beel project site is a part of Baghair beel complex in Rajoir upazila under Madarpur district, which has 15 villages and a population of 15,000 (2542 HH).

Many households have more than one income or livelihood strategies. Agriculture and fishing are two common livelihood activities in the floodplain area, with about half the households having farmland of varying sizes. According to the 1991 population census, about 53% of the workforce was involved in agriculture, 24% as agricultural labourers, 8% engaged in business, 6% service holders, 3% full-time fishermen and 6% belonged to other occupational groups in the area. In contrast to these many groups, about 81% of the households were used to catching fish from the beels, khal's and kuas, of which 7 % were full-time, 35 % part-time and 39 % occasional fishers (Quddus, 1994).

The total population of the Gopinathpur Union is about 13,000 and the total number of homesteads and households are 773 and 2,371 respectively. Out of the 2,371 households, 328 (14%) are landless and 846 households have homestead land only and no agricultural land at
all. The majority of the households (84%) belong to the 1-50 decimals landholding group. The households having landed property measuring above 200 decimals were 340 (14%). According to the yearly income of households in Gopinathpur, the income range, number of households and percentage of total households were: 1-5,000, 89, (4%); 5,001-10,000, 299, (13%); 10,001-15,000, 439, (18%); 15,001-20,000, 611, (26%); 20,001-25,000, 280, (12%); and over 25,000, 653, (27%). Typically, the richer people live in the villages Charpara, Dighirchar and Bhatipara. Ten occupational categories for the household heads were identified in the area. Gopinathpur Union is dominated by day-labourers (33%), followed by farmers (28%). A substantial number of household heads were businessmen (19%) though. 6% of the household heads were professional fishermen. A good number of potters (20%) live in Mazampara.

The total population of the Boka beel area is about 11,243 people. The majority of them, that is, 52.44% were male and 47.56%, female. Most of the people were Muslims (99.82%), and the rest were Hindus (0.18%). The average family size was found to be 4-5 members per household.

In the project area, 25.64% of the people (old, dependent and unemployed) have no primary occupation, whereas, 74.36% have some primary occupations. On the other hand, about 45% of the total household members were not involved in any secondary occupation and 17% of the total population of the Boka beel area was involved in agriculture and business as a secondary occupation. Some were found working as day labourers.

The mean annual income of all households was estimated at about Tk. 36,572 (Tk. 3047/month). Although the rich and the middle class families earn around Tk.8,000 to Tk.13,000 /month, on average, the poor and the very poor families earn just below Tk. 2,000/month. This gives an indication regarding the poor economic status of the households. The majority of the households of the Boka beel area depend on agriculture, business, services and day labour for their subsistence. The rest of the income comes from selling of handicrafts, fruits, vegetables, fishing, and other sources. Most of the poor and the very poor depend on daily labour wages, or some small business or agriculture (IUCN Bangladesh 2005).

The distribution of cultivable land shows that the mean cultivable land holding for the households of Boka beel is 92.48 decimals, the solvency wise distribution of cultivable land is the highest in rich groups, followed by the middle class and the lowest is in very poor solvency class. On the other hand, a high percentage (47.14%) of the households (poor and very poor) has no cultivable land of their own. Most of the cultivable land is used for two-crop cultivation in a year and people cultivate only one crop in 40.46% of their cultivable land in a year.

Most of the land, in the project area, falls under the category “land class-1” (Less than .50 acre) area. 25.30% of the households fall into the landless class having less than or equal to 50 decimals of land.
5.1.3 Biological criteria

The sites contain a wide range of aquatic habitats and ecological niches or have potential for restoring habitat for the once rich biodiversity of flora and fauna including invertebrates.

The Madhumati floodplain is enriched with many of the biodiversity communities—both aquatic and terrestrial. There are large varieties of reptiles, birds and mammals. The terrestrial biodiversity is also dependent on the aquatic components. Due to changes in the water systems, these unique biodiversity resources are facing serious depletion lately. To stop and reverse the adverse trend, restoration of water channels and flows has been considered extremely important to undertake. Maintenance of aquatic system is a necessity to conserve the local biodiversity for overall sustainability of the beel ecosystem.

85.66% of the population are aware of the effects of declining trees on the environment, 56.62% know that degradation of wildlife has a great negative impact on the environment, 67.46% know about the drawbacks of using pesticides and 65.80% know about the disadvantages of using chemical fertilizers. On the other hand, only 47.44% of the people have heard about the advantage of using compost fertilizer. The rich are more conscious about the need for and role of plantation and other issues.

Only 37.63% households have planted different types of trees while 35.56% of households have felled trees of different species last year. More than 40% of the households neither planted nor cut any tree last year. The ratio of tree plantation and felling was 1:3. Only 12.31% of the households mentioned that they had hunted or caught wildlife last year, whereas 87.69% said they had not. Analyses with regard to solvency wise wild animal hunting showed that the poor hunted the highest percentage of wild animals. Domestic birds were hunted most commonly for food; also, people hunted other animals for sport. Most of the hunting of the wild animals was carried out in the Bengali month of Agrahayan(October-November) and some in Sravana (July-August).

The overall causes of degradation of natural resources are manifold. Excessive use is the single highest reason for degradation of natural resources in the wetlands of the area. 28% of the resources are declining only due to excessive use. Chemical fertilizer and pesticide use is another important cause of degradation (13%). Other causes that exacerbate degradation included procuring resource for poultry feed (12%), beel dewatering, cultivation, etc. The majority of the respondents (28%) stated that harvesting immature fish is a major cause of degradation of fisheries resources, while 43% mentioned that over-harvesting was the main issue. Most of the respondents mentioned that the local community could play an effective role in conservation while some opined that the fishermen, government officials, NGOs and farmers could also make a difference in this respect (IUCN Bangladesh 2005).
5.1.4 Management/General criteria

Local communities undertook the management of the re-excavated canals. In the beginning of the project activities, IUCN Bangladesh in association with BCAS and NACOM formed local Floodplain Resource Management Committees (FRMCs). The committee members were assembled from the villages adjoining the beel. At Manikganj site, the local UP chairman headed the committee and a member of the local elite headed the Trishal committee. The Gopinathpur FRMC and the local VEC (Village Environment Committee) managed the Bahadurpur canal. The Boka beel FRMC and local VEC (Village Environment Committee) managed the Boka beel canal fish micro sanctuary there.

