BANDUDELTAS
BDP 2100

Delta Atelier
Hot spot Haor

Sunamganj 19-20 May 2015

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1. Introduction

On 19-20 May a Delta Atelier was organized in the Haor region. An interactive workshop was held with approximately 70 participants/representatives of the region, followed by a field visit and various interviews with local people (villagers and farmers). The aim of the atelier is to learn from the local people. The BDP2100 project intends to identify a strategy for the Haor region. This strategy aims to achieve the Delta Goals (see box 1). During the ateliers, the people from the region are invited to share their knowledge on key issues and the potential solutions. This report presents the outcome of the first atelier held in the Haor region. In a second atelier, the focus will be on a smaller area. In this second atelier the potential strategy will be further investigated and tested.

The BDP 2100 Goals

Goal 1:	Ensure safety against water and climate change related disasters
Goal 2:	Ensure water security and efficiency of water usages
Goal 3:	Ensure integrated river systems and estuaries management
Goal 4:	Conserve and preserve wetlands and ecosystems
Goal 5:	Develop effective institutions and equitable governance for intra trans-boundary water resources management
Goal 6:	Achieve functional and optimal use of land and water

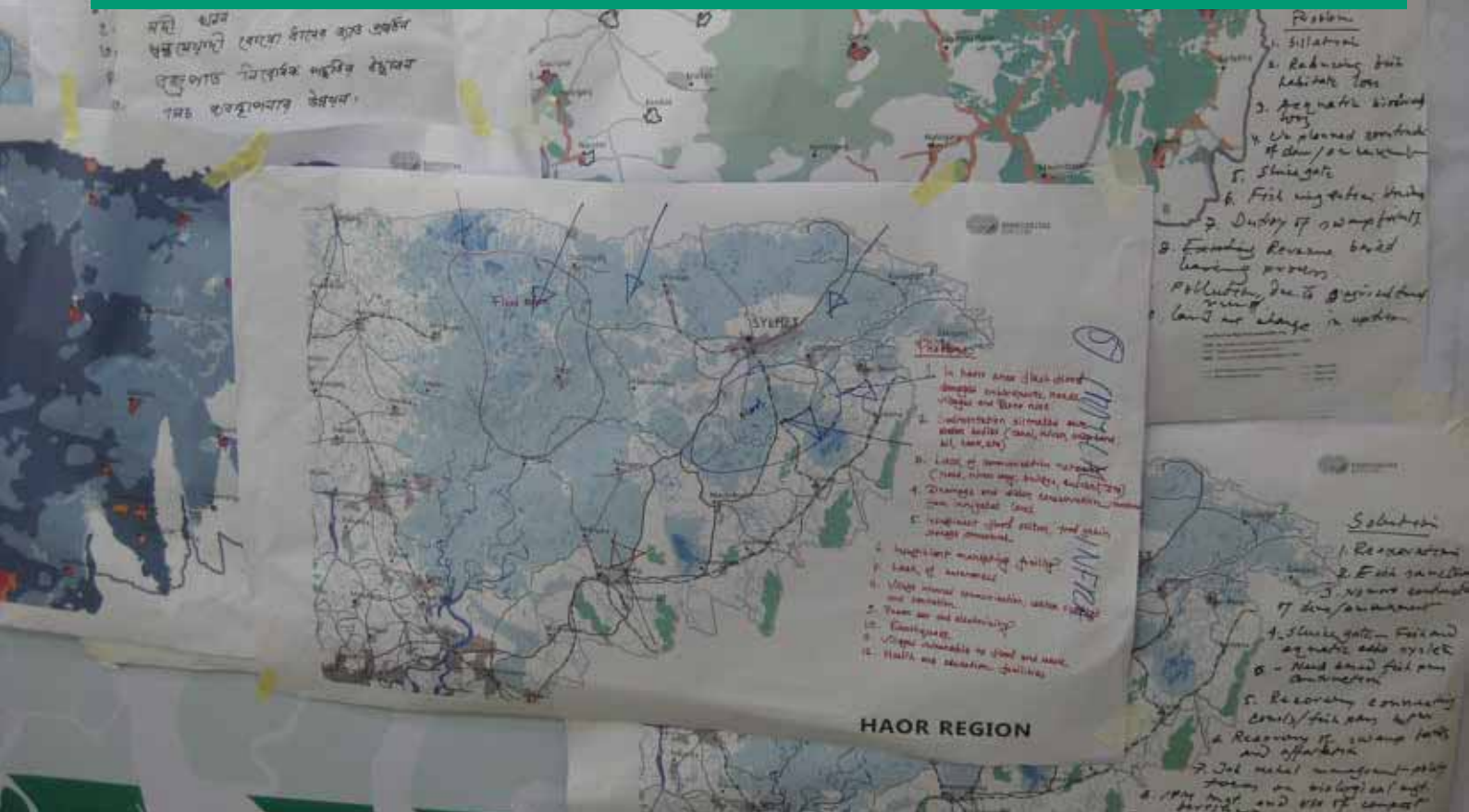


Figure 1: Hakaluki Haor in February 2012

2. The Haor area: a valuable, but complex system

The Haor region, a characteristic region in the northeast of Bangaladesh is appointed as hot spot within the formulation of the Bangladesh Delta Plan (BDP2100). Haors are large bowl-shaped flood plain depressions located mostly in north-eastern region of the country covering about 25% of the entire region. There are altogether 411 haors comprising an area of about 8000 km2 dispersed in the districts of Sunamganj, Sylhet, Moulvibazar, Habigonj, Netrokona & Kishoreganj.

Besides the famous teagardens, spread along the more hilly areas around Sylhet, the main source of income and livelihood depends on the hoars. The hoars are primarily used for agriculture (boro rice) and fishing. Furthermore, the area is important for livestock. The Hoars have a rich biodiversity and are the main source of income in the agricultural economy and livelihoods. The Haors are rich aquatic ecosystems with various aquatic species along with 140 species of fish. About 8000 migratory wild birds visit the area annually.

Thus, the Haor area is a unique area with high biodiversity values and great productivity from both agriculture and fisheries. The Haor area has a strong identity, and the people of the region are proud and share a strong solidarity and connectedness with the Haor region. However, the area is under great pressure.

Figure 2: A Great Egret at Hakaluki Haor

The region is a complex system with a complex network of haors, rivers and streams. The region lies at the base of the riparian foothills in the Indian Mawsynram area, which is known for being one of the wettest regions in the world, with an annual rainfall of around 12.500 mm.

Flash floods are devastating for rice production in the premonsoon months of March and April. The extreme flashy character of the rivers and high rainfall compare to other part of the country in the region causes frequent flash floods in the Haor. Population growth causes unplanned encroachment of rivers, loss of agricultural land and wetland habitat loss.

During the monsoon, extreme flooding causes erosion of embankments and especially landless people in unplanned developments suffer heavily from the consequences. After flooding takes place, water resources and drinking water supplies become polluted leading to outbreaks of diseases such as cholera.

The Haors are connected to the river system, and exchange of water between the rivers and the haors is good for migrating fish and also for navigation. Many people in villages depend on transport by boat. Therefore, water flow in the winter period is essential. Due to low flows and siltation of rivers, many haors become disconnected.

3. Workshop program & field visit

The first session focused on the problem statement, and identifies possible measures and priorities.

Groups were be divided along the primary sectors/ themes:

- Fisheries and ecosystems
- Navigation and river management
- Agriculture, rice and Food Security
- Floods, Flash Floods and Drainage congestion
- (Critical) infrastructure

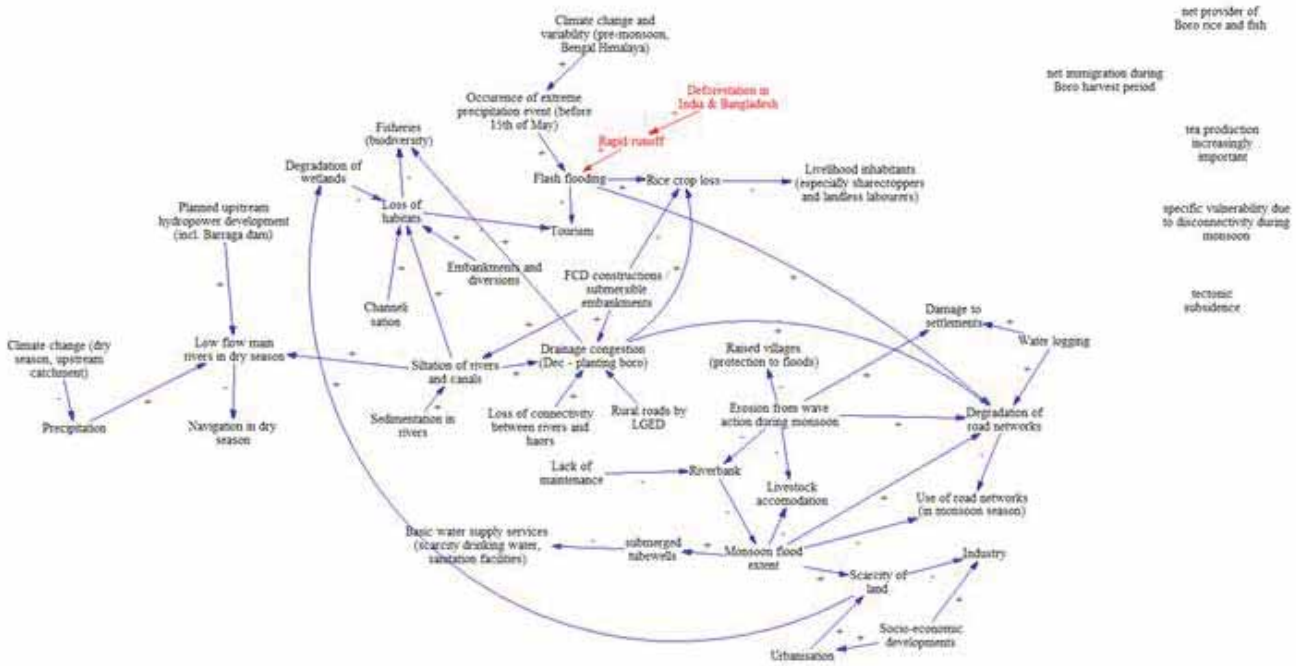
The second session was aimed at designing maps of potential measures . This was supported by 2 touchtables and maps were printed of impacts of floods and droughts.

