



# Technical Assistance Consultant's Report

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TA Number: 4896  
December 2007

## INDIA: Northeastern Integrated Flood and Riverbank Erosion Management Project (Assam)

### TA (Phase 1) Workshop Materials

This consultant's report does not necessarily reflect the views of ADB or the Government concerned, and ADB and the Government cannot be held liable for its contents. (For project preparatory technical assistance: All the views expressed herein may not be incorporated into the proposed project's design.)

**ADB TA No. 4896-IND: Preparing the North Eastern Integrated Flood and  
Riverbank Erosion Management Project (Assam)  
Key Findings of Phase 1 (Draft)<sup>1</sup>**

**BACKGROUND**

This study was conducted as a consequence of the extreme 2004 flood, which once again demonstrated the increasing vulnerability of the floodplain dwellers in Assam, and specifically in the Brahmaputra valley to recurrent natural hazards. In the past a sizeable number of committees addressed the specific problems of flooding and erosion and provided good background and recommendations but not much translated into concrete action or was implemented. In parallel it is increasingly acknowledged that riverbank erosion and flooding are major factors hampering the development of Assam, which has fallen back and lags behind India's average development indicators. Recognizing this deficit Government has decided to develop the region's large untapped potential and to provide a better future for the large percentage of poor rural households in the densely populated Assam plains.

The 2004 flood demonstrated again that the past approach of addressing erosion and flooding in a non-systematic manner limited to local engineering interventions is not successful. Recognizing the need for a wider investment program, Government asked the ADB for assistance. It was jointly agreed to address the problem in an all encompassing manner, focusing on all three major elements of Integrated Water Resources Development (IWRD), (i) an enabling environment, (ii) the institutional framework, and (iii) management instruments. The three major detrimental aspects of an abundance of water, riverbank erosion, flooding, and related drainage problems, need to be addressed together. The suggested approach needs to be based on a good understanding of the physical environment and the institutional framework, to provide sustainable solutions for the future. In addition, the conceived new approach needs to be demonstrated at sample project locations. The high 2007 flood experienced during this study reiterates the need for a systematic approach.

A study team under the Technical Assistance (TA) was fielded between May and September 2007. The team, together with WRD officers, prepared the background for a future investment project at pre-feasibility level starting with the Brahmaputra main stem in general and four priority sites in particular. These sites are high priority areas and planned to form the starting point for future continuous interventions that could be progressively extended to cover larger areas in Assam. In response to the task, the phase 1 study is structured in four parts: Part I provides background about the problem of flooding and erosion in Assam, Part II outlines a Flood and Riverbank Erosion Management (FREM) framework, and Part III summarizes concepts and expected economic benefits for managing flood and riverbank erosion along the first four pre-selected priority project sites. In addition, Part IV summarizes the data collected and provides particulars about the schedule and organization of the subsequent feasibility phase (phase 2).

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## THE PROBLEM

In summary the purpose of this study is to outline ways that allow an ever increasing population to live in a sustainable manner on the floodplains of the flood and erosion prone Brahmaputra valley while develop higher living standards and leaving poverty behind. This challenging task has to consider four key issues:

1. **Brahmaputra Basin:** Large-scale river instability is triggered by factors mostly outside of Assam and largely beyond the control of human beings - mainly tectonics of the Himalayan mountain range. This means that erosion and flooding in the Assam valley can best be addressed through an adaptive response, managing the consequences of the ever changing river environment in an integrated manner. While high dams are recommended for flood control Assam will continue depending on the existing network of embankments in the future and needs to maintain them.
2. **Brahmaputra in Assam:** The Brahmaputra River is in a stage of widening in Assam, resulting in an average annual land loss of 3,900 ha over the last 34 years. Widening is also the main reason for the lack of success in flood protection, which as a consequence has lead to wide-spread risk adverse behavior of the rural population. For example, agricultural land use often remains limited to subsistence level farming, providing no future for the economic development of the State. On local level, the rural population is caught in the vicious cycle of subsistence based farming, poverty, and frequent disasters, which result in more poverty, increased vulnerability and reiterate low risk farming. Land-loss and related uncertainty will continue in future if not addressed in a systematic manner. The widening of the river makes the Assam State Government an increasingly large landowner while mostly poor rural households loose land. Poverty reduction of erosion victims can take place through the rehabilitation of slum dwellers or the reduction of vulnerability through the protection of their land from erosion.
3. **Riverbank Erosion** is slowly acknowledged as the main problem hampering effective flood protection of the Assam valley however, there is an unclear concept of how to address erosion. There is additional strong indication that erosion is a major factor of river instability due to the very large amount of sediment intrusion from bank erosion itself. This sediment causes further instability downstream, triggers more bank erosion, and apart from loss of land and flood protection hampers navigation.
4. **Institutions:** Diverse interests of and little joint coordination among river basin stakeholders on international, national, and inter state level, but also among different Assam State departments and local stakeholders result in a complicated institutional environment often without joint planning. This does not facilitate a systematic approach. The Northeastern Region does neither have the funds nor the institutional capacity to address the problem of riverbank erosion and flooding fully, but without addressing this problem at least in certain priority reaches development activities remain rudimentary. The understanding and knowledge base of the Brahmaputra River is still limited in terms of geomorphology and hydrology in particular.

## **LESSONS LEARNED FROM THE PAST**

Success and living in a more predictable and stable Assam valley, with less riverbank erosion and flooding damages requires a paradigm shift from a limited response to riverbank erosion based mainly emergency repair work of breaches in the flood embankments, to an Assam-wide planning and implementation program. This study, focusing on the Brahmaputra main stem is the first step towards formulating an Assam-wide integrated approach with the future potential for extension to tributaries in Assam and neighboring states (such as Arunachal Pradesh, Meghalaya, and Bhutan) on the way to truly Integrated River Basin Management and success in mitigating large-scale flood damages. Success also depends on the strong political will for example through the Assam State Government, declaring the next two five year plans the period of providing stability to their floodplains.

Success in providing a stable environment is possible and was demonstrated in Assam. The history of Dibrugarh town protection is the prominent example. Dibrugarh, situated in an exposed location at the banks of the mighty Brahmaputra is protected from erosion and flooding since 1955. Different from other places, riverbank protection was built first in Dibrugarh, providing stability in the eroding environment, followed by flood protection one year later. Continuous efforts were also made to provide incremental riverbank protection works in response to the changes in the morphological environment in an adaptive manner. In contrast, Palasbari town eroded at the end of the 1950s being left without riverbank protection, but having flood protection since 1955. In this area limited riverbank protection was only built in the mid-1980s after three decades of embankment erosion and reconstruction, and permanent uncertainty to the remaining rural communities. The total cost at both areas over the last 50 year is at the same level with the sharp difference that Palasbari disappeared while Dibrugarh is still prosperous. The important lesson is that the long-term development of life on the Brahmaputra floodplains depends on a ‘stability first’ approach, which in the context of the Brahmaputra River means, providing bank protection first. The protection of Dibrugarh became possible through strong political commitment driven by Prime Minister Jawaharlal Nehru.