Apart from the above-mentioned efforts of organizing the community through organizations, awareness among the community was also enhanced. The communities involved demonstrated positive ownership of the project interventions, even those who lived outside the project areas happened to exhibit similar zeal in some cases as it had been on the occasion of the Ranapasa canal re-excavation campaign. More than 5000 people signed an application addressed to the BWDB demanding re-excavation of the canal. Facilitated by the project personnel, the management of all interventions, including re-excavation, has been carried out by the local communities. The willingness of the local community basically was the insurance for the sustainability of the project interventions everywhere.
6. WETLAND SYSTEM IN THE PROJECT AREAS

During the monsoon when the area is generally inundated, fishing activities spread all over the beel. With the recession of water, fishing activities are concentrated in the canals and the kudas, as well as around the homesteads. These then turn into lucrative and important fishing grounds, having a heavy concentration of fish.

6.1 General description of rivers, canals and kudas in the project area

Chanda beel is partially protected from river flooding. Low earthen roads, however, surround the beel on three sides and the other side is exposed to the Madaripur Beel Route Canal. The Madaripur Beel Route Canal and the Kumar River receive flood waters from the Padma (Ganges) River system. The beel being a very low lying area with elevation varying from 0.61 m (PWD) to 3.66 m (PWD) is inundated totally during the monsoon. The water level inside the beel is mainly governed by the water levels in the beel route canal but seasonal rainfall also contributes to it.

6.1.1 Canals in the beel catchments

There are 25 major canals in the project area, of which 8 major canals connect the beel catchments with the Beel Route Canal (Ranapasa canal, Basudevpur canal, Simakhali canal, Majumdar canal, Rahuthor canal, Hatia canal, Bowser canal and Chokkona canal). Water level of these channels/routes is the lowest in February-March and the highest in August-September. Most of the canals silted and lost its courses. The Beel Route Canal has tidal characteristics, so water flows through the above mentioned canals during high tides and the hydrology of considerable portion of the beel is affected by tidal fluctuations.

There are 7 canals in Gopinathpur beel, which connect the beel with the river. Of them, two canals were connected with the Padma river and the rest are connected with the Ichhamoti River. All the canals got silted and hence there was no connection between the river and the beel.

6.1.2 Beel/Jheel

The area represents a typical floodplain ecosystem of Bangladesh. Gopinathpur is characterized by the presence of an extensive water area called Gopinathpur beel. The beel also retains perennial waters during the dry season and at times, the water is drained out for cultivation of boro crop there during the dry season. The beel basically represents the old course of the Padma river. All the nine villages of the union surround the beel, except the southern part that faces the river Padma. The homesteads are elevated/raised land with dwelling houses that remain flood-free during the wet season.
6.1.3 Kua

A "Kua" is defined as a sallow ditch, dug in the beel or near a homestead which is normally flooded and is deliberately made for harvesting natural fish stock aggregated during the flood season. The average size of a kua in Chanda beel area is about 0.27 acre. The average size of the ponds in the beel, however, was found to be greater in comparison with the kua. In the project area, kua are generally found in the deeper beel areas, canals or in the crop fields, where mostly paddies are grown. On the other hand, ponds are found generally within and around the villages.

Kua dug alongside the homesteads of a village in limited numbers, which are made both for natural fish congregation and stocking for a short period of time. Additionally, kua are also used for domestic purposes when they are located near the homesteads and also for irrigation when they are sited inside paddy fields. Kuas, however, are not commonly used for irrigation.

6.1.4 Other water bodies

There are 41 dangas (open bank ponds) in the Gopinathpur beel, three in Arua beel and two in Vedamara beel of the Padma-Jamuna floodplain site in Manikganj. There are 30 mandas (trough like depressions) in Boka beel of Brahmaputra floodplain in Mymensingh. During the dry season, dangas and mandas are used as water reservoirs, where fishes can breed naturally.
7. APPROACHES

7.1 Organization of people

The project adopted a participatory approach all through the project phases, integrating ecological protection and the need for meeting human needs to strengthen the fundamental connection between economic prosperity and environmental well being in the floodplain environments. Before the re-excavation work was undertaken, the project staff conducted PRA in the project villages. The VRMC members, farmers, fishermen, businessmen, elite, social worker, teacher, NGOs, women’s groups, UP Chairmen and Members, member of Environmental Clubs, resource persons from BWDB of Gopalganj were all involved during the PRA exercise. From the PRA, the pressing problems in the beel area were identified. The participating villagers mentioned that the canals, which used to connect the beel to the rivers, were then silted. They proposed the re-excavation of a canal to revive the lost connection.

The first step of the process was to form a local committee named “Re-excavation Committee” in the intervention areas. The committee was formed with the local stakeholders to ensure smooth implementation of the activity to be undertaken. Local stakeholders of different levels were made members of the committee. Consultation meetings were held before and after the formation of the committee. The committee ensured the activities listed below.

- Conservation and development of degraded water bodies by re-excavation
- Problem identification and finding ways of resolving the same
- Preparation of the re-excavation strategic plan
- Collecting, organizing and managing daily labour and delineating the actual earth cutting work and fixing unit rate for payment of wages
- Ensuring quality of work and volunteering necessary suggestions during and after the implementation of earthwork
7.2 Resource mapping

Mapping activities were carried out in a participatory way considering the prevailing and past land use patterns, again using the PRA methods. *Upazila* base maps were collected from the local LGED office. *Mouza* maps and topographical maps were used for preparing resource maps for specific sites. Sketches were also prepared based on existing land use pattern for a re-excavation site. The natural resources of the intervention areas were mapped and the prevalent and the potential uses of different resources were taken into account, so that the re-excavation could be accomplished appropriately. The maps along with the compiled information were translated into a GIS database.

