

FLOOD IN MAHANADI DELTA STAGE II AREA -- A CASE STUDY

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Abstract - Mahanadi delta stage II area is affected by flood every year. From the flood data (1964 - 1992) it shows that every year flood exceeded than 6 lakh cusecs except the floods in 1965 ,1966 , 1987 , 1988 , 1989 .In stage II area there exists low level flood escapes at the head of the doabs .These escapes starts functioning at different stages of undivided floods in Mahanadi at Naraj starting with 16990 cumecs(6 lakh cusecs) to about 25,485 cumecs (9 lakh cusecs) . In the process the delta stage II irrigated area gets dose of flood when the Mahanadi flood has not attained any unsafe value from embankment point of view . Therefore even after the lapse of 25 years from the commencement of irrigation , the stage II area is not protected against river floods . Once the flood water enter the doabs , it is not easily drained out and causes flood ,drainage problem and water logging in stage II command area .Structural measures like Naraj barrage and different types of embankments can mitigate the floods upto 10 lakh cusecs .But It has been seen that in the post Hirakud period upto 1992 the flood has exceeded 10 lakh cusecs seven times . As the flood cannot be predicted so non structural measures are also to be advocated to mitigate flood damage .

INTRODUCTION

Flood plays a great havoc and causes untold miseries in the area affected. It causes loss of life ,disruption of human activities , damage to properties , agricultural crops and health hazard . The Mahanadi delta stage II area is largely affected by flood. Flood occurs frequently in almost every year . The causes of flood are mainly due to followings 1 . Precipitation in the command area 2 . Flood water entering the doabs through low level escapes in the river embankments 3 . Irrigation water through canals 4 . The other causes

of flood is that water comes to Naraj due to uncontrolled catchment below Hirakud in later part of monsoon. River in stage II area are being fed from river Mahanadi drawing from an area of 1,32,197 sq. km (51000 sq miles) at Naraj. Out of this catchment the uncontrolled catchment, which are below Hirakud upto Naraj is of catchment area 49250 sq km (919000 sq miles) experiences heavy rain fall during south west monsoon in view of its location just south of tracks of monsoon storms.

The Mahanadi embankment system is safe for an undivided Mahanadi flood of 26900 cumecs (9.5 lakh cusecs) and a flashy flood of 10 lakh cusecs at Naraj. The irrigation area of stage I are fully protected against river floods due to construction of river embankments which are continuous on both sides of river, excepts when breaches occur during high floods. But in stage II there exists low level flood escapes at the head of the doabs. These escapes starts functioning at different stages of undivided floods in Mahanadi at Naraj starting with 16990 cumecs (6 lakh cusecs) to about 25,485 cumecs (9 lakh cusecs). In the process the delta stage II irrigated area gets dose of flood when the Mahanadi flood has not attained any unsafe value from embankment point of view. Therefore even after the lapse of 25 years from the commencement of irrigation, the stage II area is not protected against river floods. Once the flood water enter the doabs, it is not easily drained out and causes flood, drainage problem and water logging in stage II command area

HISTORY

The Mahanadi delta irrigation system is divided into two district phases i.e. stage I and stage II. The stage I area was brought under irrigation about 120 years back with the Mahanadi, Birupa, and Naraj weirs. This area is mostly in the district of Cuttack. The stage II area developed as a post Hirakud development by construction of Munduli weir on the undivided Mahanadi at Munduli (u/s of Bifurcation of Mahanadi and Kathajuri) and Puri main canal system, which is mostly in the district of Puri. This canal system provides kharif irrigation to an area of 136000 hectares with rabi coverage in 2/3 rd area. The area affected due to poor drainage is 114200 hectares. The stage II area is subdivided into 4 doabs. The doabs are the area between two rivers those are between 1. Kathajuri and Kushabhadra 2

.Kushabhadra and Bhargabi 3 . Bhargabi and Daya 4 . Area west to Daya .The doabs tends to slope down from the river to the interior and from top near the delta apex to bottom at the coast . Slopes in the doabs interior are generally in the range of 1: 5000 and land form is quite flat . The Mahanadi embankment system is safe for an undivided flood of 26900 cumecs and a flashy flood of 10 lakh cusecs at Naraj .But in stage II there exist flood escapes at the head of the doabs . These escapes starts functioning at different stages of undivided floods in Mahanadi at Naraj starting with 6 lakh cusecs .Therefore even after the lapse of 25 years from the commencement of irrigation the stage II area is not yet protected against river floods .

In the original project report of Hirakud dam project no proposal was given to delta irrigation . In the revised project report (1952) , the new delta stage II area was proposed to be brought under irrigation with total closure of Kuakhai at its off take . The Majumdar committee(set up by government of India) recommended not to close the Kuakhai river . Instead they advised to construct a new barrage across Kuakhai to control the distribution .