On the 20th of May 2015 a field visit was hosted by local experts and stakeholders. Interviews were held with villagers and farmers, officials from the BWDB, LEGD and various sites and projects were visited.

The first day a broad participatory meeting provided more in-depth insights in the problems, possible solutions and priorities leading to potential strategies, and reflection at the baseline studies and problem statement. Nearly 60 local experts and stakeholders worked in groups closely together, sharing knowledge and ideas...

The second day a field visit gave insight in the lives of the people of the Haor area, their unprecedented adaptive capacity to cope with floods and natural disasters.

This report on the Delta Atelier combines all input given in a framework of pressure needs, possible solutions and reflection towards clear priorities and strategies.



Preliminary Problem statement, formulated by the BDP 2100 team:

- Flash floods (most devastating before 15th of May)
- Siltation in rivers > navigation problems
- Riverbank erosion
- Subsidence due to lack of sediment and tectonic
- Impacts of monsoon floods especially in the aftermath (outbreaks of cholera, damage to property and infrastructure)
- Drainage congestion > delayed planting of boro
- Land use conflict between fisheries – boro rice in transitional period
- Seasonal migration of landless agricultural workers
- Poor area
- Loss of agricultural land
- Wetland habitat loss

4. Results of the Atelier Haor

The first part of the session focused on the key issues. An overview of the problem statement was presented by the BDP2100 team, based on the baseline studies. Box 2 summarized the problem statement.

These problems are interconnected. The BDP2100 team has developed a causal loop diagram illustrating how the issues in the region are interlinked.

Table 1, on the next page, summarizes the issues and solutions as forwarded and discussed in the various thematic groups.

Figure 2: River flood and flash flood affected areas (BDP2100 project)

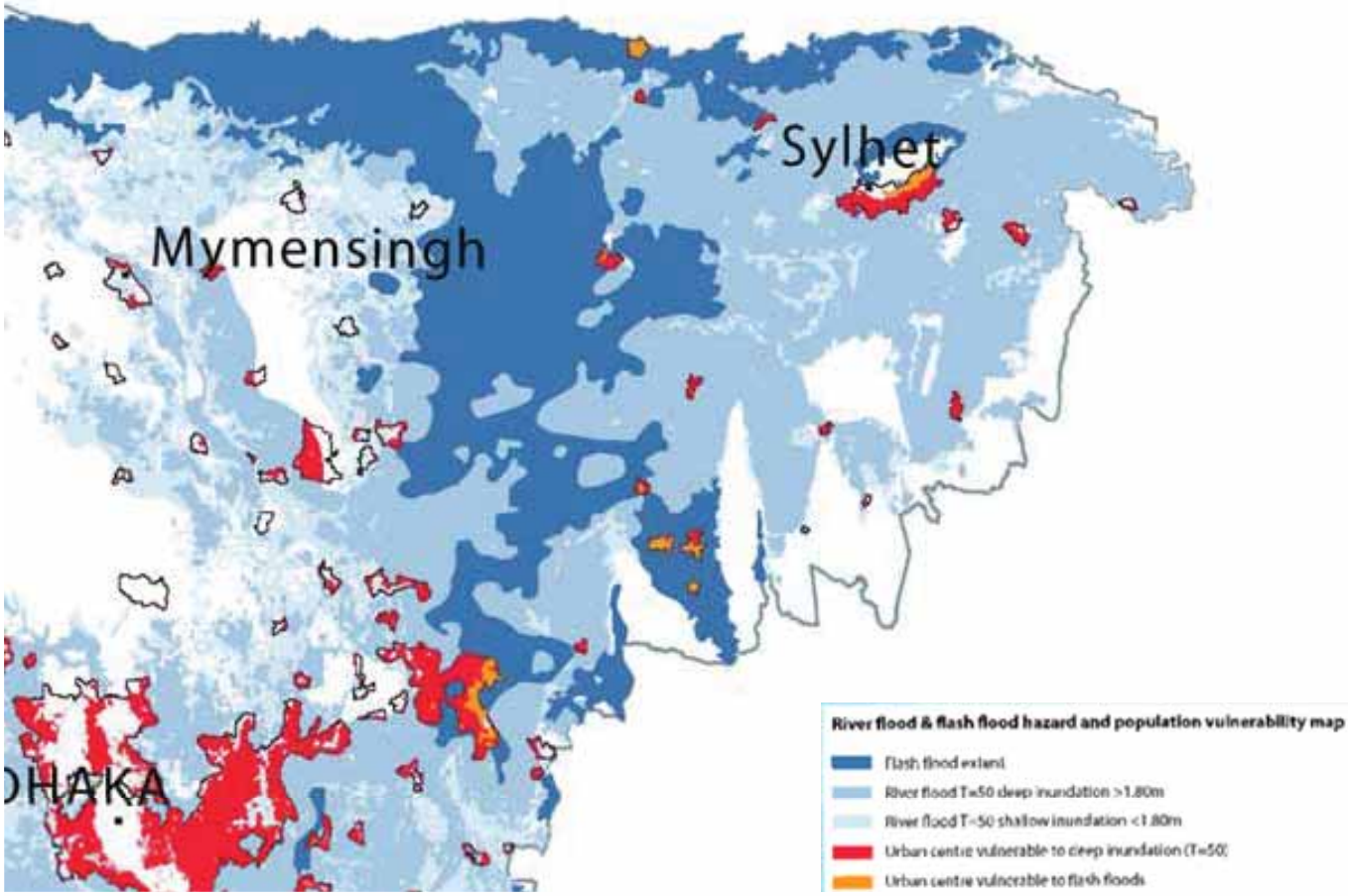
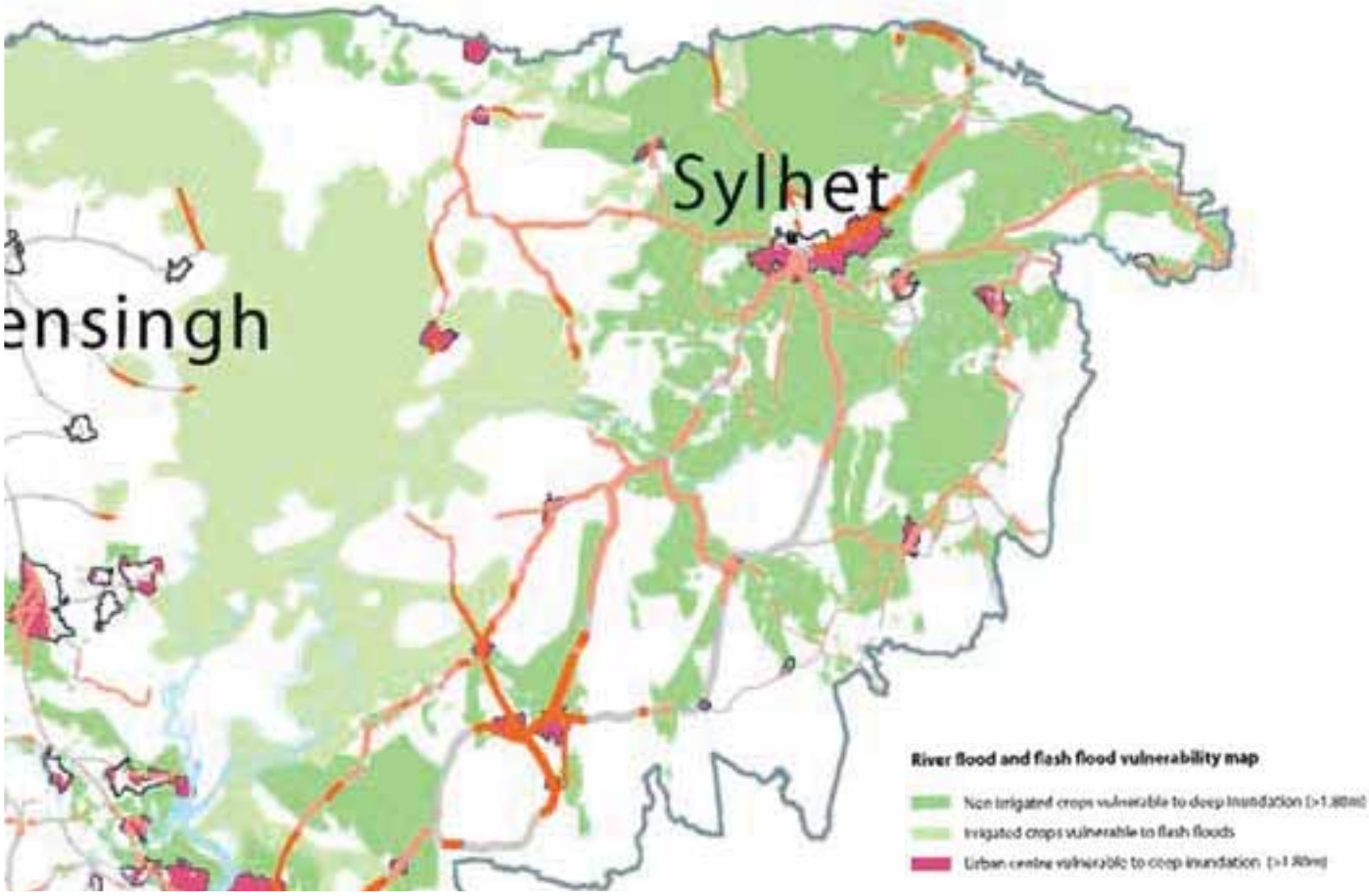