## **THIS STUDY**

In a broader context, success depends on five main points: (i) a strong political will to succeed, (ii) sufficient funds for the start and long-term funding commitments, (iii) data and information sharing to allow the development of innovative solutions, (iv) a champion – a strong and prominent personality that initiates and drives the process, and (v) a history of decentralization. Another key element of success, internationally widely acknowledged, is that problems are best solved at the lowest appropriate level. In other words at the level where the impact is directly visible and where the suffering is greatest. This naturally is in Assam and consequently the suggested flood and riverbank erosion management framework focuses on Assam State initiatives. These initiatives shall develop in parallel with the capacity of the organizations and local people to deal with the problem and demonstrate ownership for commonly defined solutions.

World-wide flood and riverbank protection are financed by governments, however often involving local stakeholders during planning and later to help protecting and

maintaining the investment. In the context of Assam, where many people in the worst affected areas live below poverty line, special programs will be required to initiate a higher degree of economic development and to reduce the poverty level.

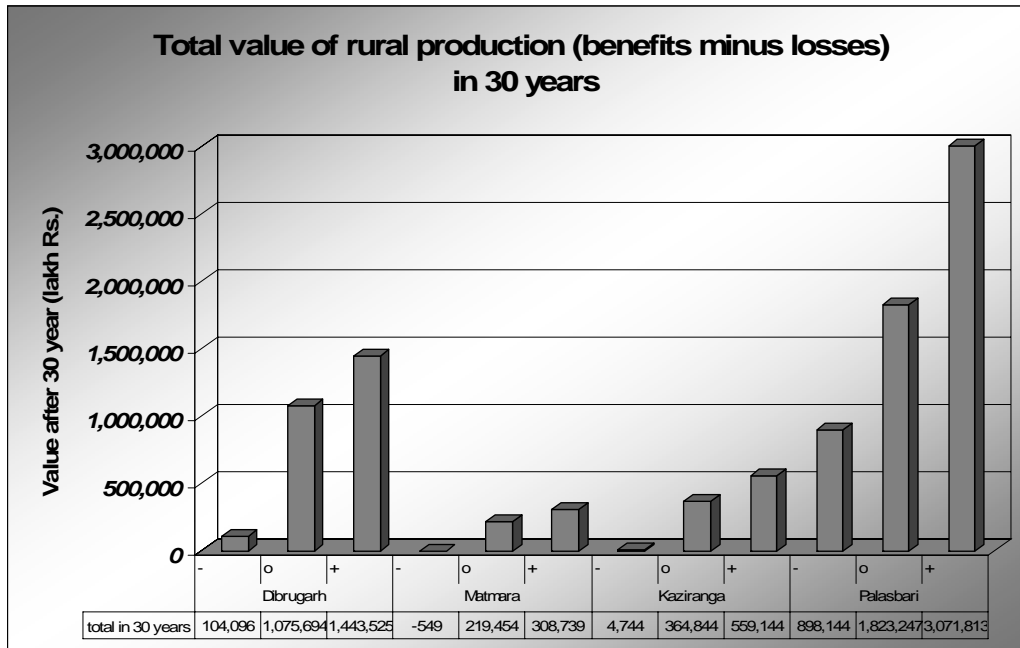
The envisaged investment program takes the emerging holistic approach towards flood and riverbank erosion management into account. This study looks at four sample project sites at Dibrugarh, Matmara, Kaziranga, and Palasbari. It does not narrowly look at local initiatives as in the past, but treats the problem in an integrated manner over longer reaches. The length of the interventions range from 10 to about 40 km and incorporate a wide range of structural and non-structural options. The key element is integrated management and not construction of engineering works. Even though the project looks mainly at the Brahmaputra main stem, local tributaries are considered in as much as they have an influence on flood and erosion mitigation measures.

The proposed interventions are clearly in line with the demands of the local population. The project undertook substantial efforts to complete a socio-economic field study in the four areas, incorporating not only the identification of the present status of living at the sites, but also asking the population what their demands are and what potential they see if these demands are fulfilled. Not surprisingly, the general consent is that flood and erosion protection are urgently required to provide a stable environment. The rural population has spontaneous plans how to move from subsistence based farming to more intensive production once the presently unbearable risk of losses is taken away. The will of the local population to produce more, is one cornerstone for Assam's development in two ways: (i) on the one hand the increasing population can be fed from own resources, and (ii) the development of the rural economy is the best way to reduce rural poverty.

A key outcome of this study and suggestion for the subsequent feasibility study is the recommendation to provide enhanced security against flooding and riverbank erosion along the selected reaches. What does this mean? (i) In terms of perception this means dramatically reducing the risk of land erosion and sudden devastating flooding due to embankment breaches. (ii) In terms of technical interventions this means (a) strengthening the existing embankments including the closure of gaps along the tributaries, (b) securing the embankments from riverbank erosion, and (c) introducing a range of non-structural measures with knowledge development to enhance the risk management capacity. (iii) In terms of institutions this means changing from short-term technical interventions to a long-term risk management approach.

For demonstrating the difference between continuous instability and stability in economic terms two main scenarios were defined: "business as usual" and "reliable protection". Both scenarios have two supplementing considerations: "business as usual" a lower-end scenario of "do-nothing", which means no further investment into erosion and flood protection at all, and "reliable protection" an upper-end scenario with additional targeted support in rural development. The four scenarios are explained in the following table. The comparison of economic benefits indicates that stability would provide substantial economic benefits over the next 30 years, only from rural production, although the level of impacts differs depending on the locations which may call for different approaches or combinations of options in different locations.

Option	Interventions	Impact
Do-nothing (-)	No future interventions	Large-scale degradation of the environment
Business as usual (o)	WRD interventions as in the past and at present	No improvements to the stability, reduction of living conditions due to increasing population pressure
Reliable protection (+)	Full flood and erosion mitigation	Stability and increased productivity of the area reaching State average
Reliable protection with additional programs	Full flood and erosion mitigation plus supporting targeted programs	Stability and increased productivity above State average



This pre-feasibility analysis is limited to the output of rural areas over 30 years, which means agricultural and fisheries produce and wage earnings. This is done intentionally (i) to assess if rural areas can be provided with full protection at economic cost, and (ii) to demonstrate that the planned approach is a management approach over the next decades and not limited to an investment project with initial high investment into engineering interventions alone. A preliminary estimate for the future investment project of 7.5 years duration, or 25% of the total considered period, could assume that 50% of the total investment cost of a 30 year period, need to be made during the initial project period to unleash the economic potential.

The overall program under this study envisages the period of over 30 years towards stabilizing around 100 km of Brahmaputra bank and to provide protection to around 650 villages and urban areas with 1.2 million people.

