Managing Embankments to ManageDisasters

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Status of Flood Control in the Country Central Water Commission reports that the average affected area within the country due to floods is 75.5 lakh hectares (almost the area of Assam or Jharkhand) and on an average a population of 3.29 crores (more than that of Kerala) is hit by floods every year. The average area where the crop is lost every year is 35.4 lakh hectares and 12.18 lakh houses are washed away in the floods every year (rendering a population more than that of Bangalore homeless). Cattle loss is estimated to be around 95,000 annually and the human lives lost amount to 1589, on an average.

There are, inherent problems with embankments in dealing with floods and it is essential to understand that when a heavily silt laden river is embanked; the sediment gets trapped within the embankments, pushes the bed level successively upwards necessitating the raising of the embankments also. There is a practical limit to which the embankments can be raised and maintained. The river water seeps through these embankments and cause water logging in the countryside.

These losses have occurred despite building nearly 34,000 kilometers of embankments along the rivers, 39,000 kilometers of drainage channels, raising and protecting 4716 villages above flood level, protecting 2358 towns and building 58 raised platforms at a cost of Rs 17,237.48 crores during 1952-2006. Only 182.22 lakh hectares of land is reported to have been protected till 2006 according to the CWC Reports while the flood prone area of the country is reported to be 400 lakh hectares. **This means that more than half the flood prone area of the country is yet to be protected.**

The country had 5280 kilometers length of embankments in 1947 which got increased to nearly 6,000 kilometers in 1954 according to the Report of Rashtriya Barh Ayog (1980). Some 28,000 kilometers length of embankments were added during the plan period till 2006 and this has singly been a major intervention by the state as far as flood control is concerned and needs to be examined.

Controversial Technology of Embankments Building embankments along the rivers has been a major intervention by societies and the states to protect the countryside. These are essentially mud walls of trapezoidal section designed to prevent the river water from entering habitations on the countryside of the embankments and this has probably, been the most ancient method of dealing with the floods. The countryside is deprived of the nutritious silt that it could have got if the river was allowed to flow freely. The embankments prevent the flow of the tributaries from getting in to the main river and sluice gates have to be constructed to allow the tributary water to flow into the main river.

These sluice gates cannot be opened during the rainy season because there is a possibility of the main river water entering into the tributary and flooding newer areas hitherto unknown to flooding. The tributaries, on their own, may start flowing parallel to the main river outside, again flooding new areas. It can be suggested then to embank the tributaries also and in that case the rainwater between the embankments of the main river and the tributary may get trapped. The only route for this water to escape is through evaporation or seeping into the ground. Or else, it may have to be pumped into either of the streams. Should any of the embankments breach, then the people residing between the two embankments will meet their watery grave.

No embankment can be guaranteed against breaching, not even in the USA or China. The cost of relief & rehabilitation would offset all the benefits that have accrued over the years in case of one single breach. It was for these reasons that the British, having failed to tame the Damodar River, never repeated the mistake till they ruled India.

The debate whether embankments increase the floods or decrease them, is yet to be resolved amongst the engineers. The engineers escape any debate by saying that every river has its own special characteristics and should be dealt with separately. They also take advantage of approving or rejecting any embanking scheme depending upon the social or political pressure brought on them. The arguments for or against the embankments are, apparently, technically so sound that nobody can point his finger towards them. **The fact is that the benefit of this inconclusive debate goes to the politicians who take the decision on embanking the river & engineers play only a subservient role.**

The British Government found it uneconomical to check floods by embanking rivers; their engineers spoke the same language. The Government after independence of India wanted the rivers to be tamed at any cost, the engineers of the regime spoke the same languages as convincing scientific arguments were available to both.