Figure 3: Crops vulnerable to flash floods and deep inundation (BDP2100 project)



Issues/problems	Solutions
Flash floods (most devastating before 15th of May)	Submersible embankments (inflatable dams, embankments)
Siltation in rivers > navigation problems	Dredging
Riverbank erosion, land loss	Riverbank protection (hard & geotextile)
Relocation of unplanned developments in river beds	
Subsidence	Land elevation with dredging material
Extreme monsoon floods, submerged tube wells	Shelters
Village protection walls	
Drainage congestion	Improved drainage
Canals	
Land use conflict between fisheries – boro rice in transitional period	
Seasonal migration of landless agricultural workers	
Loss of agricultural land/scarcity of food	
Lack of area for drying of rice harvest	Land for drying
Extreme weather (hailstorm, thunderstorms)	
Wetland habitat loss and wetland degradation	Wetland restoration and protection
Fallow land	
Low water table & stony surface	
Shortage of manpower & technologies	
Low prices of paddy	
Crisis of labour	
Loss of fish habitat	Restore connectivity between rivers and haors
Fish sanctuaries	
Sluice gates	
Uncontrolled and unplanned developments blocking free flow of rivers	Create awareness
Law enforcement	
Upstream land use change	River basin management and coordination
Destroy of swamp forest	Recovery of swam forests
Create awareness	
Law enforcement	
Pollution due to agricultural activities	
Lack of communication and navigation (roads, bridges, siltation of rivers)	Improving road network, water flow in winter season (dams)
Insufficient flood shelters	More flood shelters
Illegal sand extraction	

Figure 5.1: Water flows rapidly from the riparian foothills. A flood wave causes damage to boro fields and embankments

5. Key issues for the Haor region

Based on all the input of the atelier, the field visit and interviews with local villagers and farmers we present a first synthesis and analysis of the results. We identify the key issues, and propose 4 key principles to achieve the delta plan goals. Finally we identify institutional boundary conditions required for the implementation of the principles.
The issues that need to be solved for the haor region are 1) Flash floods; 2) Impacts of extreme flooding; 3) impacts of low flows

5.1. Flash floods

Flash floods are devastating for the boro rice fields, especially in the premonsoon months of March and April. By mid-May the boro has been harvested and therefore the effects of floods are minimal after 15 May. The flash flood causes a surge of sediment-laden water which damages embankments and rice fields and leaves behind a layer of non-fertile sandy sediment (see figure 5.1). The extreme flash floods may be occurring more frequently in the future due to the impacts of climate change. This needs further investigation (research question).

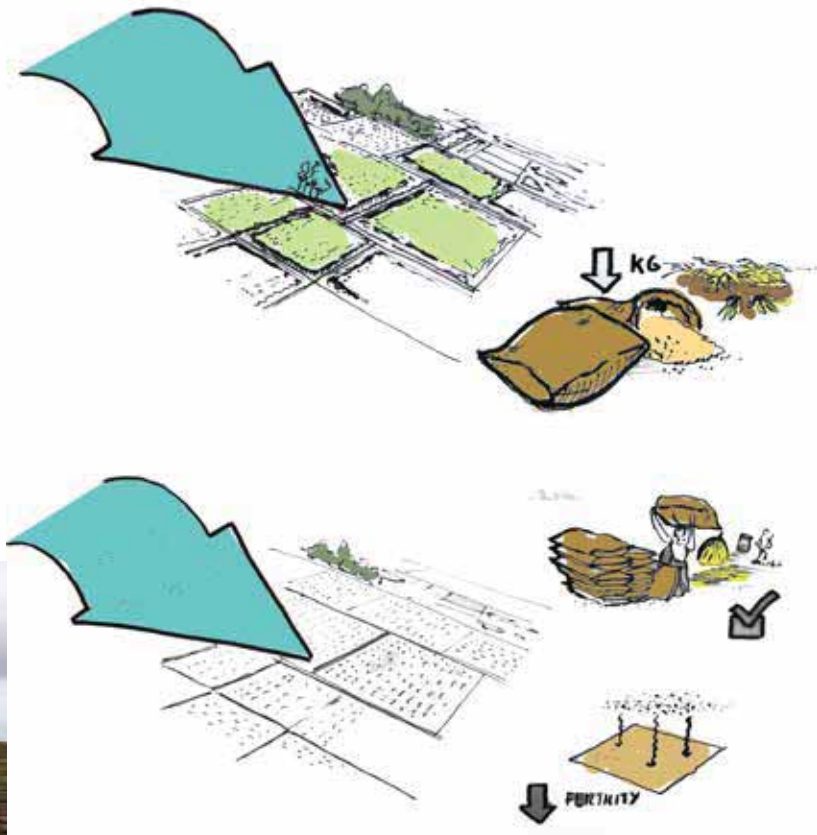
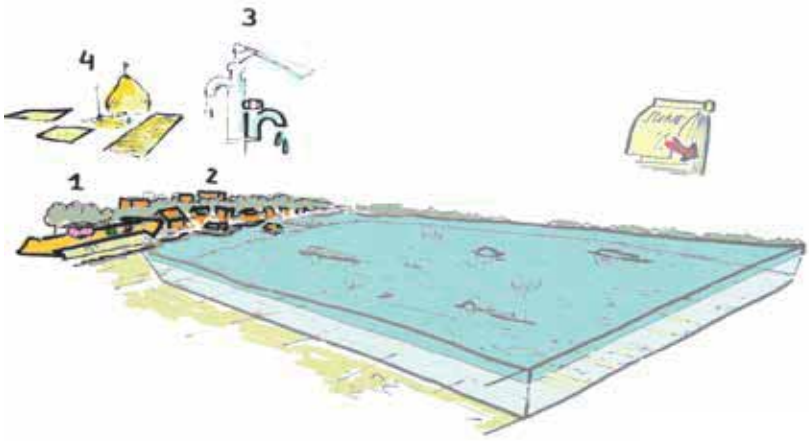


Figure 5.2 Flash flood before harvesting damages or destroys the paddy and decrease or destroy the yield. If flashflood occurs after harvesting, the harvest is safe. Nevertheless the sediment causes negative effects on fertility of the soils.