## SUMMARY FINDINGS

Key findings of this study relevant for the subsequent feasibility phase are:

1. The **Brahmaputra River is the main cause for erosion and flooding** in Assam. The Problem of flooding of the Assam valley is intrinsically interwoven with the geomorphological process of Himalayan mountain building and slope erosion, which is beyond human influence. The combination of two extreme processes, tectonics and monsoon rainfall causes great river instability and little predictability.
2. The Brahmaputra **instability hampers development of and poverty reduction in Assam**. Without effectively managing or coping with flood and erosion, major goals of poverty reduction and closing the development gap with all India will be difficult to achieve.
3. **Flood proofing** may not change the instable characteristic of the environment and the generally risk adverse behavior of the rural population. As such it provides little development perspective and is a less preferred option by local stakeholders compared with flood protection. Nevertheless, this may still remain as an option in areas where protection cannot be immediately envisaged.
4. **Address erosion** to sustain flood protection as continuous riverbank erosion will lead to repeated erosion and breaching of this flood protection keeping an unacceptable risk level for investment into economic development. The comparison of Dibrugarh and Palasbari demonstrates that it does not pay off to delay the investment into riverbank protection. An equally important element is a continuous adaptation of the riverbank protection infrastructure to the changing morphological environment, which has been generally lacking in the past.
5. The proposed project plans to **strengthen the existing embankment network** and to mitigate the risk of embankment erosion through different measures which in the long-term target at providing a more stable river environment. The envisaged combination of flood and erosion protection will not interfere with the status of the floodplains outside of the embankments and as such protect the biodiversity of this valuable land habitat.
6. The development of flood and riverbank erosion management needs a **modern organization** that leads the process. The Water Resources Department has engineering background that should be developed through systematic **capacity building** in terms of staff resources, technical and non-technical managerial capacities to comprehensively manage flood and riverbank erosion risks, management systems and business processes, and inter-departmental coordination towards comprehensive risk management set in the context of integrated water resources management.
7. One consequence of the widening of the Brahmaputra is that private land predominantly held by poor rural households, turns systematically into government land without compensation mechanism for the poor private land owners. The challenge during feasibility study is to define appropriate coping measures in the context of the selected reaches of the Brahmaputra river, either with provision of stable environment with necessary riverbank protection where economically and morphologically feasible (with provision of sufficient income

and employment for the poor), or alternative coping measures to live with riverbank erosion where immediate protection cannot be envisaged.

8. Key for future planning is the development of erosion prediction and the improvement of **flood forecasting** with a better forecasting of catastrophic landslip dam outburst floods but also village level information about the development of the annual regular floods.
9. **Floodplain zoning and mapping** is an old demand increasingly necessary with increasing population density in the plains. The project incorporates this at all four sample project sites, initially to improve the data background, and finally to provide the necessary background for an adequate land-use where people live in an equitable and sustainable manner within their environment.
10. **Assam** is the major stakeholder and **needs own capacity and research** to deal with flooding and erosion problems. At the same time, Assam needs to develop **cooperation** mechanisms with neighboring states initially to improve flood forecasting and warning and to commonly develop a better understanding of flood and erosion processes.
11. Understanding the Brahmaputra River in Assam and planning human interventions is all about **understanding and forecasting soil erosion and sediment transport processes**. For this reason major efforts are required in future to measure and analyze sediment transport and morphological river changes. Likewise, the knowledge base on the natural environment and hydrology of the basin as a whole needs to be strengthened to monitor and assess the impacts of developmental interventions as well as of climate change.
12. There is a scope for enhancing the cost-effectiveness and sustainability of riverbank erosion infrastructure by (i) strategically planning, placing, and progressively strengthening protection measures following the short-term erosion prediction system; (ii) exploring alternative designs more adaptive to natural river processes such as revetment (along the naturally developed bank line, as opposed to protruding structures) and siltation-inducing measures (such as porcupines), (iii) enhancing the implementation efficiency with stringent quality control; and (iv) strengthening the monitoring and maintenance system to ensure incremental adaptation works can be provided in a timely manner.
13. Integrated planning requires a strong **participatory process**, with central, state, and local government agencies sharing the responsibilities with local stakeholders and their representatives.
14. There is a need for developing a sound enabling policy, planning, and institutional framework to support the integrated management of flood and riverbank erosion risks encompassing all stages of disaster risk management. Financing for infrastructure maintenance remains also largely insufficient to pursue adaptive incremental approach to effectively respond to the dynamic morphological environment. The Assam state government has recently initiated the process of preparing a state water policy, which is expected to provide a starting point to this end.

The planned project intends to enhance the security against flooding and riverbank erosion along four reaches of the Brahmaputra River with a longer term goal of progressively stabilizing the riverbank by confirming the viability of the approach

through continuous learning and adaptation. It is the first step to an Assam-wide initiative to manage the flooding and erosion problem and to provide enhanced security to the pre-dominantly rural population of the plains. The implementing agency, the Water Resources Department, Assam needs to develop the capacity required for integrated flood and riverbank erosion management, involving local stakeholder and partner organizations and develop a culture of managing problems in an integrated manner in communication with local stakeholders, national, and international organizations and bodies while ensuring the transparency and accountability of the services delivered.

**Project Preparatory Technical Assistance (PPTA)  
North Eastern Integrated Flood and Riverbank  
Erosion Management (NEIFREM: Assam)**

**Process**

- 2004-2005: Consultations between ASG and ADB
- Dec. 2005: ASG request to ADB through GOI
- Mar. 2006: TA Fact-finding mission
- May 2007: PPTA initiation
- Phase I (– Sept 2007): Sector review & strategic framework; pre-feasibility assessments
- Phase II (– May 2008): Policy & institutional assessments; feasibility & safeguards studies; project formulation
- June 2008 –: Appraisal process (subject to technical, social, environmental, institutional, & economic feasibility)

1 ADB

**NEFREMP (Assam) Preliminary Objective & Scope  
Objective**

Strengthen ASG's risk management systems & capacities for flooding and river erosion through comprehensive, cost effective, affordable, and sustainable measures

**Coverage**

- State wide institutional strengthening
- PPTA covering four priority sites by ASG for specific FREM interventions (having flood embankment systems)  
→ Dibrugarh, Palasbari, Kaziranga, and Matmara

2 ADB

**Tentative Scope**

**A. Institutional Strengthening**

- Policy, planning and institutional framework – disaster mgt system, FREM, IWRM, sustainable funding, etc.
- FREM institutional systems: KM, T&A, QC, participation, etc.

**B. Comprehensive FREM Measures in Priority Sites**

- Participatory planning and design with options assessments
- Comprehensive FREM structural & non-structural measures most suitable to the locality
- Support systems, e.g., livelihoods for the erosion victims
- Monitoring and sustainable maintenance

**Potential Project Modality**

- Longer term programmatic approach with several tranches – 1<sup>st</sup> tranche to focus on most critical areas with pilots and knowledge building

3 ADB

**NEIFREMP (Assam) – Opportunities**

- Flood and bank erosion major destabilizing factors of state economy  
→ Flood embankments requiring rehabilitation, many threatened by riverbank erosion
- Present approach ad hoc, reactive, structure-oriented, top-down with certain inefficiency in management process  
→ Scope for better cost effectiveness & sustainability, with alternative approach following international good practices
- State willing to promote comprehensive FREM with IWRM perspectives linked with improved disaster mgt systems

4 ADB

**NEIFREMP (Assam) – Challenges**

- Highly dynamic morphological processes under limited stabilization requiring high capital costs
- Balanced combination with nonstructural FREM measures – suitable to local conditions accepted by stakeholders
- Limited stakeholder participation for all processes
- Policy, planning, and institutional framework for integrated FREM and disaster mgt – early stage of development
- Limited data and knowledge base (e.g., hydrology, geomorphology, environment, catchment-sediment relations)
- Sound management systems for planning, design, and implementation with accountability – improvement critical
- Lack of mechanisms and funding for systematic monitoring and maintenance

