A study on flooding problem of mighty river Kushiyara

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Abstract
Floods have been an alien source of handicap to the development of Assam. Flood waters typically en-gulf farm land, making the land unworkable, subsequently preventing crops from being planted or harvested. This leads to shortage of food both for humans and farm animals and thus price increase is a common aftermath of severe flooding. Entire harvests for a state can be lost in extreme flood circumstances. Flooding includes loss of life, infrastructure damage including bridges, roadways, canals, power transmission and generation systems, wrecking of drinking water treatment plants, water supply and sewage disposal facilities. Lack of clean water combined with human sewage in the flood water raises the risk of waterborne diseases such as typhoid, cryptosporidium, cholera, leptospirosis, hepatitis A, dermatitis, conjunctivitis and many other diseases depending upon the location of the flood. This paper mainly deals with the flooding problem of mighty river Kushiyara (acting as the river boundary between India and Bangladesh and situated on the bank of Karimganj town, Assam) which is one of the major sources of flood in lower Assam along with the various phases of anti-erosion works done in one of the flood affected reaches of Karimganj town by the Water Resources Department, Assam in order to safeguard human life and properties from this natural calamity.

Key Words: Wrecking, Sewage Disposal, Cryptosporidium, Leptospirosis, Karimganj town

1 Introduction
Assam, the Central State of North East Region is located in a peculiar geographical entity which is having a geographical area of 78,438 sq. km. Hydro logically, it receives all the runoff of the surrounding states and countries and drain them off through principal river systems namely the
Brahmaputtra and the Barak which are fed by innumerable tributaries and the sub-tributaries. The Southern Assam is completely drained by the Barak river system which is the second largest river system of the North East India having interstate and international ramifications. Although, many short term flood management and anti-erosion measures in pursuance of recommendations of ‘Rastriya Barh Ayog’ have been taken and long term, cost intensive measure like ‘Tipaimukh Storage Dam’ is under active consideration of the Govt. of India, still the state is affected by successive huge loss of human habitation, cattle/livestock and standing crops due to the severe flood that occurs each and every year in the state of Assam. The loss to the three districts of lower Assam (Cachar, Karimganj and Hailakandi) constituting the Barak valley covering an area of 6922 sq. km., is to the tune of hundred crores.

The river Barak, originates in Nagaland near the Nagaland-Manipur border. After flowing through the hilly terrain in Manipur state and then along the Manipur-Mizoram and Assam-Manipur borders for a distance of about 403Km, the river Barak reaches Lakhipur in Assam, where the river flows for a distance of 129Km through the plains of Cachar and Karimganj districts of Assam till it reaches Bhanga, where the Barak splits into two branches known as the Surma on the right side and the Kushiyara on the left side. Both of these branches further extend upto Bangladesh.

The river Kushiyara which is the Southern branch of the river Barak is a meandering river with prominent loops among its course. It flows towards west and enters Bangladesh near Lafashail of Bangladesh.

Figure 1: River Kushiyara acting as the river boundary between India and Bangladesh.
Karimganj district, Assam. It carries approximately 80% of the discharge of river Barak. The Karimganj town being the District head quarter of Karimganj district which comes under the Indian territory is located on the left bank of the Kushiyara and the opposite bank is the Bangladesh.

1.1 Flood:

A flood is an overflow of water that submerges land which is usually dry. The European Union (EU) Floods Directive defines a flood as “a covering by water of land not normally covered by water”. It may also refer to the inflow of the tide.

2 Problem

About 70% precipitation of South-West monsoon takes place between June-September during which high bank slumps down and get eroded. The meandering and shifting pattern of Kushiyara through the alluvial plane also results in bank erosion and sloughing. Due to construction of anti-erosion works on the Bangladesh side, the deep channel flow line has shifted.
towards the Indian side, where progressive bank sloughing have eaten up great chunk of Indian land and now threatened the existence of flood protective embankment and will expose Karimganj town to floods. As a result the NH-44, NH-151 and other public and private utilities writhing crores of Rupees will be damaged. In fact, the problems are twofold. During monsoon, huge discharge having high velocity hit the left bank causing erosion, while during winter at draw-down stage, seepage flow from within the country side gradually removes soil particles causing slumping of the exposed side of the bank towards the river side. The primary cause of the seepage is the permeable soil media and the batteries of the ponds in the country side of the embankment.