7.3 Site selection for re-excavation

The sites for re-excavation were selected on the basis of their physical, hydrological and social criteria. The sites were selected by using and applying PRA methods in the villages contiguous to the concerned *beel*. The actual sites were selected through participatory multi-stakeholder consultations. The issues of land ownership, contiguous communities’ resource use patterns and participation of the local stakeholders viz. the VRMC, Vulnerable Group members, Local Government, fishermen, farmers, local elite etc. were treated with high priority. Several canals happen to connect each *beel* to a river in the project area. One canal for each *beel* was selected for re-excavation. To determine which canal would be taken, the project staff had
a number of discussion meetings with the local communities. After the selection of the site, the staff would conduct a feasibility study with assistance from the LGED officials of the concerned upazila and prepare a plan and budget for the activity. Technical input from the BWDB and LGED was also considered during the design of re-excavation sites. Pre-feasibility studies and pre-excavation surveys were conducted at each of the sites. The intervention areas had more or less the same general features characteristic of a floodplain. Each of the intervention areas was surveyed and an outline of the re-excavation was made. The routes of the re-excavated canals were re-aligned, as necessary to ensure better flow and accessibility for the local communities. The local communities' resource use patterns and the prevalent land ownership were always considered in order to ensure local support and participation of the local communities in the activity.

7.4 Deployment of community people and labour

The project mainly depended on the positive motivation and spontaneous involvement of the local communities and used them to the advantage of the development work being carried out. Motivation programmes were organized to encourage the people to work on a voluntary basis. However, most of the workers were paid for their services. Both men and women were actively involved in the re-excavation. Besides, some local work groups particularly, the skilled earth cutting labour were involved in the earthwork. Paid labour, project staff, committee members, local govt. representatives, CBOs and youth volunteers actively participated in the re-excavation activities. The labourers were gathered from the villages adjacent to the respective
excavation sites. For kua re-excavation, paid labour was engaged from the nearby villages to ensure community ownership and also to ensure that they could participate and get some financial benefit from the activity. The total number of labour (man-days) required for each re-excavation was calculated basing on the total volume of earthwork. The committee decided the conditions of work and fixed the unit rates of earth-cutting (cubic meter) following negotiations. Labour maintenance, logistic support, and volunteers, etc. were organized by the village committee. Representatives of the UP e.g. chairmen and members, engineers from BWDB and LGED, Govt. officials and local elite, social workers—all participated and supervised actively, as befitting, through the re-excavation activities. A total of 10-15 work groups (consisting of 15-40 members) were involved at each site. The project staff agreed with the local work groups that they would be paying Tk.35/m³ for the Manikganj site work, Tk.32/m³ at Trishal site and Tk.39.51/m³ for the Gopalganj site re-excavation. The local community members, local government representative and social and religious leaders closely monitored the activities. The sub-assistant engineers of the LGED of the concerned upazila assisted the measurement of the earthwork locally. The labourers and volunteers were provided with pure drinking water by establishing three tube wells at the work sites; a total of 12 tents were pitched for providing the workers with necessary resting place during the activity.

7.5 Earthwork

7.5.1 Padma-Jamuna and Brahmaputra-Shitalakshya floodplains

With the help of the LGED and the local landowners, extensive survey work and measurements were carried out to make blueprints of the re-excavation areas. The earthwork was conducted in a traditional way. People used spades to dig and wicker baskets to dispose of the dug earth on the canal banks. The total area of re-excavation (Table-1) and the expenditure (Table-2) is shown. Locations of the re-excavated canals and beels are shown in annexes 1 and 2. An embankment was made through depositing and compacting the dug earth. After the re-excavation, Bahuruppur canal measured 2,260 m long, 4.5 m wide and 1.9 m deep, whereas the Boka canal was 2,190 m long, 6.5 m wide and 2.1 m deep; the
micro sanctuary of Boka Beel was 190 m long, 12.7 m wide and 2.8 m deep. A total of 14,905.68 m$^3$ of earthwork was done in Bahadurpur canal, 25,489.5 m$^3$ in Boka Beel canal and 6,730.9 m$^3$ in Boka Beel fish micro sanctuary. There were 11 work groups (consisting of 15-45 members) involved in the Bahadurpur canal re-excavation, 12 work groups (consisting of 15-35 members) in Boka Beel canal and three work groups (consisting of 15-40 members). So far, in the Padma-Jamuna and Brahmaputra-Shitalakshya floodplains, 47126 m$^3$ earth works was done by spending an amount of Tk.15,55,490. Therefore, the average cost of re-excavaion was Tk 33.00/m$^3$. Seedlings of indigenous trees were planted along the embankment immediately after the earthwork was completed, so that the embankment would have sufficient protection against erosion and the landscape would become more diversified.

Although adequate time has to elapse after such an activity as this earthwork has been carried out in order to assess the various changes caused by the intervention, yet based on the immediate observations in the field and interviews held with the local people, some obvious positive changes occurring have been recorded and discussed in section 9 of this report.
Table 1: Areas of Re-excavation in the Gopinathpur and Trishal Sites

<table>
<thead>
<tr>
<th>Name of Beel/canal</th>
<th>Location</th>
<th>Re-excavated area</th>
<th>Total earth work (m³)</th>
<th>Total Area (acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Length (m)</td>
<td>Width (m)</td>
<td>Depth (m)</td>
</tr>
<tr>
<td>Bahadurpur canal</td>
<td>Gopinathpur, Harirampur, Manikgonj</td>
<td>2260</td>
<td>4.5</td>
<td>1.9</td>
</tr>
<tr>
<td>Boka beel canal</td>
<td>Singrai, Trishal, Mymensingh</td>
<td>2190</td>
<td>6.5</td>
<td>2.1</td>
</tr>
<tr>
<td>Fallow wetland Boka Beel</td>
<td>Singrai, Trishal, Mymensingh</td>
<td>190</td>
<td>12.7</td>
<td>2.8</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>4640</td>
<td>23.7</td>
<td>6.8</td>
</tr>
</tbody>
</table>

Table 2: Budget and Expenditure of Re-excavation in the Gopinathpur and Trishal Sites

<table>
<thead>
<tr>
<th>Name of Beel/canal</th>
<th>Total Estimated Budget (BDT)</th>
<th>Total Expenditure (BDT)</th>
<th>Total earth work (m³)</th>
<th>Unit Cost (BDT/m³)</th>
<th>Purpose of re-excavation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bahadurpur canal</td>
<td>6,37,795.00</td>
<td>5,26,369.71</td>
<td>14,905.68</td>
<td>35.31</td>
<td>To open migratory route for fishes and aquatic resources</td>
</tr>
<tr>
<td>Boka beel canal</td>
<td>8,34,880.00</td>
<td>8,14,134.63</td>
<td>25,489.5</td>
<td>31.94</td>
<td>To open migratory route for fishes and other aquatic life.</td>
</tr>
<tr>
<td>Fallow wetland Boka Beel</td>
<td>2,14,985.00</td>
<td>2,14,985.00</td>
<td>6,730.90</td>
<td>31.94</td>
<td>Micro sanctuary and brood fish stock</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>6,87,660.00</td>
<td>5,55,489.34</td>
<td>47,126.08</td>
<td>Av=33.06</td>
<td></td>
</tr>
</tbody>
</table>