5 ADB

**NEIFREMP (Assam) – Activities So Far**

**Project Preparatory TA – Phase I**

- FREM sector and institutional review, strategy and action agendas
  - Design options and performance review of conventional and alternative FREM measures
  - Participatory preliminary feasibility assessment of four core subproject sites proposed by ASG
  - Stakeholder consultations
- PPTA Phase II to undertake (i) scoping of specific interventions for core subproject sites; (ii) detailed institutional assessments & action formulation; and (iii) feasibility studies including safeguards

6 ADB

## NEIFREM (Assam) – Key Strategic Elements (1)

### Policy, Planning, and Institutional Framework

- Sound policy framework for FREM and IWRM – State Water Policy and institutions with stakeholder participation
- Integration with ASG's disaster mgt system with institutional strengthening of the latter at State to grass root levels
- Sound & strategic planning and programming framework for comprehensive FREM – FYP, 20 year vision, etc.
- Political will and stakeholder awareness and support

### WRD Institutional Setup and Management

- Vision and strategy; human resources & skills mix; financial mgt; knowledge base and mgt; business processes for planning, implementation, QC, M&E; T&A mechanisms with participation; asset inventory and mgt

## NEIFREM (Assam) – Key Strategic Elements (2)

### Flood Risk Management

- Structural: Flood protection security in strategic critical urban and rural centers, and alternative approach (e.g., flood proofing, small-scale community approach) for other areas
- Multiple use of embankments where feasible, with platforms for erosion displaced people as appropriate
- Non-structural: Extending FF&W with stronger dissemination, flood plain zoning (with better knowledge of local hydrology), flood moderation with wetland reservation/restoration
- Community-based approach in flood risk profiling, mapping, and zoning; community disaster plans, and capacity building for disaster management

## NEIFREM (Assam) – Key Strategic Elements (3)

### Riverbank Erosion Risk Management

- Structural: Exploring lower cost and adaptive alternatives, e.g., revetments, porcupines, sand-filled geo-bags, etc.
- Adaptive and flexible response to dynamic river process through a programmatic approach
- Substantial improvement in management systems – planning, prioritizing, designing, implementing with QC, and M&E
- Non-structural: State-wide bank line prediction and monitoring system integrated with pro-active planning and programming
- Establishing firm knowledge base for basin geo-morphology
- Establishing erosion warning and relief mechanisms integrated with flood plain risk mapping and zoning

## NEIFREM (Assam) – Key Strategic Elements (4)

### IWRM and Planning Perspectives

- Establishing sound data and knowledge base on basin hydrology, geo-morphology, environment, etc. – with coordinated planning of infrastructure (e.g., roads & railways)
- Steps towards interstate cooperation, e.g., data exchange, common knowledge base, basin-wide planning, etc.
- Environmental implications of FREM interventions – downstream & upstream hydrology and morphology, impacts of upstream works, climate change, riverbed rising, etc.
- Social implications of FREM interventions – R&R, scheduled tribes, and other vulnerable people
- Multi-disciplinary setup for planning and implementation

## NEIFREM (Assam) – Key Strategic Elements (5)

### Sustainable Maintenance of FREM Infrastructure

- Establishing sound asset inventory and management system
- Involving community/local government institutions (LGIs) in asset performance monitoring, maintenance planning, and implementation monitoring
- Improving planning, prioritization, fund allocation, and implementation mechanisms with stringent QC
- Promoting multiple use of embankments for cost sharing, and exploring existing LGI programs and funds
- Progressive increase by ASG in fund allocation for FREM infrastructure maintenance

## Next Steps

### Phase II (up to mid May 2008)

- Scoping for specific interventions for core subproject sites
- Feasibility studies and safeguards assessments, including EIA and RP (and IDP as required)
- Institutional assessments for policy, planning, and institutional framework, & WRD institutions
- State/national workshops at mid-term and draft final stage



Assam State Government  
 Ministry of Water Resources  
 Water Resources Department

**North Eastern Integrated  
 Flood and Riverbank Erosion Management (FREM)  
 Project (Assam)**

**PRE-FEASIBILITY STUDY  
 PRELIMINARY FINDINGS**

Knut Oberhagemann, Consultant, PPTA Phase I

1 December 2007

**This presentation**

- Outlines approach and present status of knowledge of the WRD's ongoing flood and erosion mitigation initiative supported by ADB.
- Summarizes the preliminary findings of the first initial study
- Indicates the importance of integrating structural and non-structural measures
- Outlines future steps before starting implementation under a new initiative

**Outline of Presentation**

1. Background
2. The Problem
3. Pre-feasibility Findings
4. Feasibility Approach (the next step)

**General Background**

Development Need of North Eastern Region

1. Lagging behind average country wide development
2. Above average poverty
3. Recurring disasters related to flooding and riverbank erosion
4. Sustainable development depends on reducing the vulnerability to flooding and erosion

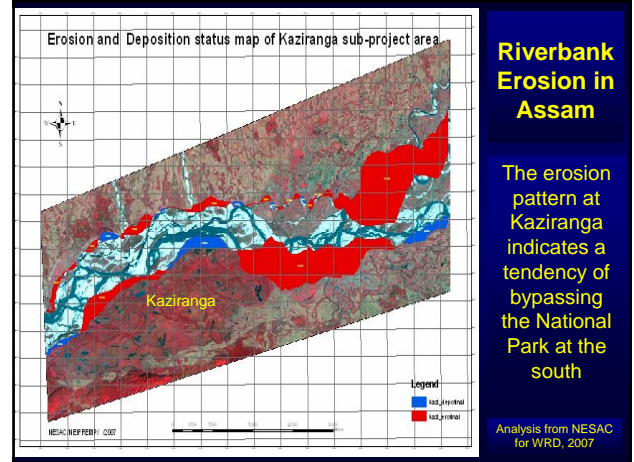
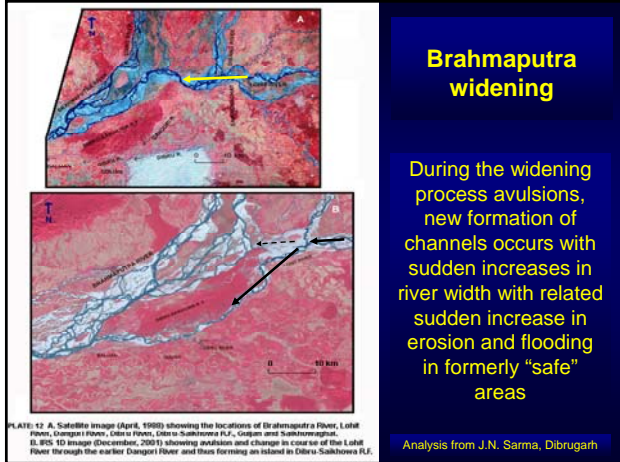
**Project Formulation and Future Scenario**

After the 2004 flood Government of India asked ADB for support. This has started a multi-step approach concentrating on the Brahmaputra main-stem:

- Technical Assistance Fact Finding (early 2006)
- Project Preparatory Technical Assistance (PPTA)

pre-feasibility	May – Sep 2007
feasibility	Nov 2007 – May 2008
- Loan Fact Finding (review of PPTA and decision about implementation)
- Implementation (for example 2009 - 2017)