3 Justifications and Scope

The protection work of Karimganj town is required to be implemented immediately as otherwise there will be huge loss of Indian Territory. This urban area is densely populated and there is no scope for retirement of embankment. As such there will be snapping of NH-44, NH-151, railway lines, which are the only surface link between Tripura and Assam with the rest of the country. So to save these assets of public and government, it has become utmost necessary to take up the scheme for execution immediately which will benefit an area of 2500 hectares and 40,000 Nos. of population. Although the study of the proposed project undertaken by the Water Resources Dept has a wide scope, still due to Govt. regulations the scope of this project is limited to its own state only.

4 Objectives of the Study

1. To identify the flooding problem of river Kushiyara.
2. To study the various phases of River protection work.
3. To provide suggestions and recommendations

5 Need for the study

Need For Closing/Drainage of Ponds, Water Bodies In That Area

The batteries of tanks were excavated by the local people within the country side long back were far away from the bank of the river but within the country side of the dyke. The water accumulated in the tank finds its way through the seepage leading to the river. As a result, soil particles are very slowly and steadily removed through the seepage lines because of the ponds. The first step to eliminate this flooding problem is, therefore, to close this battery of ponds or to create proper drainage to drain out the water at a distant place downstream.

6 Phases of the Project

Phase-1: Preliminary survey of the project site

The selection and priority of the Water Resources projects are based on various aspects viz. the number of loss of life & public properties, traffic and transportation, business activities, socio-economic aspects, National & International security issues, public demand & grievances etc.
Therefore, reduction on flooding damages is estimated as a certain percentage of annual flooding damages depending on the design period of facilities.

\[ \text{AFD} = ( (\text{RA} \times \text{AVRA} + \text{CIA} \times \text{AVCIA}) \times 1.50 + \text{AA} \times \text{AVAA}) \times 1.05 \]

Where: \( \text{AFD} \) : Annual Flood Damages.

PHASE 1
PRELIMINARY SURVEY OF THE PROJECT SITE

PHASE 2
ADMINISTRATIVE, TECHNICAL AND STATUTORY CLEARANCE FROM THE STATE / CENTRAL GOVT. AUTHORITIES

PHASE 3
PROJECT COST MANAGEMENT

PHASE 4
FUNDING OF THE PROJECT

PHASE 5
ADMINISTRATIVE APPROVAL AND TECHNICAL SANCTIONING OF THE PROJECT

PHASE 6
PROJECT PROCUREMENT MANAGEMENT

PHASE 7
WORK ORDER GENERATION

PHASE 8
PROJECT SCHEDULING

PHASE 9
QUALITY CONTROL ASPECTS

PHASE 10
PROJECT MONITORING

PHASE 11
BILL PASSING AND PAYMENT

Figure 2: Phases of the project

RA : Residential Area.
CIA : Commercial/Industrial Area.
AA : Agricultural Area.
AVRA : Assessed Value of damageable property within RA.
AVCIA : Assessed Value of damageable property within CIA.
AVAA : Assessed Value of damageable property within AA.

Hence,

\[ \text{Benefit} = \text{AFD} \times (\% \text{ of reduction of flooding due to the project}) \]
Among the facilities that can be considered under this category are flood control dam, dike/levee/embankment, retarding basin, cut-off/diversion channel, deepening/widening/dredging works.

Further the bank erosion damages are taken into consideration for selecting such projects. There are two types of bank erosion damages: a) due to continuous bank erosion and b) due to change in river course & seepage from country side. Continuous bank erosion damages are assumed to be the assessed value of damageable area based on the bank erosion rate. Damages to river course change are assumed to be the assessed value of properties within the areas enclosed by the existing and possible river course. Benefits on bank erosion damages are estimated as the assessed value of properties within the area being threatened.

Hence,

\[ ABED = \frac{TAVP}{PL} \]

where : ABED :Annual Bank Erosion Damages

TAVP :Total Assessed Value of Property within the threatened area

PL : Project Life

Among the facilities that can be considered under this category are revetment, spur dike, cut-off channel, re-channeling, groundsill etc.