The then Chief Engineer of Orissa did not agree to the proposal of Majumdar committee and proposed to have double embankments along the river with high level escapes to discharge the excess discharges into the interior doabs .

Hiranandini -1955 (the delta project report) recommended for the construction of a barrage across Kuakhai so that Kuakhai will carry its bankfull of harmless discharge and to divert the balance to the branches of rivers . It provided for closing of escapes in the embankment system and to provide full protection to the irrigated area in the doabs .

In practice no flood control in full was provided to the doabs and no control structure on Kuakhai has been built nor any construction at its off take has been attempted .Escapes are still existing and causing flood and drainage .

There is a proposal of constructing Manibhadra project in the Mahanadi , which when done , shall control the flood at delta head to 9 lakh cusecs . So in addition to Naraj barrage if Manibhadra project is done , shall control most of the flood .

RIVER BASIN CHARACTERISTICS

The river Kathajuri is one of the river of Mahanadi system . Mahanadi in whole of its length of 858 km has come across 437 nos. of tributaries into deltaic area of Naraj .Kathajuri and Birupa , the main branches of Mahanadi are taking off from the parent river at Naraj at Jagatpur on its right and left respectively . The Kuakhai takes off from the Kathajuri just opposite to Lalbag 8.8 km D/S of Naraj . Presently Kuakhai has become a river with poor carrying capacity and its bed at the off take is about 2.5 m higher than its parent river Kathajuri .The river Kuakhai bifurcates into three rivers , the river Kusabhadra , Bhargavi (undivided) and Daya which all flow in district of Puri . The river Bhargavi has branched into several small rivers before joining the lake Chilika .

Kushabhadra has out fallen into the Bay of Bengal and the rivers Bhargavi and Daya have out fallen into the lake Chilika . The water levels of Chilika is about 1.5 m higher than mean sea level and as a result , the flood discharge is not quick and causes inundation on the upstream reaches . The river flood in new delta area in the river Kushabhadra which falls into the sea is also blocked as sand bars and tends to form across mouth due to littoral drift .These sand bars shows a clear tendency to grow in a month easterly direction upto the coast as a result of coastal process . The river Bhargavi , branch river of Kuakhai runs a considerable length almost parallel to sea due to high sand spit condition in the shore . The rivers are badly silted up and do not have important function of discharging Mahanadi flood into the sea.

The river flowing in the stage II area are almost flat in character .The average ground profile varies from 1 in 5000 to 1 in 6000 .The doabs in the delta stage II area are intersected by several drainage channels and are draining either to main stream or to the sea . Flatness of the ground is one of the parameters of poor drainage characteristics of the area .

DESCRIPTION OF FLOOD PROBLEM AND FLOOD DAMAGE .

Almost every year the delta stage II area is affected by flood and drainage problems . Flood water which enters the doabs through the escapes are responsible for these problems . If these escapes are closed then the river section cannot carry the flood discharges and there will be breaches

at unknown points even at low floods . So controlling the discharge in Kuakhai

is the main need . Mahanadi has a flood control storage reservoir at Hirakud intercepting a catchment of 80 ,000 sq km . Below Hirakud there remains another 52 ,000 sq km of catchments and total is 132,000 sq km .There are other small storage reservoirs in the tributaries .But the flood modernisation capacity of these small reservoirs particularly in the later part of monsoon is negligible .Hirakud is able to moderate floods arising out of catchment but becomes vulnerable in later part of monsoon . If a late flood of considerable magnitude strikes Hirakud . The free catchment below Hirakud can also produce a very high flood in the delta . There are some floods which cannot be controlled fully at Hirakud and these floods at delta head will create danger . In 1980 such a flood which came later part of monsoon was routed by Hirakud reservoir partly to produce a flood of 12.3 lakh cusecs at Naraj .This also happened in 1982 when practically no contribution was there from Hirakud . In totality however , we see that Mahanadi has crossed 28,500 cumecs (10 lakh cusecs) at Naraj five times in the post Hirakud period (1958-1988) and crossed two times in next four years .

The existing drainage channels insides the doabs have agraded , silted up , cross bunded , full of weeds and some times considerable enched upon .Therefore their carrying capacity is deteriorated to agreat extent . Very inadequate provision of water ways in the construction of bridges and other cross - drainage structures have resulted in unexpected afflux . Nonavailability of field drains and link drains aggravate the situation by prolonging the retention of water in the fields .Once the river water enters the doabs it doesnot get drained out easily and reasult in substantial damage to the crops , to the distribution system , and publics and private properties and utility services .

More and more lands becomes subjected to continious poor drainage conditions and get water logged . More and more lands becomes subjected to continious poor drainage conditions and get water logged .

The avarage annual loss due to flood and drainage comes about Rs 19.03 crores per year according to 1988 base *** and affecting area of 1.36 lakh hectre in Mahanadi delta area .The indirect loss suffered by

inhabitants in the area is also very high and retards the economics growth of the entire area since several years .