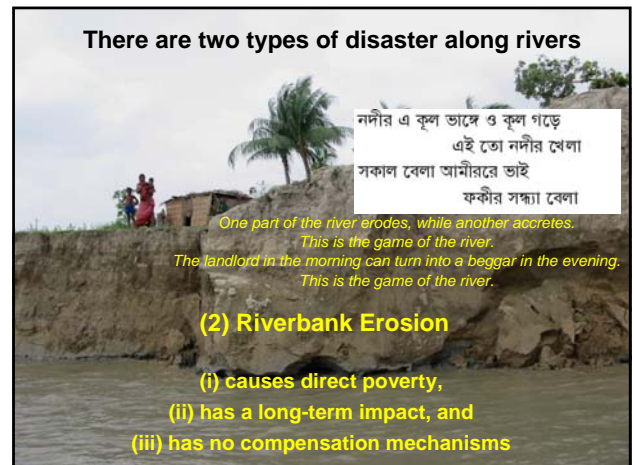
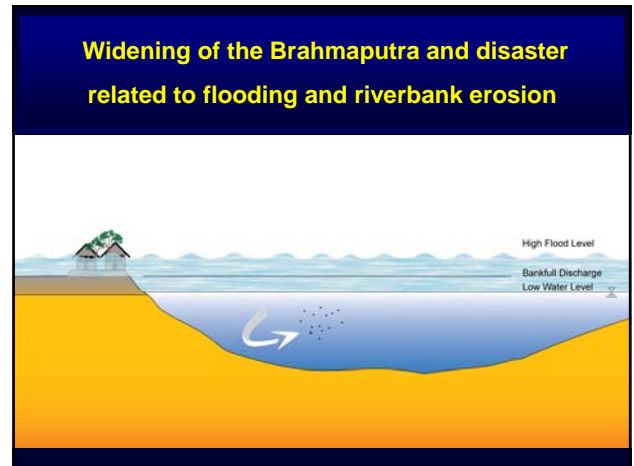




**Brahmaputra widening**

1. First survey (1912-28):	area:	3,870 km <sup>2</sup>
2. Second survey (1963-75):	area:	4,850 km <sup>2</sup>
3. Third survey (2006 NESAC):	area:	6,080 km <sup>2</sup>

**Indications**  
 The river area increased by more than 50%  
 The annual average loss of land is nearly 2500 ha



## Social Dimension of Erosion Related Disasters

Riverbank erosion and inundation frequently affect large parts of the floodplains.

The majority of people living along the riverbanks are poor.

Poor people cannot easily recover from disaster.

Riverbank erosion and inundation increase poverty.

## What can be done?

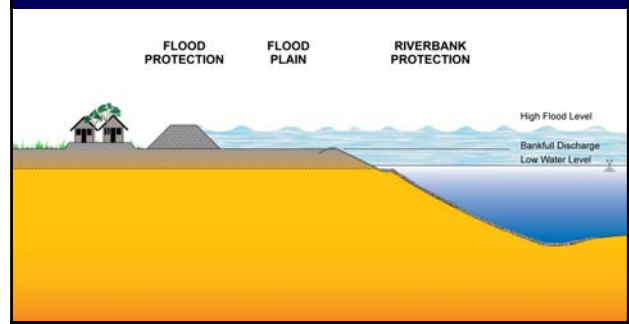
“Take people away from the risk or take the risk away from people”  
(reduce vulnerability)

Prevent disaster pro-actively or mitigate the effects of disaster

## Reduce vulnerability and pro-actively prevent disaster



## STABILITY through Flood and Riverbank Erosion Protection



## Flood and Riverbank Erosion Protection Important Issues

- Flood protection exists in Assam since 50 years (more than 4,000 km of embankments were built before the end of the 1970s)
- Effect of global warming indicates more pronounced flooding (higher rainfall intensities)
- Riverbank protection along the natural alignment (reduction of land loss and sediment intrusion)
- Riverbank protection has positive effects on a stable floodplain habitat and fish

## Riverbank Protection reduces Poverty

- Riverbank protection means stable living conditions
- Stable living conditions allow longer term planning and investments
- Investment is a pre-condition for economic development
- Economic development increases livelihood and reduces poverty

### The Story of Dibrugarh and Palashbari

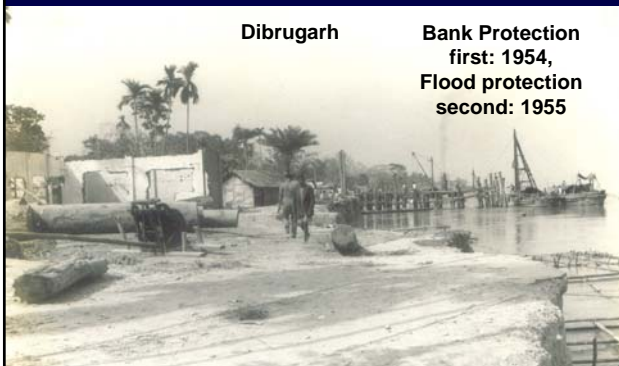


### Lessons from the Past: (i) the beginning of IWRM



**Strong political will  
Champion  
Funding  
Cooperation**

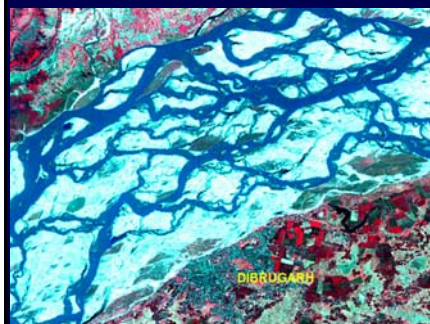
### Lessons from the Past: (ii) riverbank protection



**Dibrugarh**

**Bank Protection  
first: 1954,  
Flood protection  
second: 1955**

### Lessons from the Past - IWRM



*"What has already been done at Dibrugarh deserves to be made known throughout India, and indeed the whole world. It is a story of challenge taken and met with firm determination, hard work, and all round cooperation leading to success."*  
Jawaharlal Nehru, 1955

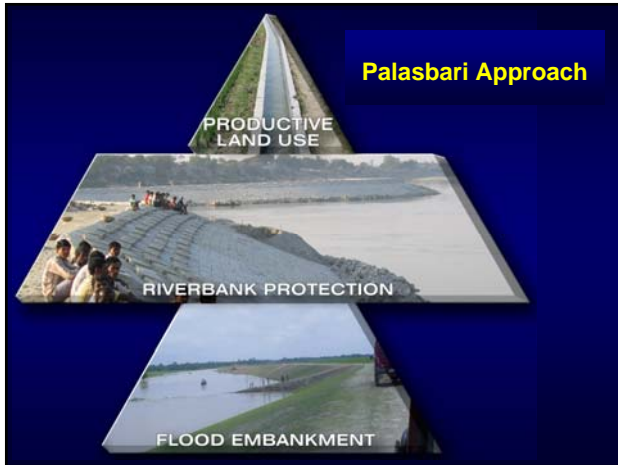
### Lessons from the Past - FREM in Assam

	<b>Dibrugarh</b>	<b>Palashbari</b>
Erosion protection since	1954	1984
Erosion since 1950	nil at town	1680 ha 1950-80
Embankments since	1955	1955
Embankment retirements	none	up to five times
Population today	120,000	10,000

<b>Cost (2003 price level, Crore Rs.)</b>	<b>Dibrugarh</b>	<b>Palashbari</b>
Anti Erosion Work	140 / 75%	137 / 82%
Embankment	27 / 15%	25 / 15%
Flood Damage Rehabilitation and Maintenance	19 / 10%	4 / 3%
<b>total</b>	<b>186</b>	<b>167</b>

### Dibrugarh Approach





- ### Outline of Presentation
1. Background
  2. The Problem
  3. Pre-feasibility Findings
  4. Feasibility Approach (the next step)

- ### Scope of Pre-feasibility Study (Phase I)
- Outline a strategic framework and options for integrated Flood and Riverbank Erosion Management (FREM) at State and selected subproject level
- Prepare a FREM strategy and action agenda with IWRM perspective
  - Identify and assess non-structural and structural options for most effective approach to FREM in sample subproject areas, following a strong participatory planning process

### Integrated Water Resources Management (IWRM)

IWRM is a comprehensive approach to the development and management of water.