7.5.2 Madhumati Floodplain

The Ranapasa canal earthwork design work was done and provided by BWDB of Gopalganj Division (Annex-3). The village committees managed and fixed the labour payment and earth cutting rates per unit volume. A total of 16 working teams consisting of 500 labourers were involved in canal re-excavation at this site. Approximately 11,000 man-days were estimated for Ranapasa canal re-excavation, 3,150 for Dodhara Kua, 1,900 for Vennabari, 4,600 for Kadambari Kua-1, 4,300 for Kadambari Kua-2, 600 for Beel Chanda Kua and 1,600 for Patkelbari Kua.

No modern technology was used in cutting of the soil and traditional basket-spade-labour format was followed. Bamboo baskets were used to carry out the dug soil out of the excavation area.
Canal side embankments were made with the dug soil. Now they are used as local roads in dry season. For kua's, the dug soil was used to build their banks all around. The Ranapasa canal earthwork was 822 m long and 15 m wide, followed by Dodhara kua which was 174 m long and 34 m wide, Vennbari Kua's earthwork was 57 m long and 36 m wide, for Kadambari Asram kua-1, earthwork was 228 m long and 24 m wide and the kua-2 was 128 m long and 26 m wide.

In Beel Chanda, the earth work was 35 m long and 18 m wide, and the Patkelbari Kua, 41 m long and 20 m wide. So far, 7.59 acres of degraded canals, beels and kua areas have been re-excavated which is estimated to be 59,512.013 m³ of dug earth in the Chanda and Kadambari Beels under Madhumati floodplain (Table-3). The average cost of re-excavation was Tk 39.51/m³ at these sites. The rate of payment for the earth work in the Madhumati floodplain sites was more than that paid for the the Padma-Jamuna and Brahamaputra-Shitalakshya floodplains. It was observed during the re-excavation that, the earth cutting rates differed from site to site depending on the soil type, labour availability, proximity of the re-excavation site to the local communities’ places of residence, season, etc. Most of the re-excavation work was carried out during the dry season to minimize the cost and maximize labour availability.

Embarkment or banks dressing was done after the earthwork to demonstrate the good practices of earthwork at the local community level. Native species of grasses, wetland plant species, etc. were planted along the banks soon after the re-excavation activities were completed, as a measure to smoothen the sides of the re-excavated site and ensure their sustainability.
<table>
<thead>
<tr>
<th>Name of Kua/canal</th>
<th>Location</th>
<th>Re-excavated area</th>
<th>Total earth work (m³)</th>
<th>Total Area (acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ranapasa Canal</td>
<td>Sanpukuria, Satpar, Muksudpur, Gopalganj</td>
<td>822.04</td>
<td>15.24</td>
<td>3.35</td>
</tr>
<tr>
<td>Dodhara Kua</td>
<td>Dodhara, Amgram, Rajoir, Madaripur</td>
<td>174.65</td>
<td>33.53</td>
<td>1.93</td>
</tr>
<tr>
<td>Beel Chanda Kua</td>
<td>Beel chanda, Jalirpar, Muksudpur, Gopalganj</td>
<td>34.74</td>
<td>17.44</td>
<td>2.77</td>
</tr>
<tr>
<td>Kadambari Asram Kua-1</td>
<td>Dighirpar, Kadambari, Rajoir, Madaripur</td>
<td>228.6</td>
<td>23.78</td>
<td>3.05</td>
</tr>
<tr>
<td>Kadambari Asram Kua-2</td>
<td>Dighirpar, Kadambari, Rajoir, Madaripur</td>
<td>128.32</td>
<td>26.21</td>
<td>2.86</td>
</tr>
<tr>
<td>Vennabari Kua</td>
<td>Vennabari, Amgram, Rajoir, Madaripur</td>
<td>57.30</td>
<td>35.82</td>
<td>2.87</td>
</tr>
<tr>
<td>Patkelbari Kua</td>
<td>Patkelbari, Ujani, Muksudpur, Gopalganj</td>
<td>41.15</td>
<td>20.42</td>
<td>2.75</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>1525.89</td>
<td>172.43</td>
<td>19.58</td>
</tr>
<tr>
<td>Name of Kula canal</td>
<td>Total Estimated Budget (BDT)</td>
<td>Total Expenditure (BDT)</td>
<td>Total earth work (m³)</td>
<td>Unit Cost (BDT/m³)</td>
</tr>
<tr>
<td>--------------------</td>
<td>-----------------------------</td>
<td>------------------------</td>
<td>-----------------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>Ranapasa Canal</td>
<td>9,38,680</td>
<td>9,58,460</td>
<td>2,71,15.70</td>
<td>35.34</td>
</tr>
<tr>
<td>Dodhara Kua</td>
<td>2,644,98</td>
<td>2,76,135</td>
<td>5,651.164</td>
<td>48.85</td>
</tr>
<tr>
<td>Beel Chanda Kua</td>
<td>1,15,000</td>
<td>54,261</td>
<td>1,528.742</td>
<td>35.49</td>
</tr>
<tr>
<td>Kadambari Asram Kua-1</td>
<td>3,75,874</td>
<td>3,96,143</td>
<td>9,877.284</td>
<td>40.10</td>
</tr>
<tr>
<td>Kadambari Asram Kua-2</td>
<td>3,82,657</td>
<td>3,77,287</td>
<td>8,784.679</td>
<td>42.94</td>
</tr>
<tr>
<td>Vennabari Kua</td>
<td>2,44,830</td>
<td>2,06,365</td>
<td>4,693.772</td>
<td>43.96</td>
</tr>
<tr>
<td>Patkelbari Kua</td>
<td>94,000</td>
<td>82,915</td>
<td>1,860.19</td>
<td>44.57</td>
</tr>
<tr>
<td>Total</td>
<td>24,15,539</td>
<td>23,51,566</td>
<td>59,512.013</td>
<td>(Av) 39.51</td>
</tr>
</tbody>
</table>

*Chital (Notopoterus chitala), Foli (Notopoterus notopterus), Magur (Clarius batrochus)*
7.6. Technical support and supervision
Supervision of earthwork was carried out by IUCN recruited consultants from the LGED and BWDB. Continuous supervision was also provided by the engineers from BWDB and LGED of respective upazilas. Two persons from each community having experience of earthwork were appointed on a temporary basis for the duration of the earthwork to maintain day-to-day earthwork measurement, labour statement, logistics and groundwork supervision. IUCN Task Manager, BCAS and NACOM project staff and knowledgeable persons from the communities kept an eye on the progress of the earthwork continuously.