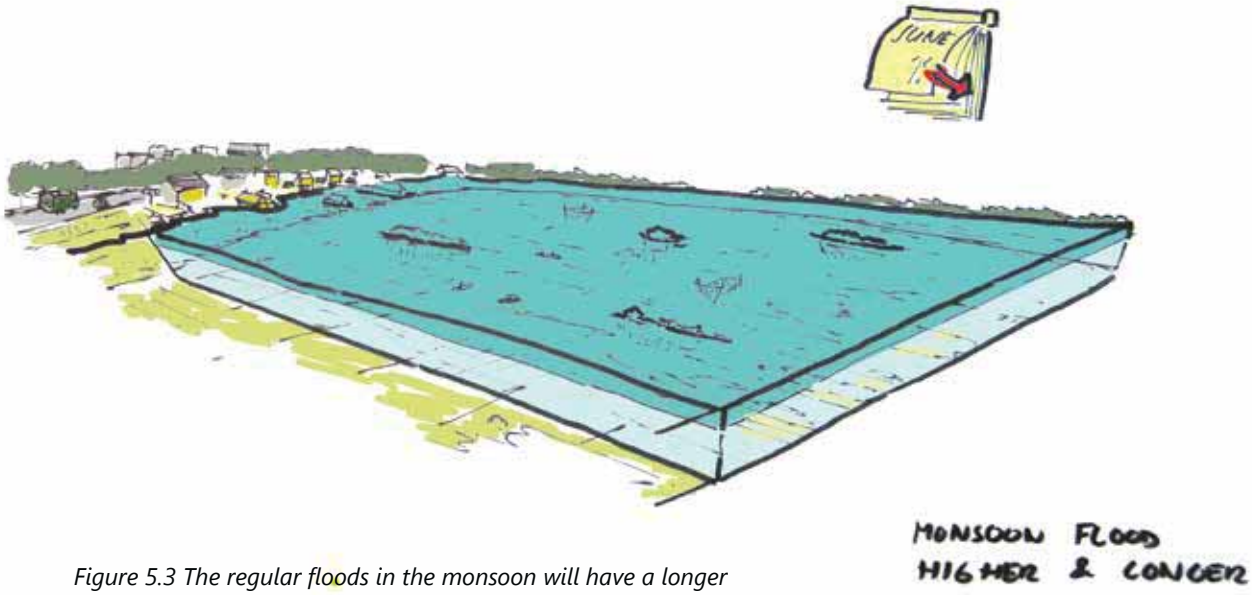


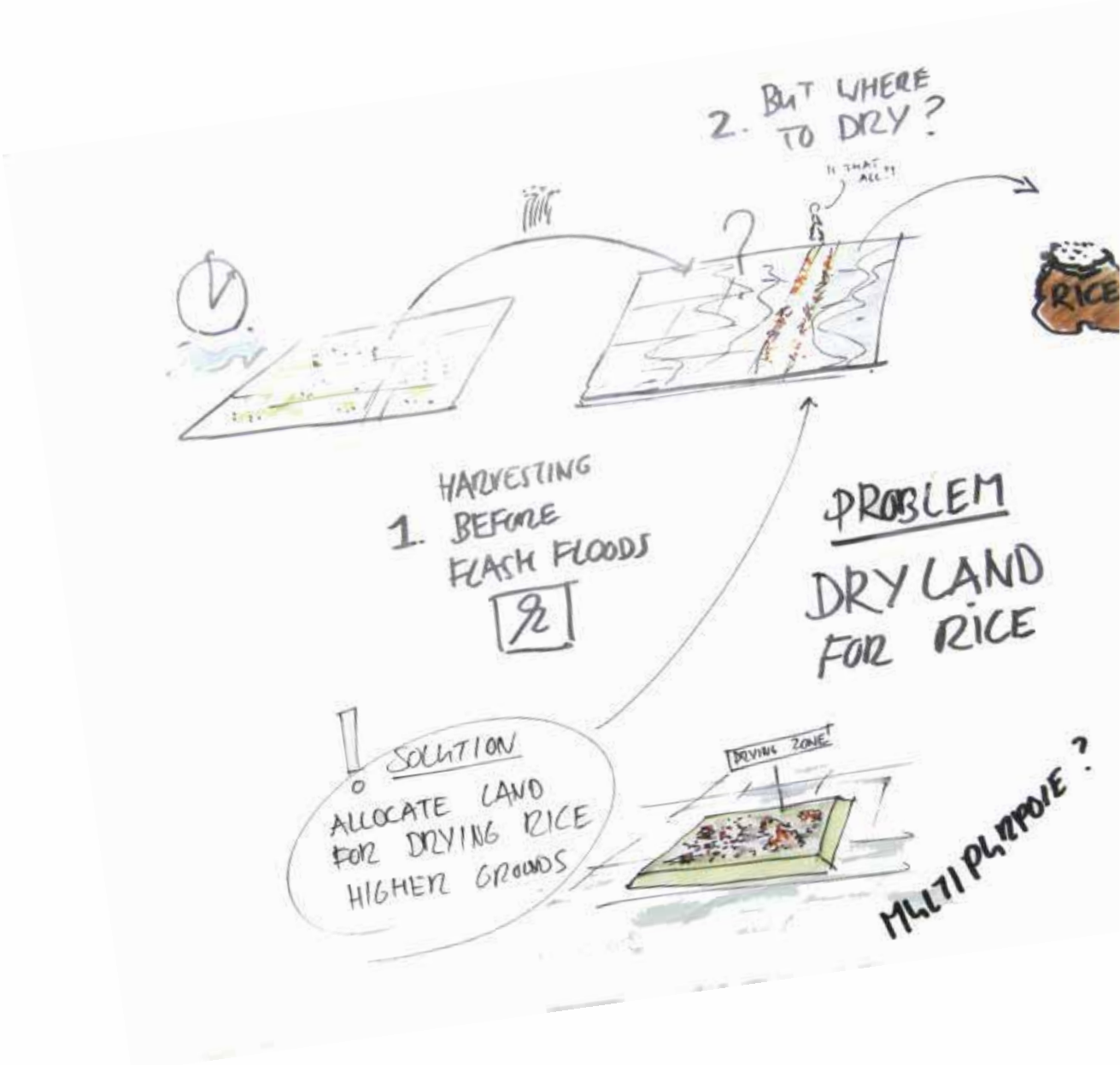
Figure 5.3 The regular floods in the monsoon will have a longer duration and the water will come higher. If the regular flooding is higher and will take longer it is important to focus on vital infrastructure (1), safe living places (2), safe drinking water (3) and fields for drying the rice (4)

5.2. Extreme floods

During the monsoon, extreme flooding causes erosion of embankments and especially landless people in unplanned developments suffer heavily from the consequences. After flooding takes place, water resources and drinking water supplies become polluted leading to outbreaks of diseases such as cholera. Population growth causes unplanned encroachment of rivers, loss of agricultural land and wetland habitat loss.

5.3. Low water flows

Due to low flows in the winter period, and due to river siltation, tributaries of rivers fall dry and haors lose connection with the river system. This causes degradation of wetland biodiversity and has negative impacts on fisheries. Also navigation between villages becomes problematic.



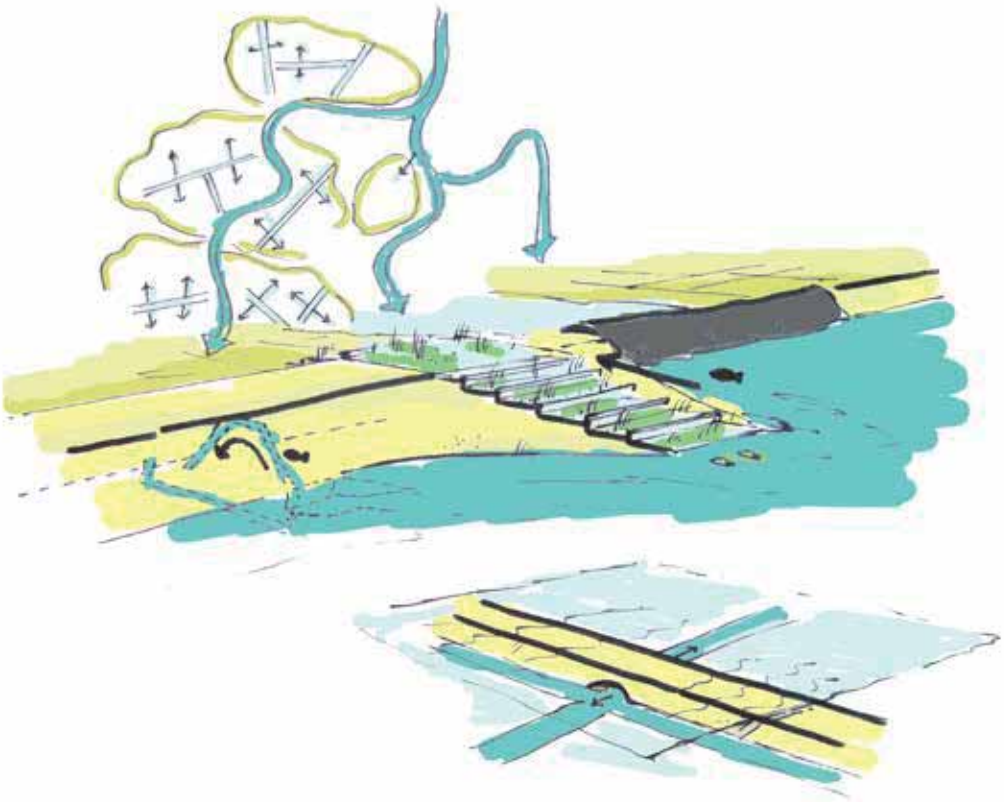


Figure 6.1: It is of utmost importance to keep the system connected, for fisheries, irrigation, navigation and the ecosystem as a whole.

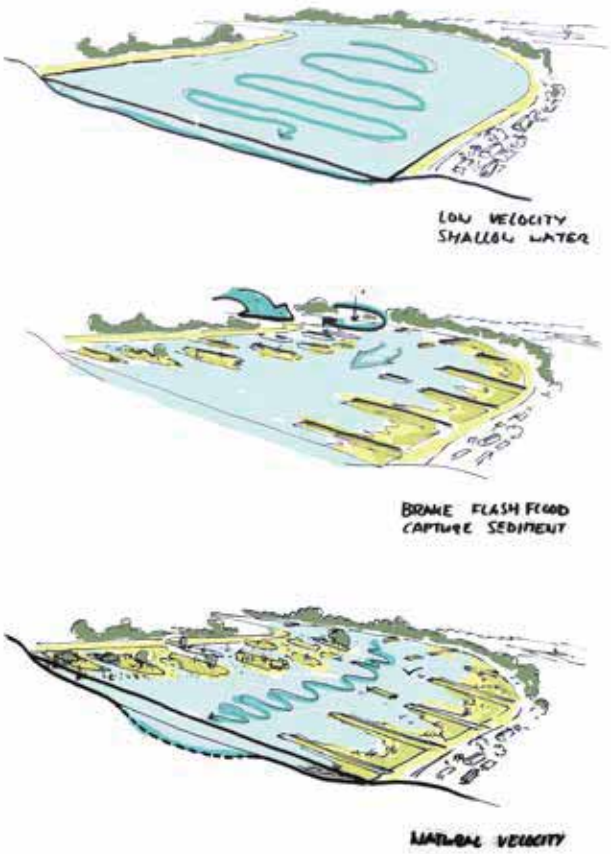


Figure 6.2:
The rivers in the hoar are wide, mostly shallow and have a low velocity.

It will be an opportunity to see if a structure can be made within the river bed that brakes the flash flood and capture sediment on the right places; also to increase velocity (more velocity means deepening the main bed).

Another possible measure, combined with the above mentioned flash flood measure could be the use of natural elements (sand banks with vegetation) or cribs to narrow the main bed, but still to provide a sufficient flood plain

6. Towards a strategy for the Haor region

To combat the above issues, we identify 4 types of measures that could promote reaching the delta plan goals (box 1). These types of measures are called 'guiding principles'.

6.1. Go with the flow

The first guiding principle is the go with the flow. Guiding principle 1 is the go with the flow (1). This will be achieved by cherishing vital connections within the water system. Riverbanks should be freed of unplanned manmade obstructions, but also river and water management measures should focus on preserving and strengthening the free flow as much as possible. Within this guiding principle different potential measures could be addressed and (better) positioned. Think of flexibel rubber dams or fishfriendly and irrigation-friendly (subermersabel) embankments Opportunities for creating river by-passes need to be investigated.

