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Risk Reduction Management Of Flood By Bhagirathi River A Case Study Of Agradweep Of Bardwan District In Gangetic Delta

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ABSTRACT:

Many states in our country are flood prone due to heavy rain or otherwise. The flood causes loss to human life and wide spread damage to property. Unimaginable damage to agriculture takes place affecting the States planning and upset the financial budgeting there by slowing down the whole economy of the country. The term "flood" is a general or temporary condition of partial or complete inundation of normally dry land areas from overflow of inland or tidal waters or from the unusual and rapid accumulation or runoff of surface waters from any source. Heavy down pore in the form of rain, brings down more water than can be disposed by combined factors natural and manmade systems causes flooding. The rivers overflow embankments may be breached. Generally rains following storm and hurricane are heavy and bring unmanageable amount of water causing flash floods. The frequency or probability of a flood usually is described by assigning a recurrence interval to the flood at each gauging station. This is accomplished by statistically evaluating long-term annual peak stream flows at a station.

I. SIGNIFICANCE OF THE STUDY:

Any research gives us a light of new vision. The significance of that research work will help us what are main causes and affect of flood in Agradweep by Bhagirathi River and what is the process of flood risk reduction management. Local government as well as govt. of India can take necessary step to reduce mitigate, and management of flood in Agradweep. Although flood is a natural hazard, but by which of interference by man increase the flood vulnerability that should control by the proper govt. policy as well as people awareness.

II. BACKGROUND OF THE STUDY:

Agradweep is an ancient land in katwa Sub-division. Ptolemy mentioned it as Apnagar or Aagaha, Will Ford Called it as Aghodeep and according to Renel, it was Aaghadweep. To reach there, one has to get down in Agradweep railway station, which is in Bandel – Katwa railway line and then travel about 2.5 km by toot or rickshaw to reach the Agradeep village, which situatied on the banks of the river Bhagirathi. Due to frequent changes in the way of river Bhagirathi, Agradeep in past remained sometimes on east banks and sometimes on West Banks.

Agradweep with its varied tectonic elements and riverine features, is a traditional zone between the Jharkhand plateau which constitute a proportion of peninsular shield in the west and Ganga-Brahamaputra alluvial plain in the north and east. In general Jharkhand plateau consists of the meta sedimentary rocks of a precambrain age .

The rivers system in Agradweep includes Bhagirathi- Hooghly in the east, Ajoy and its tributaries in the north and the Dwarakeswar, Damodar and its branches in the south-west. Besides, there are innumerable khals old river beds all over the area.

The study area experiences a climate which is CWg3 and AW1 types, where 'C' stands for 'warm temperate climates with mild winter', 'W' for dry winter not compensated for by the total rain in the rest of the year', 'g3' for 'eastern Ganges type of temperature trend' and 'AW1' for 'tropical savanna climates'.

Averages temperature in hot season is 30 degree while at the winter season is 20 degree celsius and average rainfall is 150 Millimeters. The cold season starts from about the middle of November and continues till the end of February, March to May is dry summer intervened by tropical cyclone and storms. June to September is wet summer while October and November is autumn.