The Global Water Partnership defines IWRM as *"a process which promotes the coordinated development and management of water, land, and related resources in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems"*

**FREM is a component of IWRM and deals with the destructive side of water**

- ### IWRM and FREM
- The three "pillars" of IWRM and FREM
- Enabling Environment (policy, legal framework, financing and incentive structures)
  - Institutional Framework (organizational framework, institutional capacity)
  - Water Management Instruments (for example: management plans, information management, management tool such as guidelines for design, prediction, conflict resolution),

- ### IWRM and FREM
- The three "pillars" of IWRM and FREM
- Enabling Environment – often in place
  - Institutional Framework - often ineffective and inadequate
  - Management Instruments – exist and can be integrated and further developed

## Integrated Water Resources Management (IWRM)

### SUCCESS DEPENDS ON:

- Strong political will
- Sufficient funding
- Data and information sharing for development (coordination)
- Champion – prominent leader
- History of decentralization – participatory approach
- Solving problems at the lowest appropriate level (Assam)

## IWRM and Participatory Approach

- Poor people demand permanent solutions, not relief
- Pro-poor development requires stability
- Marginal farmers have concepts of how to increase area output, after stability is guaranteed
- Flood embankments play an important role as communication arteries

## Key pre-feasibility findings

### Non-structural:

- Political commitment – “decade of flood and erosion management”
- Institutional framework – leader required (Disaster – WRD)
- Planning tools: Flood-plain zoning, erosion prediction
- Participatory planning mechanism

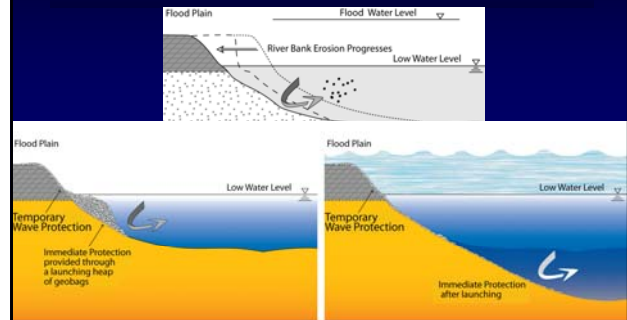
### Structural:

- Alternative low-cost riverbank protection solutions
- Embankment strengthening and closure of breaches
- Adaptive approach – phased implementation
- Riverbank protection first – where justified

### Non-structural and structural integration

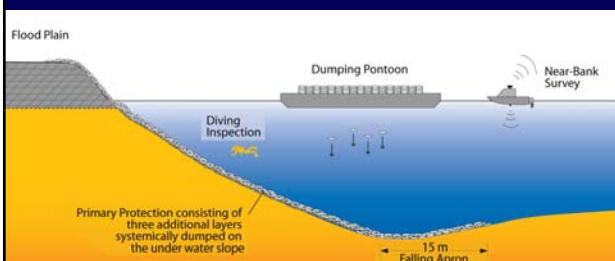
## Phased Implementation

### (1) Immediate Protection for Emergencies



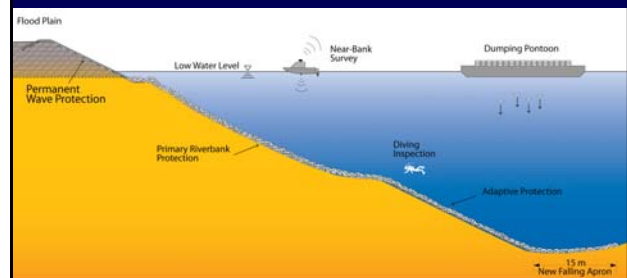
Acute erosion of riverbanks is mitigated through Immediate Protection under water and Temporary Wave Protection above low water level.

## Phased Implementation (2) Main (Primary) Protection for Stability



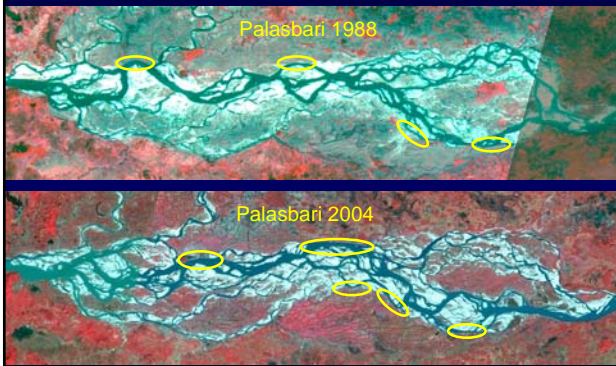
Primary Protection stabilizes the bank and prevents failure during future erosion.

## (3) Adaptive Protection and Permanent Wave Protection



Adaptation of riverbank protection to greater depth. Adaptation work after part of the primary falling apron has deployed provides a berm and additional geo-technical stability

## Adaptive work – managing erosion where required



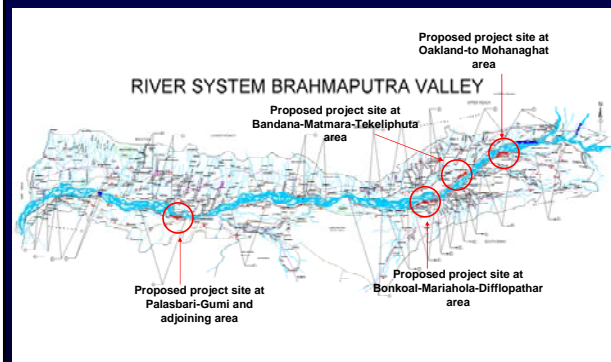
## Structural and Non-structural Integration Embankment Reliability and Temporary Shelter for Erosion Victims



- Temporary rehabilitation
- Increase of embankment stability
- Re-design for higher flood frequencies



## Four Sample Project Sites



## Salient features of Sample Project Sites

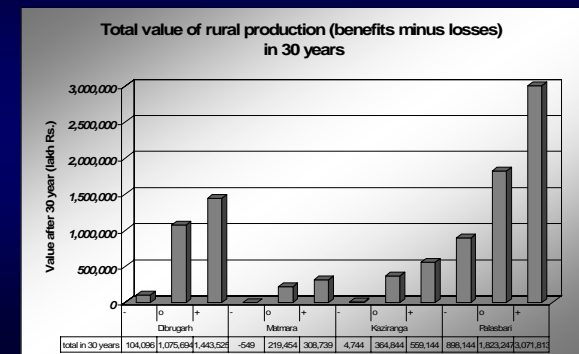
	Dibrugarh	Matmara	Kaziranga	Palasbari
<b>General Information</b>				
Estim. project area (ha)	14,979	71,534	20,413	107,943
Length of project (km)	25.75	9.0	28.9	28.5
Length of existing embankment (km)	25.75	8.5	28.4	28.5
Length of A/E works (km)	8.0	0	0	10.0
<b>Flooding</b>				
Period	2002-5	2002-5	2002-7	2002-7
Min flooded area (ha)	48 (2002)	2,908 (2002)	969 (2005)	988 (2002)
Max flooded area (ha)	24,768 (Jul 2003)	49,183 (Jul 2004)	17,567 (Jul 2004)	26,454 (Jul 2004)
<b>Erosion</b>				
Period	1972-2006	1972-2006	1972-2006	1972-2006
Erosion along bank (ha)	7,208	37,423	13,402	3,697
Accretion along bank (ha)	1,688	1,497	2,771	1,942