Figure 6.3: With careful planning of the location of flashflood embankments and flexible protection measures (i.e. rubber dams), the free flow of water can be improved and undesired effects can be prevented

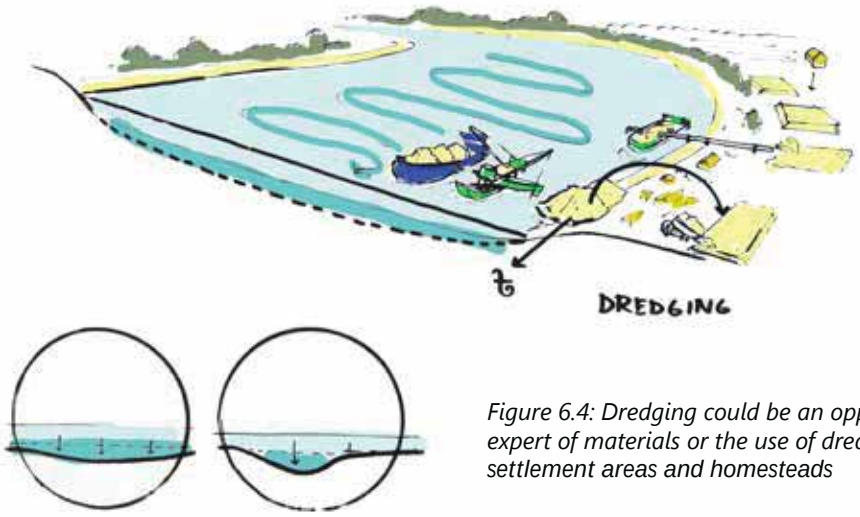
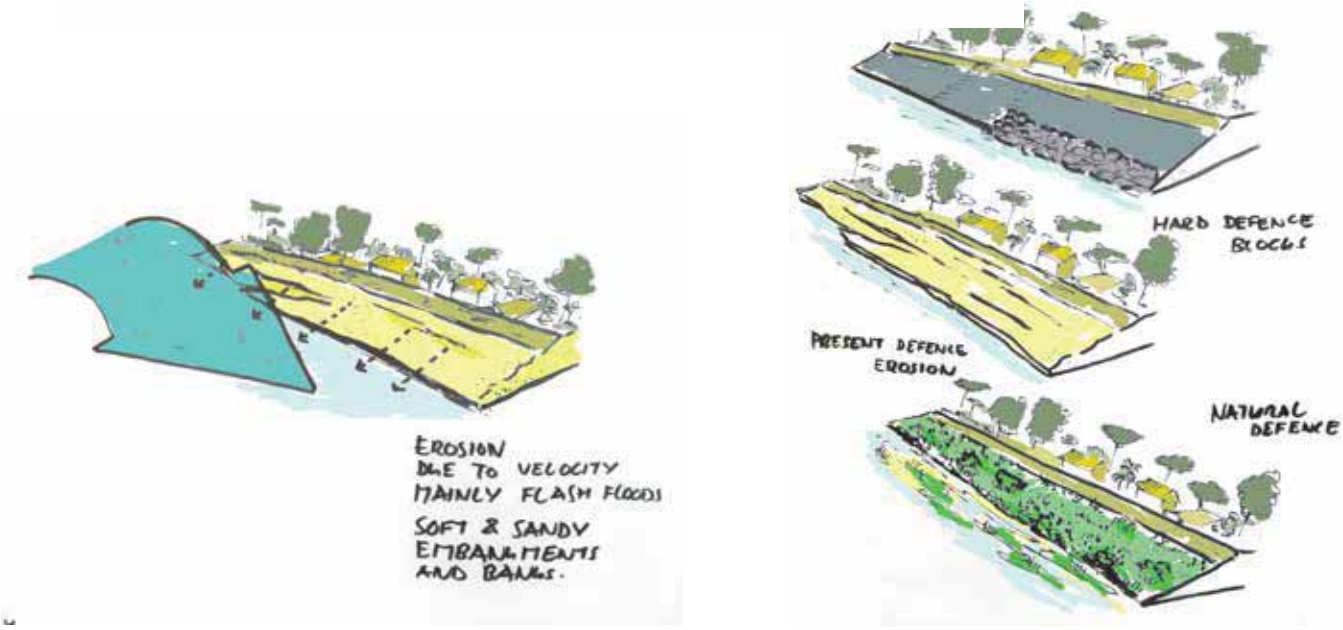


Figure 6.4: Dredging could be an opportunity with benefits for expert of materials or the use of dredging materials for rising settlement areas and homesteads



6.2. Grow with the flow

Guiding principle 2 is Grow with the flow: the elevation of land with sediment. Rivers need to be dredged and the riverbeds need to be widened. Priority are the main transboundary rivers entering the region. River dredging is urgently needed, but hampered by a lack technology and capacity (and not so much due to budget constraints). A market for dredging and riverbed mining needs to be stimulated. This market could be stimulated by giving the sand and sediment material an economic purpose. By using sediment and river bank material to elevate areas, this will attract future settlement.

6.3. Stay with the flow

Guiding principle 3 is the further development of stay with the flow. Embankments (primary embankments along the rivers and secondary embankments within the hoars) and regulatory structures are crucial in protecting the boro paddies, but also to provide evacuation routes and to make new elevated lands accessible. The primary embankments along the river suffer from erosion. Regulatory structures and secondary often block the connection between rivers and haors and divide the hoars.
Primary embankments can be reinforced. The main problem is the weak andsandy material of the embankment and the lack of fixation. A technical solution is coating the dike with hard materials (rock/stone tiles) or an alternative could be the use of vegetation as natural fixation.

Inflatable embankments can be used only in times of need. In combination with flash flood early warning systems, dams can be inflated when needed. The rest of the (winter) season, the haors stay connected to allow for navigation, exchange of aquatic species which is beneficial for fisheries and biodiversity.

The system of barrages can be enhanced by introducing smart water storage systems (in addition or as alternative). At the moment water is discharged when there is too much, but afterwards it is needed. Regular barrages causes problems downstream because the lower the discharge in dry periods.