People Are Also Divided There are many strong views about the Embankments. Some of these are:

1. Those living within the embankments want that the embankments should be demolished immediately and they see no debate over the issue. They even try to breach the embankments during the flood season.
2. Those living close to the embankments in the countryside remain confused whether they want the embankment or not. Water logging, loss of fertility of soil, threat of a breach during rainy season, mass destruction of life and property after a breach makes them talk against the embankments. Fact remains that nobody wants to face a breaching embankment and despite all the opposition to embankments, they patrol the structure during the rainy season so that no damage is done to it. It often leads to conflicts between embankment busters and the saviors.
3. There are a sizable number of people who see the flood problem as that of drainage and want more and more passage through all the structures like embankments, canals, railway lines, and roads that impede flow of water. This would automatically solve the flood problem, they feel. The state too appreciates and advocates this in all its reports but never works in that direction.
4. Those living far away from an embankment where floodwater never reaches after a breach, generally, favor the embankments on the plea that it might be doing some good to the people out there. They, in fact, have no opinion because it never concerns them. Unfortunate part of the entire game is that such people outnumber those who have some opinion, for or against, the embankments. **Most of the decisions about embankments are taken by those who are not affected by them.**
5. There are people who feel that the embankments are here to stay and the state will go all out to continue with their construction and rebuild them in case of a breach and there is no people's power that can thwart the efforts of the state.

There was time in 1950s when the embankment victims fought a pitched battle against the state when Kosi embankments were being built. There is no leadership available now that can mobilize people to oppose such constructions. Hence the approach should be made to live with the embankments. The problem here is that one day in future, it will not be possible to push the river back within the embankments after the breach, before plugging the breach. The rising bed level of the river within the embankments will prevent that. That day, the new course of the river will have to be embanked trapping more and more people within them. This is what happened with the Hwang Ho in China.

Unfortunately, embankments are the only convenient upland available and most people living within the embankments spend nearly four months on the embankments. Unmindful of the fact that these living on the embankments are the victims of flooding, erosion, or water logging, the government tries to evict the people from the embankments which the dwellers find impossible as there is no other place to go and that often leads to conflicts in which the flood victims have a history of always losing.

6. The government suggests that the real solution to the flood problem for the middle Gangetic plains lay in construction of dams in Nepal. The response of the other side is cool to this problem but it helps the government and the engineers to pass the buck of their miseries to somewhere else.

Without going into the merits of different versions of opinions about this technology of embanking and assuming that the embankments are there to stay and that the government will always plug the breaches (it calls flood fighting as one of its sacred duties) and, as a corollary, force some people to live within the embankments and some facing the fury of the river in case of a breach, **how does one deal with the situation?** Here are some suggestions:

Situation – 1 Recognize that there are people living permanently within the embankments

The country has, at the moment, about 34,000 kilometers length of embankments that run parallel to the rivers. A sizable number of population lives within embankments as, unlike oustees of dams, they were not given any land anywhere and were supposed to live in rehabilitation plots in the protected countryside and cultivate their land that was located within the embankments.

It is reminded here that there are 414 villages (380 villages of India and 34 of Nepal) located within the embankments of the Kosi with a population of nearly 1.2 million. Within the two embankments of the Mahananda in Bihar, there are 66 villages, the Kamla has agricultural lands of 104 villages within its embankments and the Bagmati has entrapped 95 villages within the embankments. The details about the Gandak and the Burhi Gandak are not available.

Most of the displaced people chose to stay back in their old villages as living in the rehabilitation site and managing agriculture at a distance of three to five kilometers was not a viable proposition.