Thus based on all of the above calculations and considerations the Project area Survey Team of Water Resources Department consisting of the Asstt. Executive Engineer, Asstt. Engineers, Junior Engineers of the concerned division headed by the Executive Engineer make the Project proposal which is further submitted to the Chief Engineer / Additional Chief Engineer through the Superintending Engineer. The Chief Engineer / Additional Chief Engineer examine the feasibility and selects the projects on the priority basis and forwards all the relevant documents of the project to the Administrative and Technical Committee meeting for final approval.

Phase-2: Administrative, Technical And Statutory Clearance From The State / Central Govt. Authorities

The administrative, technical and statutory clearance to such projects is given by the Technical Advisory Committee (TAC). The committee if formed by various administrative and technical officers viz. Secretary to the Govt. of Assam, Financial Advisor Chief Engineer, Additional Chief Engineer, Superintending Engineer, Deputy Director (Design) etc of Water Resources Department. After scrutiny by the experts present in the Technical Advisory Committee meeting, the proposal of the project is being accepted for execution. If the project site falls under Forest Area, then it is required to take clearance from the Forest Department. The same is required from the Pollution Control Board, if necessary. The Executive Engineer, Karimganj W.R Deptt. acts as the Nodal Officer and in-charge of the project. The implementation team comprises of the Executive Engineer, Karimganj W.R Deptt. with his highly experienced Engineers with proper guidance from the Chief Engineer W.R Deptt., the Additional Chief Engineer W.R Deptt., Cachar & Hills and The Superintending Engineer, Hailakandi W.R Deptt.
Phase-3: Project Cost Management

For justifying the implementation of the project, the benefit cost ratio is calculated. At first the cost of flood damages to lands/crops/houses are estimated which consists of monetary damage to the single storey, double storey, Assam type building, damage to the flood wall, damage to Govt. properties such as NH-44, NH-151, Railway lines, Temple, Mosque, & large nos. of Govt. Offices, Public Health, Institutions, Schools, Primary Health Centers etc. After considering all these factors, the value of flood damages per year which means the amount of benefit derived after implementation of the project is being computed.

In the second step, the total cost of the project which consists of the Direct charges and Indirect charges is calculated. Direct Charges includes ‘I’ Works (Preliminary, Land, Works, Building, Communication, Miscellaneous, Maintenance, Losses on stock), Ordinary T & P, Establishment, Suspense, Receipt & Recovery of Capital account etc. Whereas the Indirect charges include Audit & Account charges @ 1% ‘I’ works, 5% of cultivable land for capitalization of land. Then, the cost component towards interest charges, annual maintenance depreciation charge 10%, 5%, 2% respectively as per Central Water Commission (C.W.C) norms is considered.

Therefore, total annual cost = 17% of cost of the project

Finally, by using the value of flood damages per year and total annual cost, the Benefit Cost ratio is calculated and thus the project gets justified and fund collection and allocation phase starts.

Now, suppose if the total cost of a project is Rs 952.00 Lakh and The value of damage per year/ of benefit derived after implementation of the project is Rs. 503.73 Lakh/year, then

\[
\text{Total annual cost} = 17\% \text{ of cost of the project} = 952.00 \times 0.17 \text{ Lakh} = 161.50 \text{ Lakh}
\]

Therefore, Benefit Cost Ratio = 503.73: 161.50

\[
= 3.12:1
\]

Phase-4: Funding Of The Project

Such projects of Water Resources Department are being funded by various International and National funding heads viz. NABARD, FMP, World Bank, NLCPR, Task Forces, NEC, JRC, ACA, ISFA, SDR fund, PM package, CM package etc where a certain percentage of amount is provided by the Central Govt. and the rest of the amount is provided by the State Govt. The documents required for initial inclusion of project for funding under these agencies are as follows:

1. Clearance of State Technical Advisory Committee.
2. Clearance of State Flood Control Board.
3. Forest Clearance.
4. Certificate duly signed by concerned Chief Engineer of W.R Department of State Govt. that
   a. The land is free from any encumbrances.
   b. The project has not received any financial assistance from any agency in the past.
   c. The cost of the project is solid and any increase in the cost of the project will be borne by the State Govt.
5. Investment Clearance accorded by Planning Commission, etc.
Phase- 5: Administrative Approval And Technical Sanctioning Of The Project

After acceptance of the project by the high power Technical Advisory Committee, the project is required to be placed before the Administrative head of the Water Resources Department (The Secretary & Commissioner of Water Resources Department, Guwahati, Assam) for acceptance & accordance of the project by the Govt. of Assam by issuing certificate/letter of administrative approval so as to go ahead with the project.