7.7. Measurement finalization
Pre-excavation survey of the selected sites was carried out by consultants and the data were recorded in the measurement book. Bamboo poles (painted red) were posted in the demarcated sections to facilitate the measurement of earthwork volume after excavation. Soon after completion of the earthwork, the consultants revisited the excavation sites and took final measurement of the dug area. Comparing the post-excavation data with the pre-excavation survey records provided the project team with the actual measurement of earthwork done.

7.8. Development work after earthwork
Some development activities have been carried out on the raised banks of the canals made through deposition of the excavated soil. A dolphin watch tower has been erected at the confluence of the Ranapasa canal and the MBRC. This has now become a place for outings and recreation both for the local community people and visitors. Apart from this, some native plant nurseries, medicinal plants and vegetable gardening plots were established at different sites along the excavated canals and kusus. Strip plantations using native species were initiated along with grasses were grafted along the banks of different canals to combat soil erosion.

Fish, birds and wildlife conservation sites were also developed at the re-excavated sites.
8. CONFLICT RESOLUTION

To resolve various conflicts during re-excavation, series of village level meetings were conducted. In the meetings, all the community members were informed that they could participate and contribute as best as they could to the implementation of the project.

In the beginning, everybody had said 'yes' to the proposal of the dug soil deposition on the lands contiguous to the sites, but subsequently, as the work progressed, the owners of those lands sited near the site opposed the decision. Overwhelmingly pressurised and requested by other villagers, however, the landowners finally allowed soil deposition in their lands. Also, in the presence of the concerned UP Chairman of relevant sites and the villagers, the occupants of the lands adjacent to the sites as well as the encroachers of the wetlands agreed to give up the lands they had been enjoying illegally for re-excavation.

A seven-member management committee has been formed with various stakeholder memberships for deciding on the access and water sharing issues. Water from the re-excavated canals/beels has been decided to be used mostly for irrigating crop fields. To ensure the smooth sharing of water among the community people, the management committee decisions will be binding for all as regards their execution. It is the committee members who decide as to when the canal should be closed or opened, which would prevent any conflicts over water sharing for irrigation.
9. IMPACTS OF RE-EXCAVATION INTERVENTIONS

9.1 Socio-economic

The effect of re-exavation on the socio-economy of the local people seemed paradoxical. Temporary job opportunities had been created in the neighbourhood of the sites as need for agricultural labour increased. The previous wages of agricultural labour was Tk. 50/day and now it is Tk. 80/day. Approximately, three thousand outside labourers are now involved in harvesting IRRI-boro paddies from Chanda Beel areas during March-May in the dry season. The dry season generally is the lean period in the wetlands i.e. money and job scarcity occur then in the floodplain areas. But this story has now changed for areas adjacent to the Ranapasa canal. Due to the increase in agricultural land for seasonal crops, production and yield of agricultural crops have also been increased and hence the overall income of the local people has increased. The increased agricultural land has also increased the scope of jobs for many people in the locality during the lean agricultural period. Local communities, such as, the landless and the poor of the area are engaged in earthwork and dewatering activity as paid labour.

A total of 27,150 man-days were spent in re-exavation activities in Chanda Beel and Kadambari-Chowaribari Beel complexes. Another 25,000 man-days’ work opportunity was created by the re-exavation programme in the Bahdurpur canal and Boka Beel areas. Twenty new villagers’ settlements have been established in and around the Ranapasa canal site as a result of enhanced job opportunities, ensured water source and other livelihoods support all the year round.

At least 200 families from the Madhumati floodplain and 300 fishermen in the Padma-Jamuna floodplain are now getting more benefited from the re-exavation in their livelihood pursuits such as, fish harvesting, fish processing and fish trading within the project areas.

Dodhara, Vennabari, Kadambari, and Sanpukuria vulnerable groups’ members then produced vegetables on the banks of the canals and those of the Kuras. By selling vegetables, they could earn enough to support their family expenses.

9.2 Agriculture

The people living near and around the re-exavation sites were reportedly reaping more benefits from agricultural activities lately. Before the intervention, people had to use pumps to drain the excess water out of the fields for agriculture in the beels, which would cost them about Tk. 50,000 per year to make each of the project sites cultivation worthy. After the re-exavation, people no longer needed pumps, as there was no excess water stagnating the agricultural lands. Thus people could now save an additional expenditure of about Tk. 50,000 straightaway per site per year. Gopinathpur Beel contains a total of 900 acres of agricultural land. Out of that, 60 acres used to be left fallow during some months of the year before the re-exavation of Bahadurpur canal. But after the re-exavation, only 5-10 acres of
land in the deepest part of the beel had now to be left fallow, which was only natural. The total land area under agriculture has also increased as more area is now covered under the current irrigation facilities. As a result, the value of land has increased from Tk. 40,000 to Tk. 60,000 per bigha in the Madhumati floodplain area. In Gopinathpur Beel, about 60 acres of land and in Boka Beel, about 20 acres of land have now become available for seasonal agriculture. Moreover, in Boka Beel, the dug soil retrieved from the canal was used to fill the irregular depressions, which made about 10 acres of land suitable for agriculture.