## Pre-feasibility economic scenarios

Four scenarios for economic feasibility

- "Do nothing"
- "Business as usual"
- "Reliable protection"
- "Reliable protection plus supporting programs"

## Pre-feasibility economic scenarios



## Draft Pre-feasibility Study

### Summary

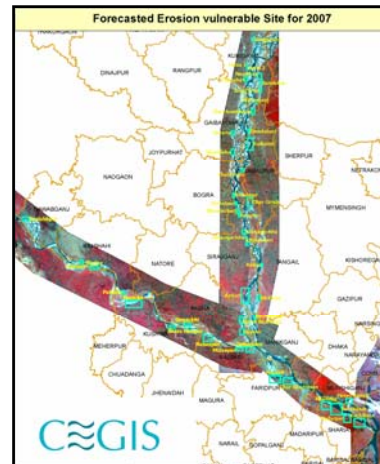
1. Strong participatory approach
2. Focus on pro-poor development (permanent solution not relief)
3. Focus on institutional framework for modern IWRM approach
4. Large amount of data collected

## Outline of Presentation

1. Background
2. The Problem
3. Pre-feasibility Findings
4. Feasibility Approach (the next step)

## Scope of Feasibility Study (Phase II)

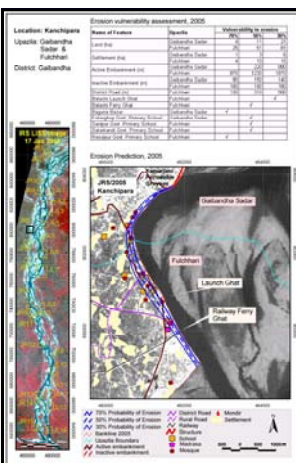
1. Feasibility Studies
  - Finalize participatory options and detailed feasibility studies of sample subprojects
  - Assess safeguards and prepare requisite action plans
  - Formulate social development strategy and action program
2. Institutional Analysis
  - Follow consultative process in preparing sector road map, including actions for strengthening WRD, sustaining O&M, and fostering integrated FREM and IWRM
3. Investment Project Packaging
  - Formulate investment program and a project package ready for implementation



## Erosion Prediction

### Number of Locations

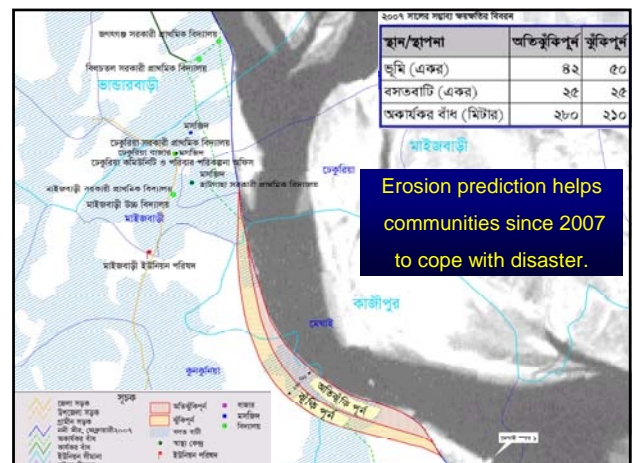
Jamuna:	28
Ganges:	10
Padma:	7
<b>Total:</b>	<b>45</b>



## Site Prioritization Erosion Prediction

Erosion prediction helps Government to assess losses and to plan future interventions.

Erosion prediction exists for the three major rivers Jamuna, Ganges, and Padma



Erosion prediction helps communities since 2007 to cope with disaster.



## Inter State Workshop

### Pre Feasibility Findings

## North Eastern Integrated Flood and Riverbank Erosion Management Project (Assam)

### Session II

### The Participatory Approach: Peoples Living Conditions and their aspirations

By

Tarkeshwar Ekande Socio-Economist ADB TAC

1 Dec 2007

## Outline of Presentation

1. Scope of Work for Pre Feasibility Studies
2. Project Protocol;
3. Project Safeguards;
4. Phase I Activities;
5. Review of Detailed Project Reports;
6. Socio economic studies;
7. Summary Findings;
8. Outcome of the Focus Group discussions;
9. Perception of people on protection measures;
10. Suggestions of the people;
11. Feasibility Phase Activities;
12. Issues for discussions

## Scope of Work for Pre Feasibility Study

- Prepare Socio-Economic Profiles: for each of the selected sub project area;
- Land tenure and extent of displacement due to the flooding and river bank erosion;
- Identify development constraints of subproject areas, covering agriculture, fisheries, forestry, industry, roads and transport;
- Impacts of the flooding and river erosion and their risks on the people's behavior and coping measures,
- Explore and identify opportunities to reduce the risks and enhance coping measures thereby enhancing their livelihoods including alternative flood management approach
- Recommend appropriate institutional modality to support community participation and local resource mobilization;
- Undertake pre-feasibility level assessment of the identified alternative FREM strategy and options.

## Project Protocol

- Creation of assets and not the liability of the bank financing on the state. It is possible if the sub projects are viable in economic and financial terms;
- Visualizing Poverty Eradication through economic self sufficiency and creating enabling environment if the area is made erosion and flood free;
- Sustainability of interventions through Participatory Planning Process involving beneficiaries of the project in project cycle – Planning, Execution, Operation and Management of the Project infrastructure; and
- Setting avenues for WRD institutional reforms.

## Project Safeguards

- Reducing Resettlement Impact;
- Interest of the Socially Backward communities; and
- Environment

## Phase I Activities

1. Study of Detailed Project Reports;
2. Collection of project level secondary data;
3. Conduct sample village level survey: 4 villages in each sub project representing upstream, middle and downstream typologies;
4. Formulating Sub Project Profiles;
5. Sharing of data with the concerned WRD Divisions;
6. Consolidating preliminary pre feasibility findings using indicative estimates

## Review of Detailed Project Reports

- Listed affected villages and urban settlements in the project areas;
- Prepared map showing high, medium and low vulnerable zones;
- Listed economic assets, properties and production systems;
- Obtained present productivity and production levels;
- Assessment of production losses and damages due to flood and erosion;
- Reviewed Benefit Cost Analysis – Need for refinement taking in to account Economic Internal Rate of Return and Net Present Value;
- Sharing of draft sub project profiles with Divisions and
- Promoting discussions towards Building Vision for NEIFREM.

## Socio Economic Studies

### Purpose:

- To understand the socio-economic environment situation in the area and proposed project benefits due to the project;
- To prepare sub project profiles of each of the project; &
- To study the detailed project reports submitted to the ADB.