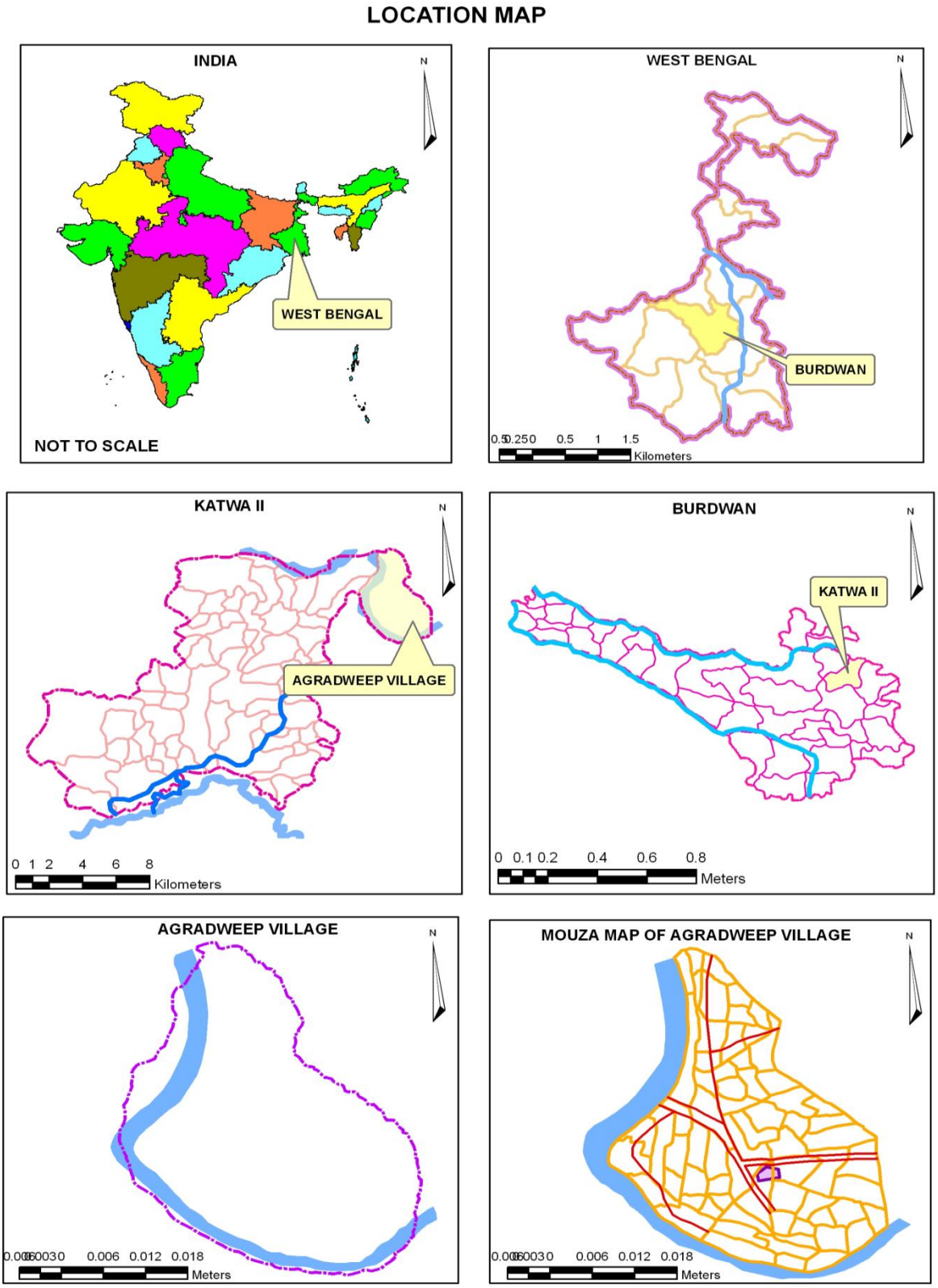

Fig-1: Location map of study area

III. OBJECTIVES OF THE STUDY:

The Objectives of the investigation has been carried to --

1. To understand of flood type in my study area.
2. To identify with focal effects of flood in the investigated area.
3. To value the role of disaster management of Government and NGOs during the flood and post flood reconstruction.
4. To find out the way of managerial procedure to reduced flood affection

IV. METHODOLOGY OF THE STUDY:

The primary data collected from the respective authority like panchayet, club and person of the villages. Though my study is based mainly on primary data but I also collected secondary data from mahakuma library, Katwa information centre, NATMO, Gazetteer, different books etc. just to get a general idea about the background of the study area.
The methodologies followed in the present report may be divided into three parts –

Pre-field methods This stage includes - i) collection of districts map ii) collection of secondary information from district handbook, cesus report, information from B.D.O office, Panchayets ,reports,others books and journals etc. iii) preparation of questionnaire statistical schedule for collection of primary data which are closely related with the research work.
Field methods By questionnaire schedule primary data will be collected from the study area. Observation schedule also help to collect the information.include collection of primary data from aged person in different G.P. and collection of present condition of Agradweep by photograph in different reliable place of Bhagirathi river.
Post field methods Collected data will be classified in a master table and various cartographic and statistical techniques will be made in support of the theoretical discussion and preparation the final report.