### Case Study 1: Ranapasa canal re-excavation site

<table>
<thead>
<tr>
<th>Name: Babu Roy, Father’s Name: Late Sharat Roy, Age: 42, Education: Class 5, Occupation: Farmer, village: Sanpukuria, Union: Satpar, Post Office: Uttar Vennabari, upazila and District: Gopalganj. One of the beneficiaries of the Community Based Floodplain Resource Management Project and directly taking benefit from the re-excavation of Ranapasa canal. It has created endless opportunities for us, like a continuous stream of golden eggs from the Ranapasa canal. Duck because crop production increased, fish and fish resources increased, easier crop transportation now, communication developed, job opportunities increased, livelihoods increased, plantation site developed, no more water logging these days, fish sanctuaries established, bird’s havens built, varieties of plants can now flourish, etc. The planted trees also provide shelter and shade during crop harvesting against the hot sunshine; the farmers should be able to take their midday meals sitting beneath the trees. We are grateful to the project and we’ll sustain this for our own good in the future… Babu Roy, Vennabari, Satpar, Gopalganj</th>
</tr>
</thead>
</table>
Babu Roy and his two brothers owned 20 bighas of lands in the areas adjacent to the Ranapasa canal. Before re-excavation of the canal was undertaken, their lands were rendered fallow and no significant farming was done there. Besides, Babu Roy’s neighbour and other landowners in the vicinity of the Ranapasa canal also left their land fallow, as the cost of farming was higher than the product or yield. There was no good system of irrigation and crop transportation in place. The fallow lands dominated by bushes were used as grazing grounds for cows and other livestock. Early flooding and delayed recession of water also posed as major hindrances to cultivation of agricultural crops there. At times, they would attempt cultivation but often lost the harvest due to the onslaught of early floods. The uselessness of the lands had adverse impact on their daily life, education of their children, medical treatment of the family members and other livelihood systems. Lamentingly, Babu Roy informed that they had sold 4 bighas (1.33 acres) of land for only Tk. 60,000.00 (Tk.15,000/bigha) in 1997. But now after the canal re-excavation, the same land was selling at the rate of Tk. 80,000.00 per bigha, which happened just because of the improved irrigation facilities. Now Babu Roy pines for his lost land, which he had thought useless before. With the enhanced facilities, Babu could now cultivate paddies in his remaining 1 bigha of land and plant another 4 bighas with jute, wheat, pulse, mustard, dhoincha and vegetables. Now Babu was able to survive easily with the income of his little remaining landed property, only because the lands were no more fallow. Now he has procured a pump machine to serve the IRRI block of 50 bighas of land and through selling this service, he can earn at least Tk. 20,000 per season. He also observed that till date, a lot of positive changes have in the agricultural sector have taken place in the project area after the SEMP interventions have been put in place viz. production of rice and other crops increased, varieties of crops can be grown, planting and harvesting are possible to accomplish simultaneously, etc. In the fishery sector—fish resources and species increased, brood fish can shelter; fishery resources can migrate between the canal and Chanda Beel areas. Development activities like a dolphin watch tower, native species plantation programme, and development of fish sanctuaries are major environment and livelihood relevant activities, which serve as demonstration activities. To sum up, the once dead Ranapasa canal has, of late, been flowing with green banks lined with trees and habitat/breeding site for birds and animals which are symbols of good life and livelihoods in the Chanda Beel area. |
Vegetables like brinjal, tomato, chili, onion, potato, garlic, cauliflower, okra, cabbage, gourd, wax gourd, teal gourd, aroid, taro, almond, pulse, jute, etc. are now produced in the adjacent areas and the their yields have also increased. Some households these days are earning up to thirty thousand taka net income per year from their respective vegetable gardens alone. However, it is also evident that there has been an increase in the productivity of almost all vegetable varieties after the intervention had ensured sustained water supply in the area.

Multiple agricultural practices (robi crops, paddy and vegetable cultivation) have also increased in the project areas due to the restoration of the degraded canals and beels and enhanced water availability in the areas.

<table>
<thead>
<tr>
<th>Case Study-2: Bahadurpur canal re-excavation at Gopinathpur</th>
</tr>
</thead>
<tbody>
<tr>
<td>Md. Abdul Motin Mollah (43) passed S.S.C, a landowner and businessman, presently Chairman of Gopinathpur Union Parishad. Village- Gopinathpur VATIPARA, Union- Gopinathpur, Post Office- Jhitka, upazila- Harirampur, District- Manikganj. A beneficiary of the SEMP project, directly benefiting from the re-excavation of Bahadurpur canal.</td>
</tr>
</tbody>
</table>

'I have 15 acres of land in Gopinathpur beel, but can cultivate only 8 acres of land due to waterlogging in the beel. I have 4 dangas too (pond with very low embankment) in the beel. My current income from annual fishing stands at approximately Tk. 32,000.00 (Taka Thirty Two Thousand Only). It is a great and enhanced opportunity for me because crop production has increased, fish and fish resources increased, crop transportation easier now, communication facilities enhanced, livelihood opportunities increased, overall development occurred at plantation site, no water logging now, fish sanctuary and bird sanctuary established. The planted trees give us shade under the burning sun in summer, especially during crop harvesting and we can take our midday meal, sitting beneath the trees at ease'.

Md. Abdul Motin Mollah owned 15 acres of lands in the Gopinathpur Beel and also 4 ponds (locally called dangas, individual water bodies in the beel with low embankment) in the beel. Before re-excavation of Bahadurpur canal, most of his lands were lying fallow (8 acres) and no significant cultivation was then possible. Not only Md. Abdul Motin Mollah, his neighbours and other landowners in the vicinity of the Gopinathpur beel too had to leave their land fallow because of water logging. At times, they had taken attempts of draining out the stagnant water by using pumps, but that would be exorbitantly expensive. Both early floods and late recession of the flood water posed major threats to cultivation there, which impacted their daily life, children's education, medical treatment and others livelihood systems adversely. Md. Abdul Motin Mollah happily informed that he was then cultivating all his lands in Gopinathpur beel, enjoying maximum rice yields. Before the intervention, he had spent Tk. 30,000.00 (Thirty Thousand) for drainage of water, which was in vain and after the re-excavation of Bahadurpur canal, he didn't have to spend a single taka for the purpose, but profited all the same, thanks to SEMP, Mollah added with gratitude. He could then plant his 15 acres of land with rice and still some could be used for onion cultivation. Before the re-excavation of Bahadurpur canal, fishing activities carried out in his 4 ponds had brought only Tk. 32,000.00 (Taka Thirty Two Thousand) per year, but after the re-excavation, with effect from 2003 the same fishing brought him Tk. 48,000.00 (Taka Forty-Eight Thousand) annually. He reiterated that since the re-excavation work had been accomplished in 2003, a number of positive changes had occurred at the site, viz. production of rice and other crops increased, fish resources and species also increased; brood fishes could find shelter, fishes could migrate from the river to the beel areas and like. Also, development of fish sanctuary was accomplished as one of the major environment and livelihood activities and the community people all around could learn positive and replicable lessons from such activities, Mollah concluded.
9.3 Biodiversity and aquatic habitats