After accordance of Administrative Approval from the State Govt., concerned Executive Engineer have to submit the project to the Chief Engineer for thorough Technical checking. Being satisfied with the various parameters e.g. rates of different items of works, quantities etc, the Chief Engineer accords the Technical Sanction of the scheme with strict instruction that there should not be any deviation in cost of the project, items of work, quality of work etc. If any deviation, due to adverse situation at the project site, the matter should be brought to the notice of the Chief Engineer immediately. In such cases, revised Technical Sanction for modified estimate is required to be accorded.

Phase-6: Project Procurement Management (Tender Invitation And Agreement Phase)

After the Administrative Approval and Technical Sanctioning of the project, necessary tender is called-for from Govt. registered contractors / suppliers of various categories such as

1. Category Class I A- Unlimited (Registering authority Chief Engineer(Works))
2. Category Class I B-UptoRs10crore (Registering authority Chief Engineer (Works))
3. Category Class I C- Upto Rs 5 crore (Registering authority Additional Chief Engineer)
4. Category Class II- Upto Rs 50 lakhs (Registering authority Superintending Engineer)
5. Category Class III- Upto Rs 5 lakhs (Registering authority Executive Engineer)
6. Category Class IV- Upto Rs 2 lakhs (Registering authority Executive Engineer)

Wide publicity is given to the Notice Inviting Tender. Tenders must be advertised in the Press and by notice in English/Hindi and regional language news paper of the concerned District. The Tender Notice is also displayed on the website of the Ministry/Department. On the due date and appointed time, as mentioned in the tender document, the W.R department opens the tenders in the presence of the intending bidders or their representative. The bidder’s name, the bid prices and discount, if any will be announced by the W.R Deptt. during opening of bids. A record of opening of tenders is also maintained.

Phase-7: Work Order Generation

After checking of all the valid tenders, the tender documents are sorted according to the various groups of contractors viz. Class I A, Class I B, Class I C, Class II, Class III & Class IV. A comparative statement (C/S) is prepared for each groups to evaluate the lowest and workable quoted rates. Then, C/S of the main C/S’s which is called as the Super Comparative Statement, is also prepared for the finalization of the rates. At the time of selection of the rates for works, it should be taken into consideration that the lowest quoted rate should be workable. Once the
contractor is selected based on the lowest & workable quoted rates, the allotment of work is done by issuing a work order to the selected contractor.

The work order is then followed by a formal tender agreement made in F-2 form (for works) / H-form (for supply of materials) of agreement document with 2% security deposit on total amount of work order, in the shape of NSC/KVP duly pledge in the favor of the Executive Engineer of the concerned division. As soon as all the legal requirements are fulfilled, the work is started immediately in consultation with the Assistant Executive Engineer and the other officers of the project team.

**Phase-8: Project Scheduling**

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<th>Total (in Rs.)</th>
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<td>1st Qtr</td>
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<tr>
<td>1. Survey &amp; DPR preparation</td>
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<td>2. Notice Inviting Tender(N.I.T), Commencement of works</td>
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<td>3. Collection &amp; supply of materials and simultaneous utilization of the materials</td>
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<td>4. Other allied works</td>
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**Phase-9: Quality Control Aspects**

The Quality Control team comprising of Executive Engineer, Assistant Executive Engineer, Assistant Engineer headed by the Chief Engineer, Quality Control, Water Resources Department constantly monitors the quality and quantity of works right from the starting of execution of the scheme till completion. For testing the quality of the various materials used in such projects, the materials are being tested in two various research centers, viz.
I. Soil & River Research centre, Guwahati, Assam renamed as Assam Water Research and Management Institute (AWRMI)

II. Hydrology division, Guwahati, Assam.

The Assam Water Research and Management Institute (AWRMI) checks the quality of the following materials as per the Indian Standards and then approves the usage of such materials for construction works.

The Hydrology division, Guwahati, Assam continuously monitors the various rivers of Assam along with their tributaries and keeps records of various hydro meteorological data for design of projects according to the river behavior and research purposes.