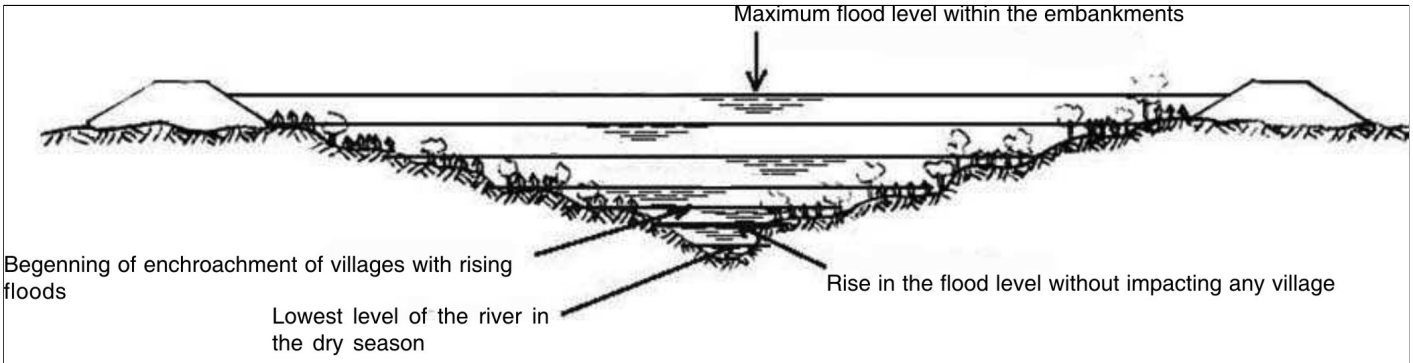

Fig. 1 : Sequence of flooding of the villages with rising flood level in the river.

Most of the rehabilitation plots got water logged later for the reasons stated above and that also forced people to move to their respective old villages. Of late, the state government has started making disaster shelters for the flood victims but there is no order in that and most of the citing of locations is done under the influence of local political heavy weights. Here is what could be done for providing shelter to the people trapped within the embankments.

Find the sequence of inundation within the embankments in case the embankment is intact Referring to Fig. 1, we can visualize the location of villages within the embankments. Water Resources Department of the state and the Central Water Commission keep a running record of the flood levels of the rivers and the discharge passing through the embankments. If we know the gauge level of the river within the embankments at any place, it is possible to predict whether a village is going to get inundated or not or whether the people living there have to be moved to a safer place. These 'safer places' can be decided in advance and if a flood shelter is to be built, one can plan its location and capacity that it will have to accommodate the population and live stock. Once a decision is made on the numbers, one can easily assess the number of boats needed to move the victims, quantity of food and fodder that will be needed, arrangements of drinking water, medicines, and sanitation could be planned accordingly. One can also plan the retreat of the people and cattle as the villages start emerging out of water.

This exercise should be repeated for every two to three kilometers length of the embankment and all the plans made to suit the local needs.

Situation 2: Life within the embankments coming to a standstill in case of a breach A breach in the river embankment does not change the situation upstream of it as the flood continues there as usual but on the downstream side within the embankments, the floodwater disappears very fast below the spot where the breach has taken place and within few hours, only a very nominal water remains in the river there. This means that the boats will get stuck wherever they are, the material supply, if any, will get terminated at that point and so will be the movement of people. One will have to wade through mud and silt and the cattle are also put to the same inconvenience. **This is a situation worse than inundation where all sorts of movements come to an end.**

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The establishment often takes a stand that these people were given rehabilitation & that they are living in a place that they are not supposed to. Sometimes, the local administration refuses even to give relief to these unfortunate victims. (This had happened in Saharsa in 1986 and 1995-96.) There is no ready answer to this problem and the matter needs to be debated thoroughly. **Those living within the embankments of the Kosi after the breach at Kusaha in 2008 suffered the same fate with no one to look after them and no one ever questioning where the flood water of the Kosi would have gone if the breach had not taken place?** With dried river, they failed to get whatever Rabi crop they used to get in a normal year.

Situation 3: There is a breach in the embankment & the river mauls the people living in the protected countryside In case there is a breach in the river

embankment, the water will gush through the settlements in the protected countryside depending up on the levels of the land.

The surges that emerge out of the breached embankment invariably sweep through neighboring villages as it is they who bear the brunt first. It takes time for the water to fill all the depressions and reach the end point which again, in most cases, is the river that it had left earlier. That is the normal occurrence.