Re-excavation has positively influenced the restoration and conservation of the local ecosystem and biodiversity. Originally, there were a number of canals connecting the beels with the local rivers. Many fish and aquatic organisms used to migrate through these canals those days. The re-excavention reopened the silted migration routes for these organisms. The micro-sanctuary served as a shelter for brood fish and other organisms, especially in the lean season and the dry months. Moreover, the plantation raised along the embankments helped enhance diversity in the landscape.

In the re-excavated canal areas designated as ‘sanctuary’ by the local conservation committees, nobody was to harvest any resources as these were supposed to be protected areas. This resulted in effecting positive and overall improvement in the wetland ecosystem as well as its aquatic and terrestrial biodiversity. As the early monsoon water enters into the beel system, a number of local species can easily breed as well as rehabilitate in the beel environment. After the Ranapasha canal was dug again, three local fish species viz. Sarpunti (Puntius sarana), Elang (Rasbora elanga) and Bamosh (Ophistertnon bengalensis), which had become quite scarce have again been found in Chanda beel area after a long period. Enhancing fish production and species restoration—both objectives have been measurably realised after the re-excavention interventions.

**Case study-3: Re-excavation of Bahadapur canal**


'It is great time for us, because we have perceived of a number of advancements in crop production, fish and fishery resources increased, livelihood opportunities increased, plantations raised, no water logging anywhere, and fish and bird sanctuaries have been established. Under the planted trees, we can take shelter in the crop harvesting season, protect ourselves against sunshine and can take meal sitting at ease. Laxman Haldar was the owner of only 2 acres of land in the Gopinathpur Beel and 4 beel ponds locally known as dangas, which actually are individual water bodies with low embankments around. His family depends on the income of these ponds. Before re-excavention of Bahadapur canal, a good part of his lands (2 acres) were fallow and no significant cultivation was done. Not only Laxman, but his neighbours who had land in the Gopinathpur Beel also left their land fallow because of water logging. Sometimes the local people took an initiative to drain out the stagnant water by using pumps after incurring such additional expenses, the fallow lands were not rendered fit for cultivation. After the re-excavention of Bahadapur canal, Laxman cultivated fish in his land beside the ponds. Prior to reexcavention, he used to earn Tk. 40,000.00 (Forty Thousand) per year from fishing in his ponds. But after the intervention was implemented, his earnings from the same have increased to Tk. 60,000.00 (Sixty Thousand) per year. He further informed that since canal reexcavention, a lot of positive changes had been evident in the Gopinathpur Beel area viz. production of rice and other crops increased, fish resources and species also increased, brood fish could take shelter, fish could migrate from the river to Beel areas etc. Development of fish sanctuary has constituted a major environment friendly livelihood promotion demonstration, from then like of which the local communities could learn a lot and prosper as well.
The re-excavated canal linked the Chanda Beel and MBRC and also revived water flow through a number of other interconnected canals viz. the Bowser khal, Simakhali khal, and Patkelbari khal in the Madhumati floodplain.

In the Padma-Jamuna floodplain, the local fishermen informed that before the re-excavation of Bahadurpur canal, a pond there could be rented out for Tk 5,000.00 - 8,000.00 per year, but after the intervention was implemented, the same rental increased to Tk. 8,000.00 - 10,000.00 per year/pond.

Due to the implementation of the plantation activities along the embankments of the re-excavated canals, the local biodiversity of birds and other wildlife has also been enhanced, the tree-bush providing the most needed habitat or shelter to for the wildlife. The populations of dolphin, kuchia (Cuchia cuchia), turtle, and snail have been increasing in the Ranapasa canal area.

On the other hand, the re-excavated kusas support shelter for the wildlife fauna and aquatic flora, turtles, birds and other species. Reptiles, amphibians and resident water birds including the migratory ones have also increased in this area. Wildlife and aquatic flora species are also conserved by the respective conservation committees.

9.4 Local transportation

Even today, when motorways are being built everywhere in the country, the waterways remain the most friendly, useful and cheapest means of transportation in rural Bangladesh. Therefore, the re-excavated canals at the SEMP sites are now used as routes for boats. People living in and around the wetlands rely heavily on water transports and in monsoon months, plying boats is an important source of transportation of fuelwood in the Ranapasha canal.
employment for the local residents. Both professional majhis (boatmen) and many non-
traditional seasonal boatmen join hands providing transportation service by boat in the
rainy season for their daily income. After re-excavation, a local kheya (short distance
transportation by boat) service started plying from Ranapasa canal mouth to Battala,
providing easy transportation of people deep into the beel area. Passengers can travel
through the Ranapasa canal both by country boat as well as engine boats and agricultural
products viz. rice, vegetables, pulse etc. are also thus transported. Goods also transported
from one village in the beel to another. Fishing boats can freely move in and around the
Chanda Beel area. Collectors of cattle feed, shapla-shaluk (lotus and lily) and other natural
resources also use the renewed, that is, reopened waterway.

In the month of Kartik (October-November), 300-400 boats ply through the Ranapasa canal
everyday. During the Durga Puja, 400-500 boats ply through the canal daily. In the monsoon
months, about 50 trawlers and 200-250 small country boats ply daily through this canal. In the
dry season, 20-50 small boats make up and down trips into the beel areas. In the paddy
harvesting season again, over 100 boats transport paddies through this canal waterway
everyday.

When the Ranapasa canal had remained silted for years, during the harvest, farmers used to cut
only the upper part of the paddy stalks to reduce their transportation hazards. Now a minimum
Tk. 1 lac is saved from harvesting the paddy straw, because now the farmers are able to carry
the whole loads home through the Ranapasa canal waterway system.