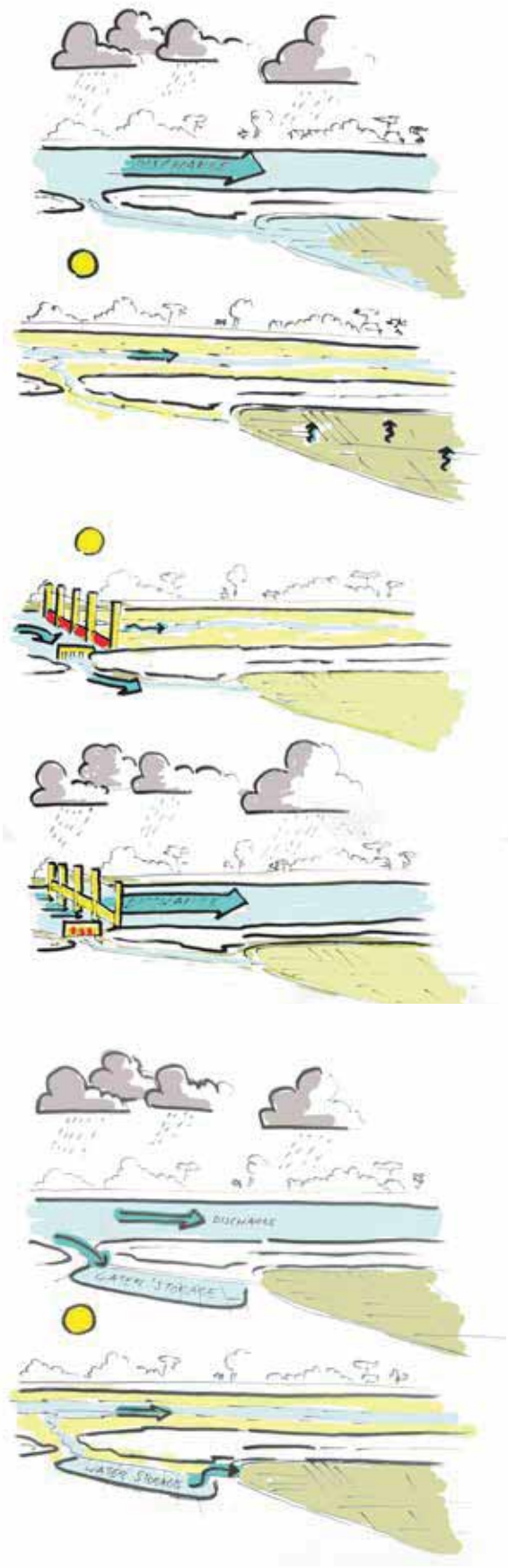
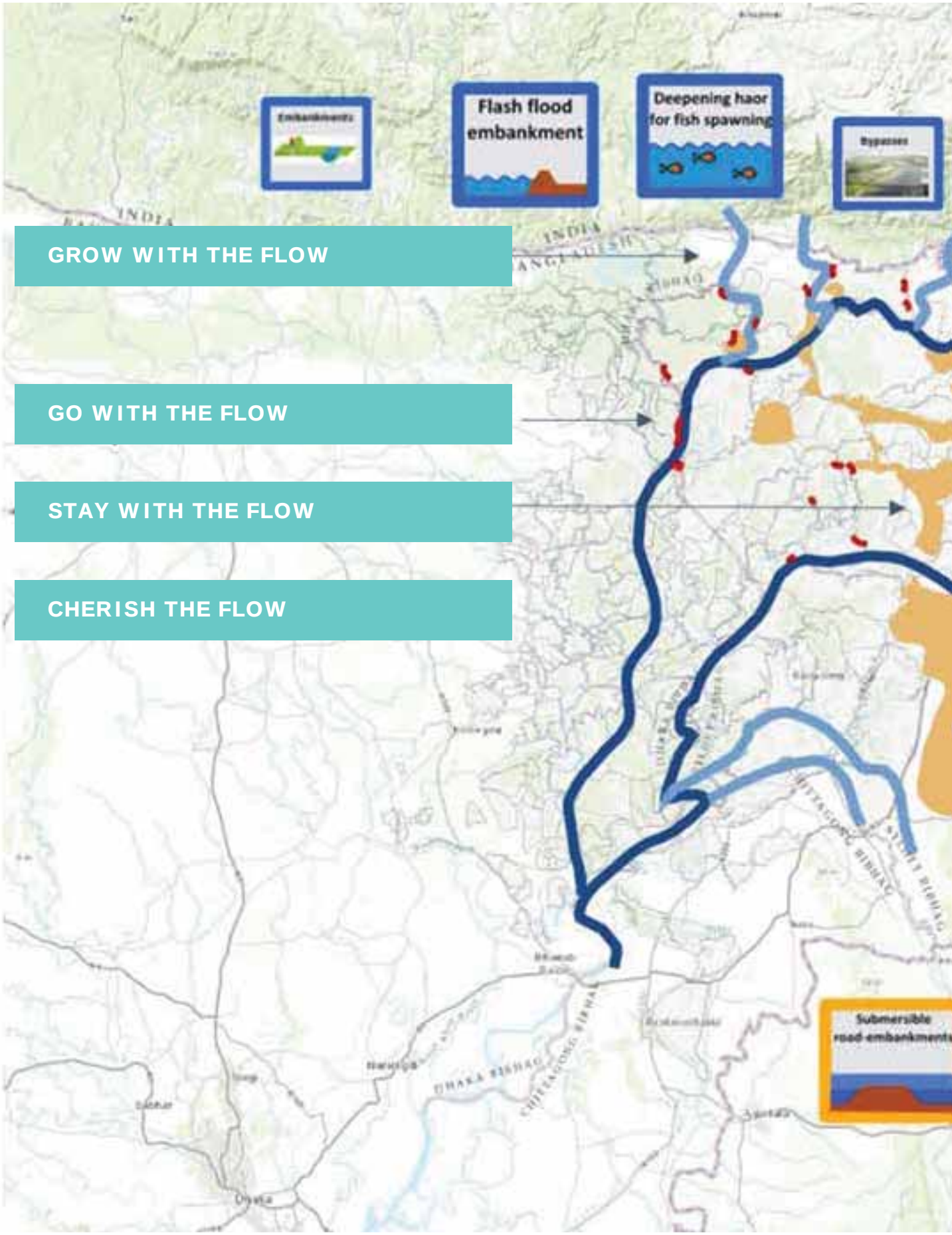
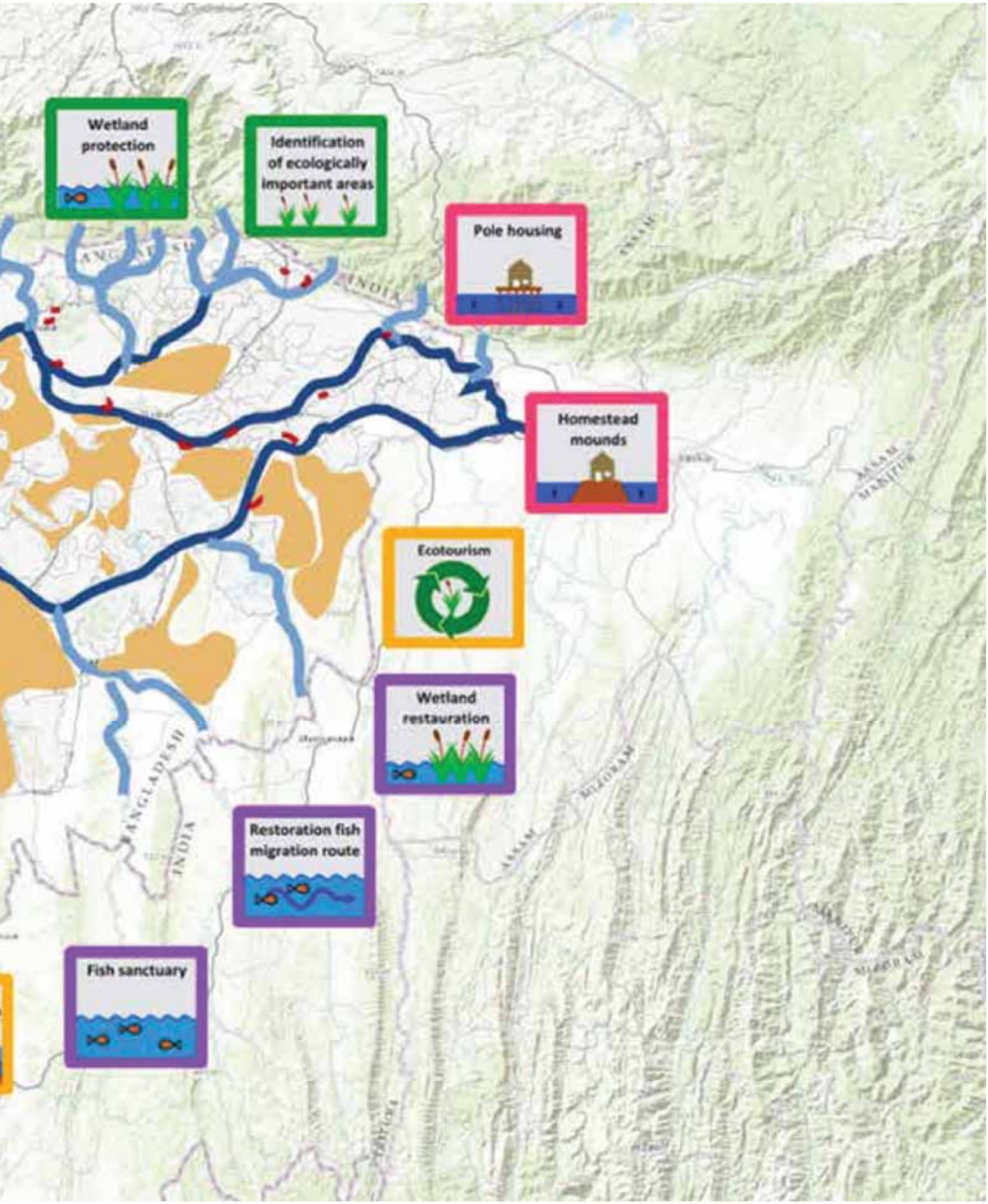


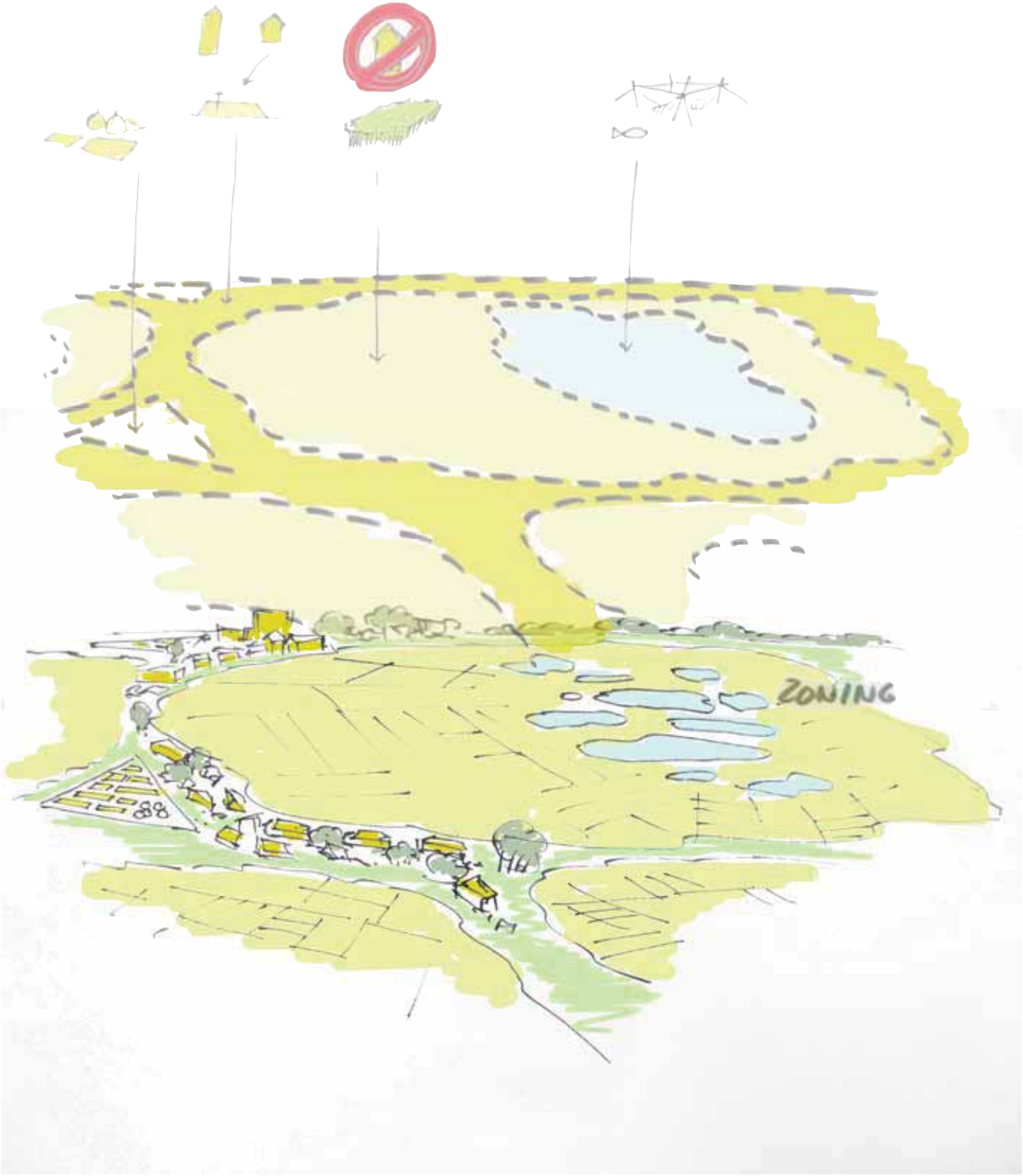
Figure 6.6: Present situation (left above), barrage situation (right above), water storage system (above)

6.4. Cherish the flow

Guiding principle 4 is cherish the flow: ecotourism and wetland protection. The Haors are a vital natural asset for the area. The wetland ecosystems provide the backbone of the region. People live from the wetlands. The area has great biodiversity values. The Haors are unique in the world. They are however rapidly decreasing and degrading. Only few Haors have a protected status. Wetland protection schemes and ecotourism facilities and infrastructures need to be developed. Development of ecotourism facilities ensures generation of income.