If the river water finds a favorable slope, it might enter another river and add to its flow causing inundation and breaches there. Sometimes, there is a reverse breach in the embankment because of water logging in the countryside and in that case the stagnated water from the countryside will gush into the riverside of the embankment and may cause similar damages if there is a village close by within the embankments.

Disaster Management Departments of the flood prone states should have the necessary skilled human resources to plan disaster management with the help of MIS that will be really effective and streamlined if the suggested process is followed. There is vast scope of building up on this suggestion and what all has been said should not be taken as final view because there are many more variables that will have to be looked into.

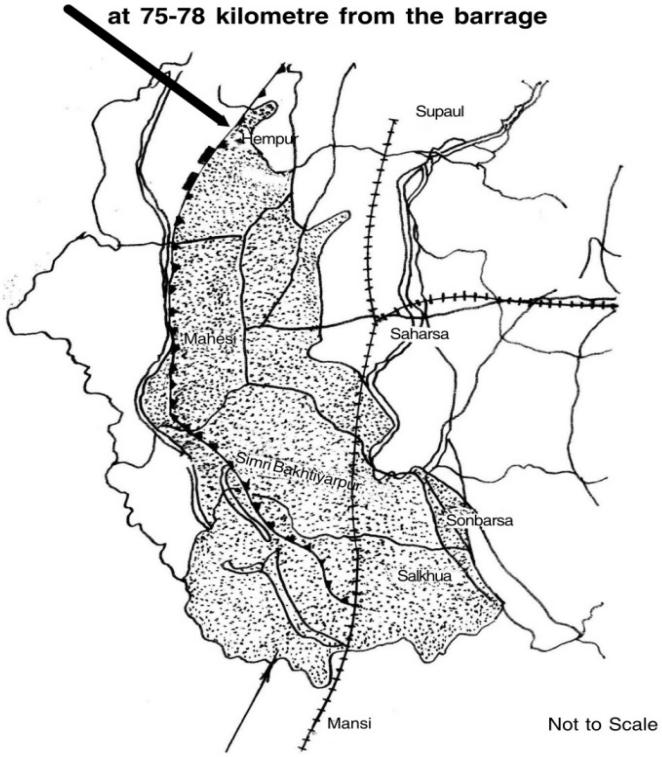

Fig. 2 : Water-spread area due to the breach near Hempur in eastern embankment of Kosi river (1984)

Such a situation had actually occurred in case of the Bahuarawa breach of the eastern Kosi embankment in 1980 and the 1984 breach of the Kosi eastern embankment at Belwara sluice in Saharsa, as the floodwater tried to re-enter the river in lower areas.

These are different settings once a breach occurs. But, let us analyze the normal situation in case of a breach in the embankment when the river water comes out into the protected countryside as shown in Fig.-2.

The inundation in the countryside will depend on the flood level of the river, discharge passing through the embankments and the levels of the countryside. It should be possible to assess the water spread area and the depth of inundation in the countryside and the time taken for it to reach various locations if the contour maps of reasonable accuracy are available.

Inundation maps of earlier breaches in the embankment and the time taken to reach various points would be very useful in making such calculations. Assessment of time taken for the water to reach a particular point is very crucial in planning safety operations. This will also help in planning evacuation, the man power and equipments / machinery needed to move human beings and their belongings to safer place.

This exercise will also reveal what will be the safe place for a particular discharge and a particular gauge reading. It should be remembered that breaches in the embankments are a common phenomenon and if we can assess the extent, depth and sequence of inundation; it should be possible to locate the flood shelters.

This exercise should also be repeated for, say, every third kilometers length of the embankment so that the travel distance and travel time of the people to move to safer places is short and manageable.

Conclusion Disaster Management Departments of the flood prone states should have the necessary skilled human resources to plan disaster management with the help of MIS that will be really effective and streamlined if the suggested process is followed. There is vast scope of building up on this suggestion and what all has been said should not be taken as final view because there are many more variables that will have to be looked into.

Let a beginning be made somewhere.

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