Phase-10: Project Monitoring

The monitoring team consists of the Chief Engineer, Additional Chief Engineer, Superintending Engineer of this department and the representatives of the funding agency. Those personnel inspect the project site time to time to monitor the progress of work and recommends for release of fund to the Government (Central and State). During the execution of the project, the monitoring team inspects the project site 3-4 times and finds out the progress of work. The monitoring team also checks the utilization of fund.

Phase-11: Bill Passing And Payment (Submission Of Accounts To The Accountant General Of Assam)

After preparation of bills of the contractors by the field officers (Assistant Engineers and Junior Engineers engaged in the execution of the project) in measurement book, the bill is submitted to the concerned Assistant Executive Engineer for verification / check measurement and countersignature. The bills along with all relevant documents are then sent to the Divisional office where it is being checked by the Accounts Officer and the Assistant Executive Engineer (Technical Consultant) and finally submits the same to the Executive Engineer for making payment. If the Executive Engineer desires on his own to check the authenticity of the field work done, he may make a recheck measurement of the bills. After being satisfied with the bills presented, the Executive Engineer makes the payment of the bills by issuing Govt. cheque, bank draft, banker cheque etc. The Bill vouchers are then compiled by the Accounts officers of concerned division and after that all the bills are being sent to the office of the Accountant General of Assam for their checking and keeping the same as a record.

7 Findings And Suggestions

1) It is seen that the upstream and the downstream of the project site gets eroded by water thrust of the river even in the non-flood season. So it should be protected by nose protection work (by taking temporary measures) to reduce further erosion.

2) During the visits to the project site, it is seen that some of the unused materials are scattered in the stack yard and also in the work site, which created some problem during the execution of work. The scattered un-sized river boulders / river shingles is to be made in regular measurable stacks so that the same materials may be laid in approach road for plying of local transportation to avoid wastage of materials.
3) Regular inspection of the project site is required by the field staffs to check any damages occurred by natural way or by the people surrounding the project site.

4) It is seen that the payments of the contractors are always delayed and there are many court cases filed by the contractor against the department for delay in payment. So, the department should take more initiative for procurement of funds from the Govt. (Central and State) in time, so that the payment of the contractor may be made without any delay.

5) Some of the field staffs are not well conversant with all types of paper works and technical works. This may be due to lack of training programs. So, the field staff should be regularly sent for trainings, so that the works can be completed within the stipulated time.

6) It is observed that the project site has lack of auto monitoring system, because of which many small erosion problems gets converted to huge damage of Government and public properties. So, it is recommended that close circuit cameras should be installed and used round the clock so that the concerned Executive Engineer and other higher authorities associated with this project can monitor the project site from his office.

7) The records should be maintained properly by structuring a central data storage centre at the Chief Engineers office.

8) The cost of implementation of all these suggestions can be easily made from the savings of vast amount of fund allocated for such projects.

8 Conclusion

The Govt. of Assam will set up a knowledge based Research & Development Centre for continuous R&D activities relating to flood & erosion management where elite institutions like IIT Guwahati, NIT Silchar and other Engineering colleges will participate to suggest innovative sustainable solutions. Information network system & migration study with modern tools will be of immense help for formulating such projects. State Govt. through Water Resources Dept will continue to implement various short term measures/ midterm measures under different programs funded by Govt. of India, Govt. of Assam & other funding agencies.

Water Resources Department on careful study will take up pilot projects for land Reclamation of river Kushiyara. In order to reduce the flood ravages and human lives loss due to flood flash from Arunachal Pradesh, formulation of interstate projects involving Arunachal Pradesh for comprehensive catchments area treatment and watershed management is of paramount importance and should be taken up as soon as possible. The Govt. of India as well as the Govt. of Assam should suitably plan for judicious implementation of both structural & non-structural methods for flood & erosion management taking into consideration the inputs from International & National Experts and with the participation of stake holders.

Finally, hope that good senses will prevail and an umbrella organization like NEWRA (North-East Water Resources Agency) will be established for harnessing huge water resources of NER (North-East Region) for prosperity and balanced development with permanent solution of vexed flood & erosion problems.
9 References


References From Departmental Reports:
[4] Reports on project scheduling, tender invitation and acceptance etc.