Embankments
Flash flood embankment
Deepening haor for fish spawning
Bypasses
GROW WITH THE FLOW
GO WITH THE FLOW
STAY WITH THE FLOW
CHERISH THE FLOW
Submersible road embankments


Wetland protection
Identification of ecologically important areas
Pole housing
Homestead mounds
Ecotourism
Wetland restauration
Restoration fish migration route
Fish sanctuary
BANGLADESH
INDIA


ZONING

7. Institutional Boundary conditions

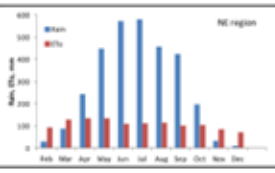
Preferably the river training measures will be implemented an intergovernmental river basin management program. Coordination between the various institutions will need to be improved (BWDB, LEGD and WARPO).

Secondly there needs to be a spatial land use zoning plan. The lowest grounds and permanent water bodies with high values for fisheries should be assigned. Here interests of fishermen are put upfront. The higher areas should be assigned for future settlement, the areas with high biodiversity values should be protected and only allow for sustainable fisheries and duck farming and other land uses with low biodiversity impacts. The key wetlands need to be given a protected status where ecotourism business need to be stimulated. This land use zoning plan should be the result of a community based participatory planning process.

The Haor community seems very aware of the natural values of the area and seems to have a strong intention to preserve these natural assets. So they should be the developers of this zoning plan. An independent temporary organization should be established to facilitate the development of such an integrated community based plan.

Factsheet

Basic Features	
Gross Area	20,061 km^2
% of the area of Bangladesh	13.5 %
Gross Area Extended (EHR)	20,038 km^2
Net Cultivable Area (NCA)	1.41 million ha
Est. pop. 2011 (BBS)	33.94 million
Est. pop. 2025 (NWMP)	42.2 million
Main Towns	Sylhet, Sunamganj, Kishoreganji, Netrokona, Hobiganj & Maulvibazar
Main Rivers	Surma, Kalni-Kushiyara, Dhanu
Main water resource infrastructure	- Submersible embankments - Manu barrage - LLP
Average Annual Rainfall (CSIRO)	3,091 mm
Annual Dependable – 80% - Rainfall (NWMP)	2,595 mm
Average Annual ETo (CSIRO)	12061mm



Drivers, Challenges & Opportunities

Drivers

- Upstream water infrastructure development – Brahmaputra, Transboundary rivers, including hydropower development - Barraga dam
- Brahmaputra avulsion
- Tectonic subsidence
- Climate change
- Urbanization & population growth
- Growing agricultural water demand

Challenges (Pressures & Impacts)

NWMP	***Baseline Studies (additions)***
- Environmental management of the Haor Basin - Erosion along the left of the Brahmaputra - Drainage congestion in the Kalni-Kushiyara rivers - Flood proofing of villages in the Haor Basin - Flash flooding and remedial actions for existing FCD schemes	- Sediment management to compensate for subsidence without causing siltation in rivers to hamper navigation - Lack of strategy on flash floods in north of the Region - Flash flood proofing of key infrastructure - Drainage congestion due to roads & other infrastructur - Reduction of the areas and connectivity of wetlands - Occurrence of flash flood before May 15th – risk of (complete) crop production loss - Embankment erosion due to wave action, worsened by lack of maintenance - Recognition and strengthening of local O&M arrangements - Arsenic in groundwater - Rapidly growing urban water demand

Opportunities – *Baseline Studies Expert Consultation*

- Haor Masterplan approved in 2013, including irrigation (DTW, STW), kitchen gardens, evacuation routes/infrastructure, and controlled flooding
- FEWS down to community level
- Small reservoir & irrigation development for tea production - tea companies
- Haor Development Board established to integrate development activities

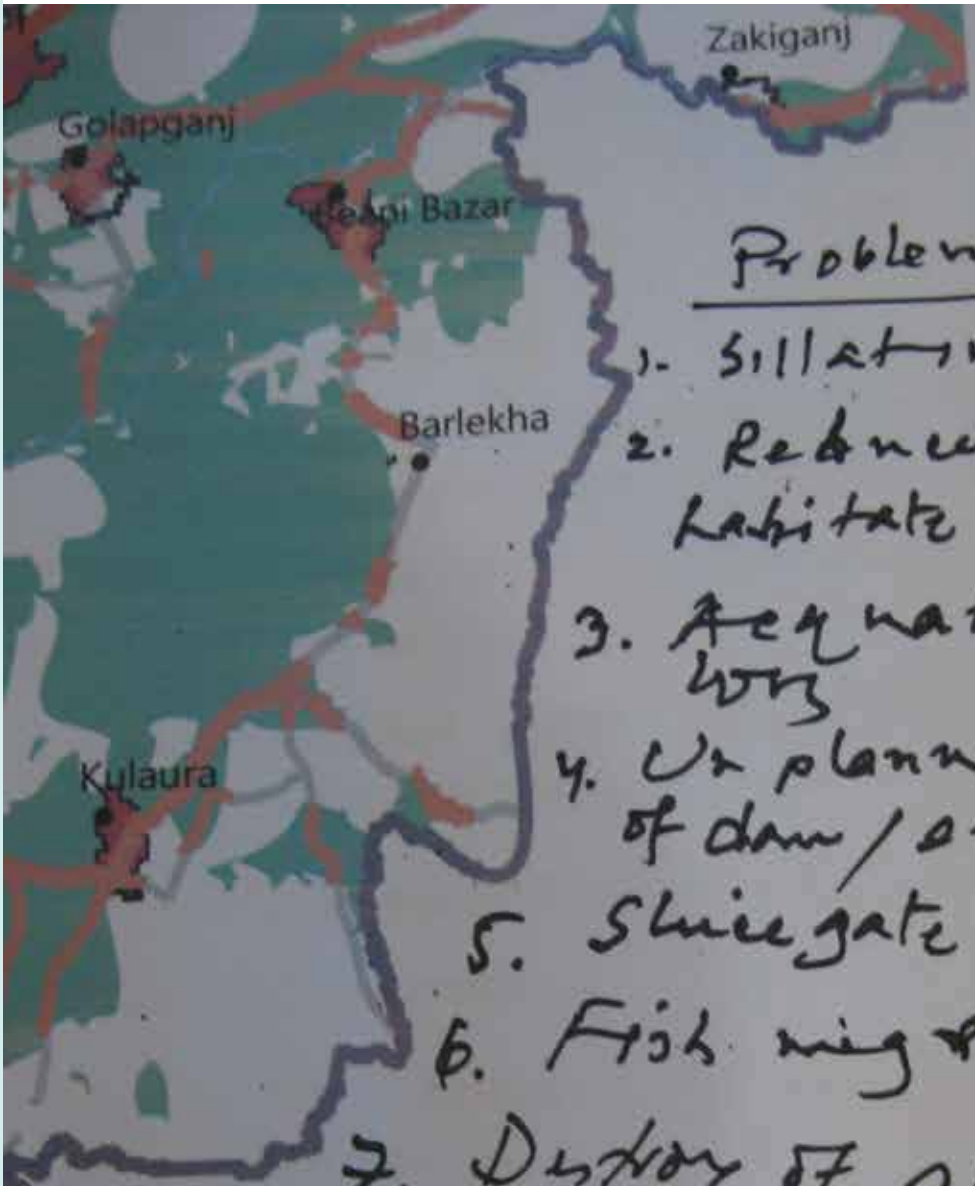
BANDUDELTAS
BDP2100

HAOR REGION

Agriculture

Problems/Challenges:

1. Flash Flood (আকস্মিক বন্যা)
2. Heavy rainfall and inundation. (অতিবৃষ্টি এবং জলাবদ্ধতা)
3. Fallow Land (পতিত জমি)
4. Low water table and stony layer (ভূগর্ভস্থ পানির স্তর ও পাথরের স্তর)
5. Siltation (পলি জমার স্তর)
6. River bank erossion & Landside (নদী ভাঙন ও ভূমিধস)
7. Hailstorm (শিলাবৃষ্টি)
8. Crisis of Labour (শ্রমিক সংকট)
9. Thunder storm (বজ্রপাত)
10. Lack of awarness about nutrition. (পুষ্টিগুণ সম্পর্কে অজ্ঞতা)
11. Low price of ~~Peak~~ Paddy in peak season. (ফসলের ন্যায্য মূল্যের অভাব)
12. Poor knowledge of farmer about technology (কৃষকের প্রযুক্তি বিষয়ক জ্ঞানের অভাব)
13. Shortage of manpower. (শ্রমিকের সংকট)



Problem

1. Sillatation
2. Reducing fish habitate loss
3. Aequatic biodiversity loss
4. Unplanned construction of dam / or barrier
5. Sluicegate
6. Fish migration hinding
7. Destroy of swamp forests.
8. ~~Existing~~ Revenue based leasing process.
9. Pollution due to agricultural runoff.
10. Land use change in upstream

River flood and flash flood vulnerability map

Non irrigated crops vulnerable to deep inundation (>1.80m)

Irrigated crops vulnerable to flash floods

Urban centre vulnerable to deep inundation (>1.80m)