9.5 Food security
The production and yield of rice paddies per bigha land has increased due to the enhanced
irrigation facilities because of the canal excavation. Reviving the connectivity of the canal
between the Chanda Beel and the MBRC took care of the water logging problem and brought
more agricultural lands under cultivation. Thus both the production of rice and vegetables
increased considerably. Moreover, the fishery resources also increased, which is supposed to
meet the protein needs of the local populations. More rice production and fish resources
should result in augmenting the food security in the project area.

9.6 Aesthetic and recreational aspects
The embankments of the re-excavated canals were planted with indigenous trees. The canals
also have recreational values. People love to bathe and swim in these canals and children like
to play around and cavort in the water. The families living near the canals use their water all
the year round extensively in the Chanda, Kadambari, Arua and Gopinathpur Beel areas.
A dolphin watch tower has been erected at the mouth of the Ranapasa canal, which enjoys fond attention of the neighbouring communities as well as the visitors.

The canal banks bearing plantations of native species have made the surroundings look like nature parks and picnic spots. In Gopalganj, the local communities from Beel Chanda and Sanpukuria villages have been reported to be organising and enjoying their picnics at the Ranapasa canal site. Besides, students, other professional groups and CBOs’ members visit the canal site and the watch tower regularly for dolphin watching and recreation. For example, a local environment club Gangshalik based at Baniarchar, Jalirpar of Muksudpur upazila under Gopalganj district has reportedly spent a day at the popular dolphin tower site by organising discussions, carrying out plantation and other biodiversity conservation activities.

The re-excavated Kadambari Asram Kua boundaries were planted with wetland adapted species. The neighbouring community people including students have been known to be spending time there in the afternoon. Kadambari Asram is a locally celebrated religious place visited by the Hindu communities regularly; more than 100,000 people from home and abroad visit the Asram during the annual Mela (village fair held during a religious congregation) period, sharing the natural beauty and the joyous environment recreated through the re-excavated and developed conservation kua sites.
10. MANAGEMENT SYSTEM

The local communities are now managing the re-excavated canals, beels and kuas. In the beginning of the project activities, IUCN Bangladesh in association with BCAS and NACOM formed local Floodplain Resource Management Committees (FRMC). The committee members were recruited from the villages contiguous to the canals and beels. The committee was headed by the local UP Chairman at Manikganj site and the members of the local elite headed the Trishal and Chanda beel committees respectively. The Gopinathpur FRMC and the local VEC managed the Bahadurpur canal. The Boka Beel FRMC and the local VEC managed the Boka Beel canal fish micro-sanctuary of Boka Beel. The Ranapasa canal is maintained by Ranapasa Conservation Management Committee (VRMC of Sanpukuria, Beel Chanda and Kaligram) and other conservation sites are managed by respective conservation committees.

In Chanda and Kadambari-Chowaribari beel complexes, the communities have been managing the re-excavated areas with financial support from the project. The communities have taken care of the sanctuaries there. A total of 7 fish sanctuaries were established in 7 re-excavated water bodies. Brush piling and bamboo piling have been provided in those sanctuaries in late monsoon and guards engaged to keep constant watch over the resources through the dry season. The respective VRMCs have been monitoring those fish sanctuaries. After phasing out of the project, the village committee will manage the re-excavated areas as well as the fish sanctuaries with the help of their own generated fund. The fish sanctuaries will always be kept undisturbed for enabling mother fishes to gather there for breeding.
11. CONCLUSION AND RECOMMENDATIONS

11.1 Conclusion

The re-excavation activities implemented by the IUCN Bangladesh in association with NACOM and BCAS at the Padma-Jamuna, Brahmaputra-Shitalakshya and Madhumati floodplain sites will undoubtedly pave the way for establishing rational conservation practices, management and utilization of all the wetland resources of the project sites.

The different case studies under this programme indicate that the re-excavation of connecting canals can prove to be very useful for the restoration of aquatic biodiversity while effecting uplift in the socio-economic status of the local communities. However, it is crucial that the needs of the local communities are taken into account before undertaking a project of this dimension.

Restoration and conservation of wetlands biodiversity through re-excavation of degraded sites and migration routes have generated a great deal of interest amongst the local communities, as it involved them closely in its planning, design, implementation and management, playing pioneering role in utilising the local natural wetland resources in a sustainable manner. Communities, particularly, the fishers and farmers have heartily accepted these kinds of activities as helpful for enhancing their livelihood systems.

In the project areas, diverse habitats and the flora and fauna that inhabit them are the most precious resources. Their values are now increasingly being recognised by the people of the project areas who have embarked on implementing strenuous conservation efforts in their respective areas.

In the wetlands where there was no previous connecting canal, no non-migratory aquatic organisms, and no dependence on seasonal agriculture, re-excavation just for connecting canals might not be successful in ecosystem rejuvenation.

11.2 Recommendations

- More degraded wetland should be considered for restoration for the development of wetland ecosystem.

- Re-excavation Management Committee (RMC) membership should be such as would have the capacity to ensure the sustainability of the re-excavation intervention through providing technical as well as financial support.

- Replicate demonstration activities in the wetlands such as Bara Beel, Baghiaar Beel, Mollar Beel and Chamta Beel, which are contiguous to the SEMP project sites.
- Regular maintenance is needed for the excavated wetlands.
- Conservation committees must be strengthened so as to render them capable of working in a sustainable manner.
- Liaising and networking with the local govt. and other community institutions with a view to building strong and effective alliances.
- Research work, particularly the impact study should be continued and the findings to be disseminated widely for the benefit of other wetlands.
- Continue technical support, monitoring and supervision needed.
- Development and renovation work by the conservation committee to be continued essentially for the sustainability and optimum water flow through the rejuvenated water bodies and migration routes.
- Conservation practices should be so integrated way such as they address pollution, habitat protection, exploitation including hunting, land use management, recreation and other relevant and diverse factors.
- Role of the local Government bodies to be clearly delineated and systematised for sustainability of the executed activities.
- Government institutions e.g. BWDB, DOF, and DAE should undertake joint re-excavation programme of degraded canals and waterbodies for habitat restoration, biodiversity conservation and enhancement of livelihood.
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Annex-2: Map Showing the Re-excavated Areas in the Brahmaputra Floodplain site, Trishal, Mymensingh
Annex-3: Map Showing the Re-excavated Areas in the Madhumati Floodplain site, Gopalganj- Madaripur