### Contains of the study:

- History of flood and erosion;
- Area Profile, Land, social characteristics – rural, urban, Livelihood Patterns;
- Environmental issues;
- Assessment of extent of benefiting area and population;
- Inventory of losses with and without interventions; and
- Exploring scope for economic development.

## Summary Findings

- Demography
- Livelihood Indicators
- Development Potential (Gross Domestic Product)
- Project Impact Projections; and
- Impact of the Flood and River Bank Erosion

## Demography

Indicators	Sub Project areas			
	Dibrugarh	Matmara	Kaziranga	Palasbari
Number of villages	26	200	57	372
a. Number of Urban areas	2	2	2	2
b. Number of Tea Estates	12	2	10	0
c. Population - No of persons	288,140	328,645	59,956	522,986
d. No. of households	9,224	44,277	46,950	49,478
e. No of Poor Households (Percentage to total households)	7380 (80)	28780 (65)	35220 (75)	34635 (70)
f. Social Categories Proportion in % of households				
SC	15		10	10
ST	15	100	42	16
OBC	25		14	40
General	45		34	34
g. Literacy Rate (% literate population)	68.56	68.96	69.38	74.16

## Livelihood Indicators

Indicators	Sub Project Areas			
	Dibrugarh	Matmara	Kaziranga	Palasbari
Type of Housing (%)				
- Thatched Roof	60	80	80	80
- Assam Type	40	20	20	20
a. Land Ownership (average holding in ha)	0.30	0.50	0.40	0.30
b. Value of the land per ha	300,000	30,000	28,500	225,000
c. Value of Productive Assets owned per household e.g. livestock in Rs.	1,000	1,500	2,000	1,500
d. Income per capita per year as per sample survey of 16 households in each sub project area	3,396	3,733	3,809	7,999
e. Cropping Intensity %	133	140	170	NA
f. Crop Productivity Paddy (Qt/ha)	3	4	4	3
g. % of population depending on daily wage	65	35	50	50
h. Access to Electricity (% villages)	0	0	0	0
i. Drinking Water Supply (% of villages)	50	50	50	25
j. Sanitation and drainage provision (% of villages)	0	0	0	0

Note: Present population and area projected based on data received from 4 revenue circles out of 6.

## Development Potential (Gross Domestic Product in Rs.)

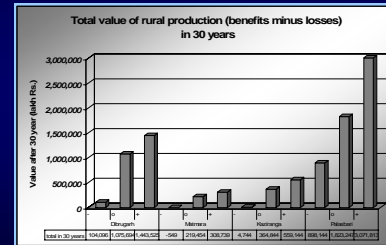
Particulars	Dibrugarh	Matmara	Kaziranga	Palasbari
Gross Domestic Product per ha in Rs. In 2005-06	68,395	32,566	34,565	1,29,408
Total geographical area of the project (Ha)	14,973	26,964	20,413	81,765
Value of GDP in the project area in Rs.Lakhs per year	10,245	7,056	8,781	1,05,810

Source: Directorate of Economics and Statistics, Government of Assam, 2005.

## Project Impact Projections (30 years)

Option	Interventions	Impact
Do-nothing (c)	No future interventions	Large-scale degradation of the environment
Business as usual (d)	WRD interventions as in the past and at present	No improvements to the stability, reduction of living conditions due to increasing population pressure
Reliable protection (e)	Full flood and erosion mitigation	Stability and increased productivity of the area reaching State average
Reliable protection with additional programs	Full flood and erosion mitigation plus supporting targeted programs	Stability and increased productivity above State average

## Project Impact Projections



## Impact of the Flood and River Bank Erosion (data for last 10 years)

Particulars	Dibrugarh	Matmara	Kaziranga	Palasbari
Total project area (Ha)	14,979	71,534	20,413	107943
Number of villages	14	200	57	372
Villages affected by flood during last 10 years	11	200	54	372
% villages affected by flood	79%	100%	95%	100%
Area affected by flood (ha)	14,882	38,194	7,967	26,454
% affected to total area	99%	53%	39%	47%
Crop lost by flood	35%	63%	59%	49%
Villages affected by erosion during last 10 years	3	109	9	150
% villages affected by erosion	21%	55%	16%	40%
Urban centers affected by erosion	1	0	1	1
% Urban centers affected by erosion	50%	0%	50%	50%
Area affected by erosion during last 10 years (ha)	1,771	3,000	5,322	3,000
% area affected by erosion	12%	4%	26%	5%
Land value (ha)	300,000	30,000	28,500	225,000
total value lost (lakhs)	5,313	900	1,517	6,750
Total affected households	41,160	23,450	6,309	21,500
Small and marginal farmers affected (percentage to total)	80%	90%	71%	80%

## Outcome - Focus Group Discussions

- Vulnerable Living Conditions – poverty, health, education;
- Drainage congestion – Dibrugarh, Palasbari;
- Occurrence of Water logging every monsoon;
- Erosion is pronounced;
- Crop damages, subsistence farming practices;
- Damage of common property resources – Beels;
- Chapori / Charlands – Resource or Threat to Dibrugarh;
- Threat to Kaziranga National Park;
- Damage to the forest areas and flora and fauna;
- Threat to Tea Estates;
- Dependency on flood relief and
- Hampered development of Dibrugarh and Palasbari.

## Perception of the People on Protection Measures

### Plus Points

- + Majority of people perceive WRD interventions as useful;
- + WRD respond positively to the post flooding and erosion along the mighty Brahmaputra;
- + Also most people assess ASG support in terms of relief and disaster management as satisfactory.

### Minus Points

- Short term control measures continues without assuring permanent protection making flood and erosion free environment;
- Measures remain inadequate and not lasting long; and
- Interventions – Community relations do not exist. At some places, lack of trust on each other was observed.

## Suggestions by People

- Address root causes of flood and erosion through long term solutions;
- Prioritize Immediate and strategic responses correctly;
- Focus on creating enabling environment for harnessing development potential;
- Timely, adequate, sustainable, appropriate interventions with transparent transactions;
- Traditional coping mechanism are also effective;
- Confidence building between Project – People (some places it is non-negotiable).

## Feasibility Phase Activities

- Socio economic analysis of the poverty implications of erosion and flood protection;
- Economic Analysis (EIRR) and NPV;
- Background analysis on commerce, trade, industry development in addition to other rural sectors such as forestry;
- Environmental Impact Assessment;
- Development of resettlement framework;
- Development of targeted social programs and outlining rural development potential including crops, fisheries, livestock, sericulture, and agro business; and
- Evolving a process of peoples participation at Planning, Execution and Operation and Management of the structures and non structural support measures including convergence of the prevailing Government Programs.

## Issues For Discussion

- Lessons learnt to determine "Do's and Do Not" for future;
- Long-term appropriate solutions to address problem;
- Vision Building through community awareness;
- Prioritization of the immediate and strategic measures;
- Integration of structural and non structural interventions;
- Safeguarding project affected persons, environment and poor segments of the communities;
- Designing process of community participation within prevailing legal framework in Planning, Execution and Operation and Management of created infrastructure;
- Specific issues – Charland, Kaziranga, Urban Centers.
- Convergence and integration of the supportive programs;
- Capacity Building measures – WRD and community; and
- Government participation in the program driven by people/communities.

Questions ???

Comments ???

Thank you