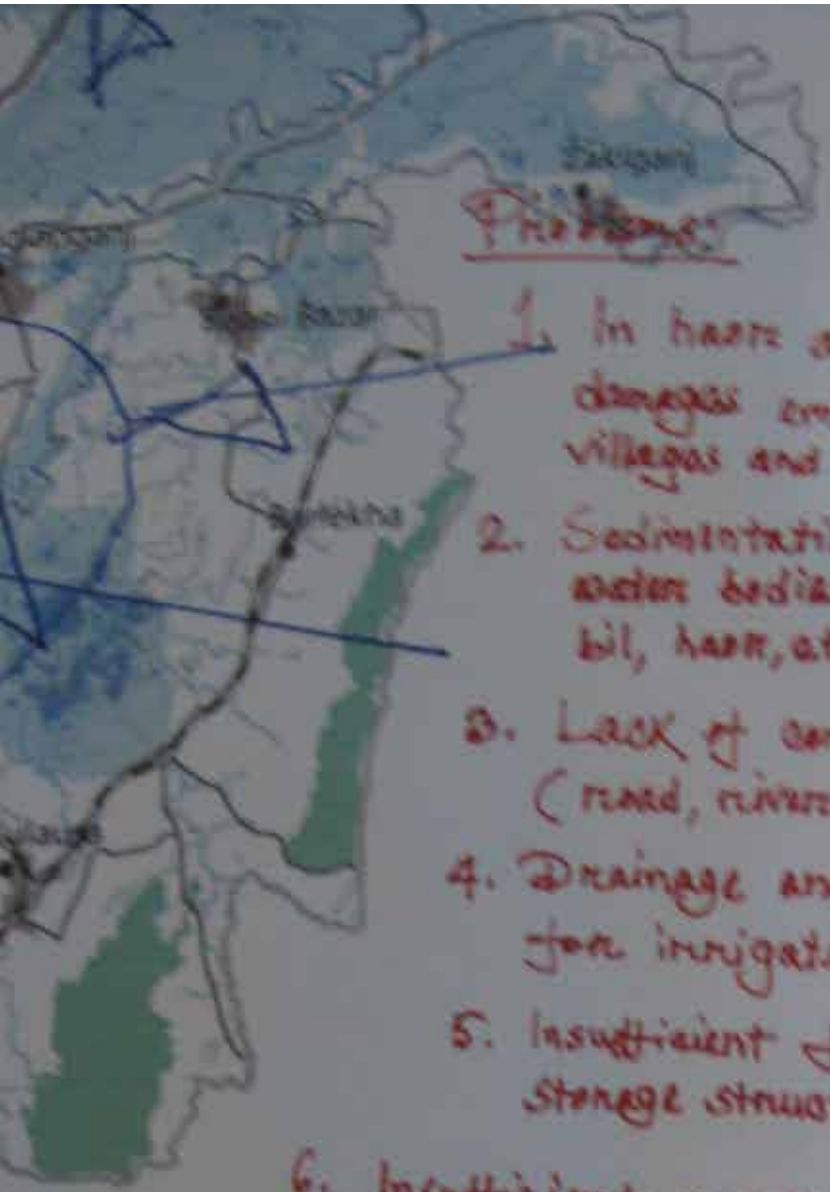
Road exposed to riverine and coastal floods

Road exposed to flash floods

National road

Regional road

District road



Problems:

1. In haor area flash flood damages embankments, roads, villages and Boro rice.
2. Sedimentation situated our water bodies (canal, river, crop land bil, haor, etc)
3. Lack of communication network (road, river way, bridge, culvert, etc)
4. Drainage and water conservation structure for irrigated land.
5. Insufficient flood shelter, food grain storage structure
6. Insufficient marketing facility
7. Lack of awareness.
8. Village internal communication, water supply and sanitation.
9. Power and electricity
10. Earthquake
11. Villages vulnerable to flood and wave
12. Health and education facilities

Possible Measures to overcome Challenges

১. সুস্থ্যী হাওর এবং বাঁধ
২. রবি ফসল
৩. খরাসহিষ্ণু বোরো ধানের জাত প্রবর্তন
৪. বৃক্ষরোপণ বিশেষকরে নদীর ইতিবাচক
৫. জেলা জলবায়ুপরিবার উন্নয়ন।
৬. ফসলের বহুমুখীকরণে প্রযুক্তি প্রদান
৭. ওয়াটার মেইনুমে ই-পরিশুদ্ধ পানির ব্যবহার বৃদ্ধি করা
৮. আধুনিক কৃষি প্রযুক্তি ব্যবহারের ও বৃদ্ধি সম্প্রসারণ লক্ষ্যে কৃষক-কৃষকদের প্রশিক্ষণের ব্যবস্থা
৯. ঘিনি শস্যের পরিমাণ বৃদ্ধি করা সরষ্টাদি ভাবে
১০. শস্য বহুমুখীকরণের জন্য প্রদর্শনী প্রদর্শনি, উচ্চমূল্যের ব্যবস্থা করা।
১১. খরা ও পানি সহিষ্ণু জাতের ফসল আবাদ বৃদ্ধি করা।
১২. শাক-সবজি ও ফল চাষ সম্প্রসারণ।
১৩. ম জনবল বৃদ্ধি করা (প্রয়োজনীয়)
১৪. হাওরের জন্য সমন্বিত প্রকল্প গ্রহণ।
১৫। রবি মৌসুমে ডাল, তেল ফসলের আবাদ বৃদ্ধি।

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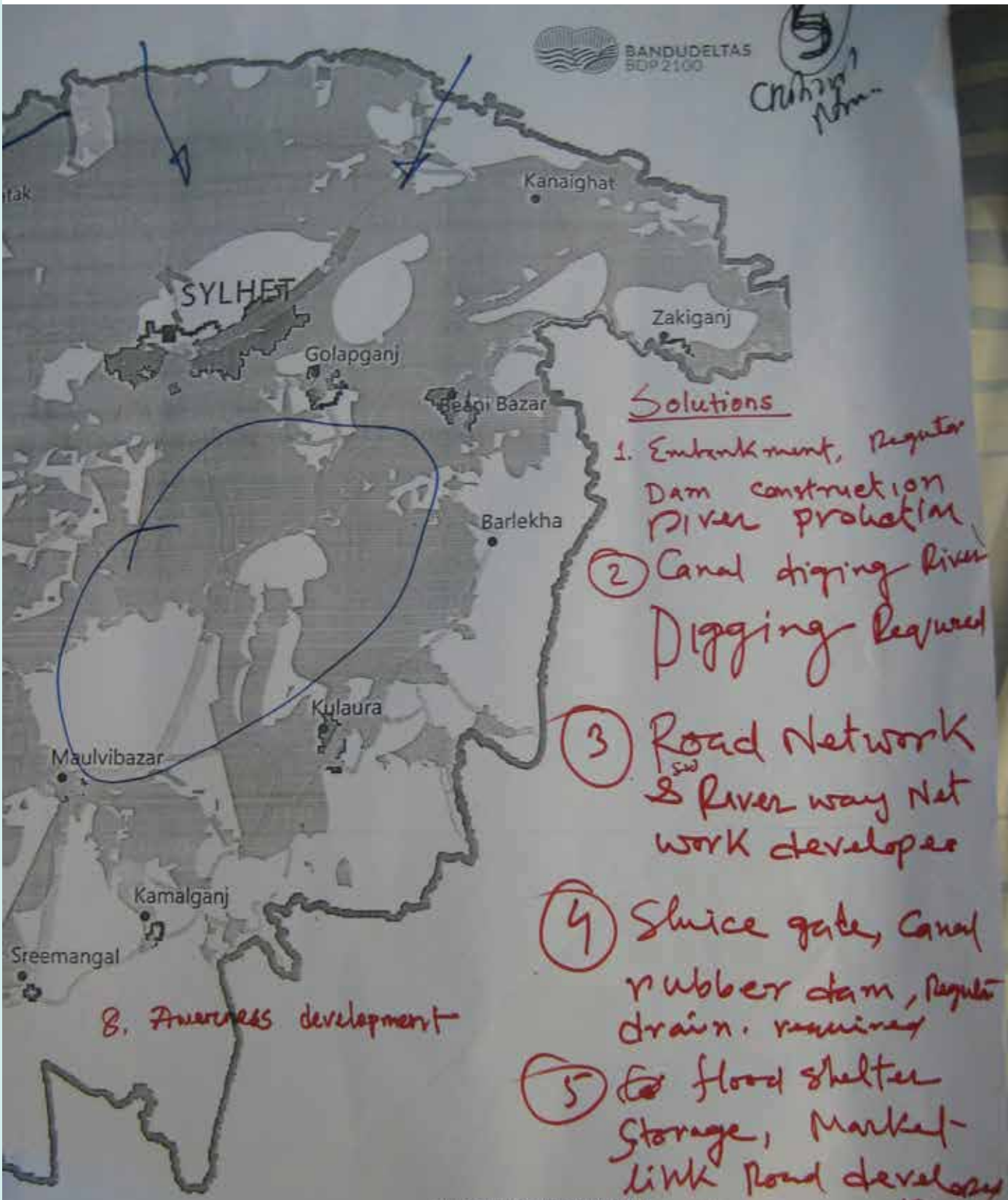
Solution

1. Reexcavation
2. Fish sanctuary
3. No more construction of dam/embankment
4. Sluice gate — Fish and aquatic echo system
5. - Need based fish pass construction
5. Recovering connecting canals/fish pass between
6. Recovering of swamp forests and afforestation
7. Jal Mehal management policy focus on biological mgt.
8. IPM mgt. and use of compost fertilizer
9. Strengthening political relationship for upstreaming land use mgt.
10. Prohibit land reclamation for homestead and design policy
11. River basin management system
12. Water content capacity increase in internal canal program.
13. [illegible]

— Ahmed, DAE
Zzam - IUCN
Kumar - VARD

...LAOR REGION



Solutions

1. Embankment, Regulator Dam construction River protection

2. Canal diging River Digging Required

3. Road Network & River way Net work developed

4. Sluice gate, Canal rubber dam, Regulator drain. reservoir

5. flood shelter Storage, Market link Road developed

6. Village protection wall etc

7. Hospital School, college

8. Awareness development

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