Taking the Hirakud dam data as the basis the return period of the floods is shown in the graph. *

RETURN PERIOD OF FLOOD PEAK IN UNDIVIDED MAHANADI AT NARAJ

Return period (years)	10	20	30	50	100	500	1000
Flood peaks at Naraj(cumecs)	35180	39596	42137	45313	49597	59503	63760

It is observed that in every year flood exceeds than 16,990 cumecs (6 lakh cusecs) The graph **shows the details of flood peak yearwise at Naraj starting from 1964 to 1992 and the safe limiting flood to delta stage II is 16,990 . The avarage annual flood damage has been calcuted as per the table *** below .

Year	Crop damage	House damage	Public utility damage	Total in lakh Rs	1988 base @10% per year	Average annual flood damage (1988 base)
1977	76.99	1.21	72.72	150.92	430.6	
1978	133.68	11.22	320.50	465.35	1206.99	
1979	N . A	N . A	N . A	N . A	N . A	
1980	802.87	78.67	146.46	1026.99	2201.44	
1981	N . A	N . A	N . A	N . A	N . A	13316.53/7=
1982	1237.48	304.48	507.44	2049.40	3630.63	19.03 crore
1983	N . A	N . A	N . A	N . A	N . A	
1984	869.91	35.15	1472.34	1877.40	2748.70	
1985	935.79	218.77	713.34	1867.90	2486.175	
1986	368.10	12.86	125.23	506.19	612.5	

1987	Drought	-----	-----	-----	-----	-----
	area					
1988	Drought	-----	-----	-----	-----	-----
	area					

FLOOD CONTROL WORK

In the benefited area river embankments exist on both sides of river branches but with escapes at the head of the doabs. The river embankments are of two types 1. capital embankments 2. other agricultural embankments. Besides rivers there are some drains which help in the discharge of doab water. Some times flood water also enters the drains through these escapes. In addition to these embankments, there are other types of embankments namely 3. The saline embankment and 4. The test relief embankments. The saline embankment are put to prevent saline waves action to in gross inland. The test relief embankments are some times constructed to protect local areas against low and medium floods.

The land of doabs is intersected by numerous small streams and creeks. In the doabs interior flow into large streams which meanders through the doab interior to the sea and provide the primary natural drainage for the doabs. Some of them however discharge to major river branches or to Chilika lake.

Though Hirakud has a big storage reservoir. It is unable to control flood when the flood is big and the small reservoirs built in tributaries in Mahanadi have no flood reserve capacity. The Naraj barrage constructed at the off take of Kathajuri will protect the delta area in monsoon against the flood arising from 6 lakh cusecs to 10 lakh cusecs at Naraj (undivided Mahanadi). This gated barrage will also divert a discharge less than 17,370 cumecs to Mahanadi and Birupa arm which is the design discharge for Mahanadi and Birupa barrage and this Naraj barrage provides irrigation in delta stage I command area. In the case undivided flood in Mahanadi becomes more than the safe limit all the three barrages (Naraj, Mahanadi, Birupa) will be fully opened and the normal distribution shall pass in the respective rivers. If the flood exceeds the safe limits, then there is possibilities of breaches causing severe damage. In that case the damage will be distributed in both stage I and stage II area as per its natural

distribution so that damages are not concentrated on any area by man-made control.

There is a proposal of constructing Manibhadra project in the Mahanadi, which when done, shall control the flood at delta head to 9 lakh cusecs. So in addition to Naraj barrage if Manibhadra project is done, shall control all flood.

CONCLUSION

Flood is a natural calamity similar to earthquake and fire hazards. Even with the knowledge of advanced technology, the period, intensity and area of occurrence of flood cannot be predicted. It is also not possible economically to give protection against probable maximum flood as it happened in 1980 and 1982 flood in Mahanadi. Though Naraj barrage can control the flood upto 10 lakh cusecs. But it has been observed from history of flood data that Mahanadi has crossed 10 lakh cusecs seven times in post Hirakud period (1958-1992) at Naraj.

Beside this structural measures like embankment systems and the barrage at Kathajuri etc. nonstructural measures has also an important role in flood mitigation.

Nonstructural measures have been advocated since the last three decades. These measures are broadly classified as 1. Flood plain management 2. Flood forecasting 3. Flood damage prevention planning. It should be clearly understood that best structural and nonstructural measures can only reduce the flood damages to acceptable level in the affected area of delta stage II.

The work of flood control measures are to be started just at the end of flood season, when the inspection to survey the condition of flood control works (embankments and barrage and other structures).

The flood management should have broad knowledge of the existing flood control structures and their conditions 2. flood prone/ disaster areas 3. pattern, magnitude and frequency of the flood. 4. post flood situation.

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