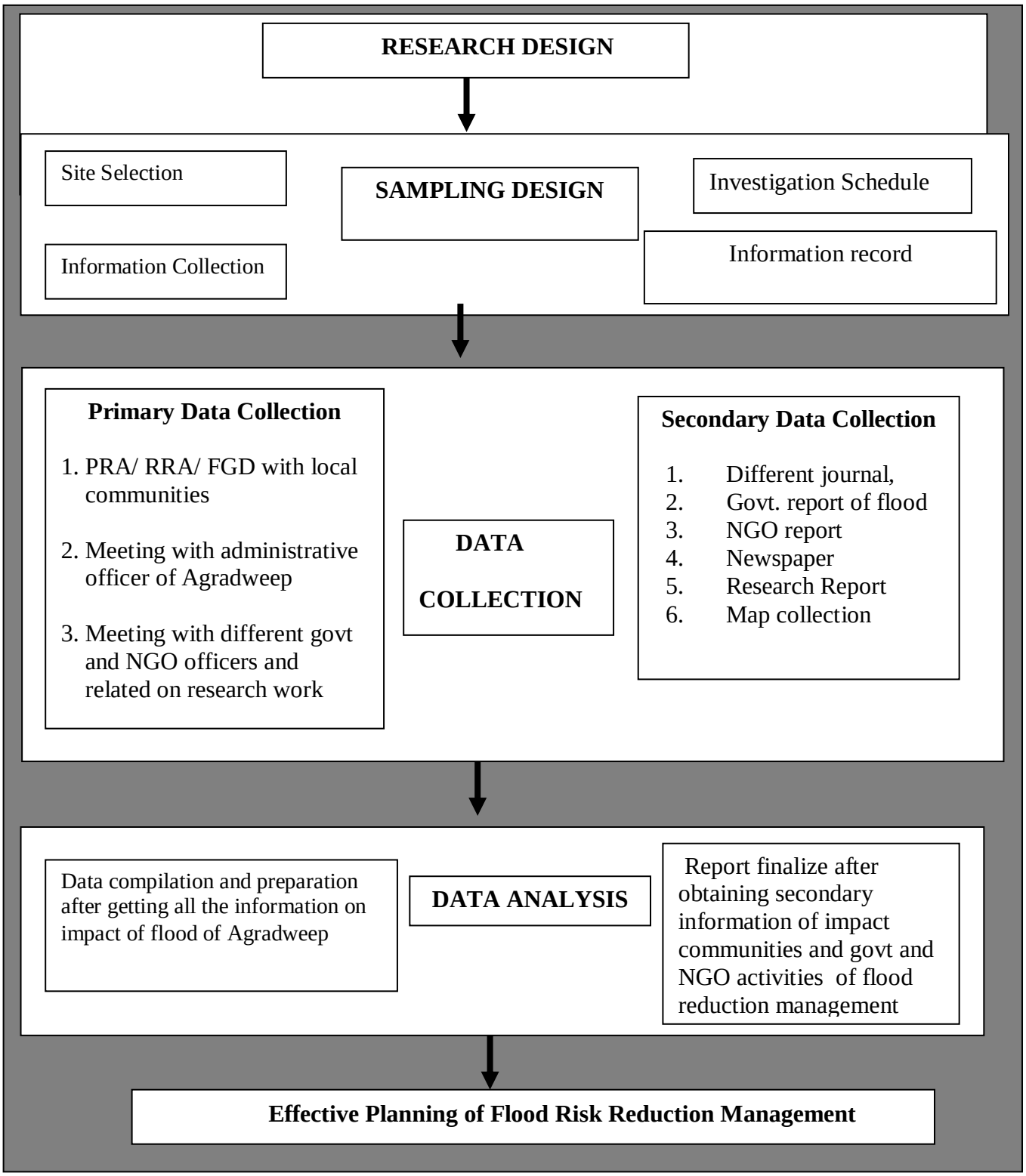

Fig-2: Lay our of the methodology of Present study

Flood Discharge:

Flood discharge is an important characteristic of flood. It can be measured. In fact it indicates the quantum of flood and it's capability of destruction. The principal river Bhagirathi and its tribaries are responsible for Bardwan flood condition. Thus, the Bhagirathi river discharge and its flood frequency analysis can be analysed using Gumbel's method.

Flood Frequency Analysis by Gumble's Method:

Chow (1951) has shown that most frequency – distribution functions applicable in hydrologic studies can be expressed by the following equation known as the general equation of hydrologic flood frequency analysis:

$$XT = X+KSd$$

Where, XT = value of the variate X of a random hydraulogic series with a return period T, X = mean of the variate, Sd=standered deviation of the variate, k=frequency factor which depends upan of the return period, T and the assumed frequency distribution. The commonly used frequency distribution function for the prediction of extreme flood values is the Gumble's method. This wxtreme flood value distribution was introduced by Gumble (1941) and is commonly known as Gumble's distribution.

It is the most widely used probability distribution function for extreme values in hydrologicstudies and meterological for the prediction of flood peaks, max. rainfall, maximum wind speed etc. According to Gumble, a flood as the largest of the 365 days flows and thepek annual of flood flows. The general formula for the prediction of extreme flood values and it's probability of occurance, is given by Gumble as below.

$$Qp = Q – +K.Sd\ n-1$$

Where, Sd n-1 = standerddeviation of the sample size, N = $\sqrt{\sum}$ (Q – -Q) 2/ $\sqrt{}$N-1,Q = Flood discharge, K = Frequency factor expressed as K = Yt-Y–n/Sn

In which Yt = reduced Variate, a function of T and is given by Yt = -[In.In T/T-1]

Or, Yt = -(0.834+2.303LogT/T-1), Yn = reduced mean, a function of sample size N table.

Sn = reduced standard deviation, a function of sample size N. The value of Yn and Sn is given in Gumble's extreme value distribution.

Table -1: Reduced Mean Yn in Gumble's Extreme Value Distribution (Sample Size N)

N	0	1	2	3	4	5	6	7	8	9
10	.4952	.4996	.5053	.5370	.5100	.5128	.5157	.5181	.5202	.5520
20	.5236	.5252	.5268	.5283	.5296	.5309	.5320	.5332	.5343	.5353
30	.5362	.5371	.5380	.5388	.5396	.5402	.5410	.5418	.5424	.5430
40	.5436	.5442	.5448	.5453	.5458	.5463	.5468	.5473	.5477	.5481
50	.5485	.5489	.5493	.5497	.5501	.5504	.5508	.5511	.5515	.5518

Table-2: Reduced Standard Deviation Sn in Gumble's Extreme Value Distribution

N	0	1	2	3	4	5	6	7	8	9
10	.9496	.9676	.9833	.9971	1.0095	1.0206	1.0316	1.0411	1.493	1.0565
20	1.0628	1.0696	1.0754	1.0811	1.0864	1.0915	1.0961	1.1004	1.1047	1.1086
30	1.1124	1.1159	1.1193	1.1226	1.1255	1.1285	1.1313	1.1339	1.1363	1.1388
40	1.1413	1.1436	1.1458	1.1480	1.1499	1.1519	1.1538	1.1557	1.1574	1.1590
50	1.1607	1.1623	1.1638	1.1658	1.1667	1.1681	1.1696	1.1708	1.1721	1.1734

Calculation for Peak Discharge and Flood Frequency of River Bhagirathi by Gumble's Formula at Agradweep is given here below. In fact, peak annual flood flow is taken into consideration .

Calculation:

$$\text{Mean / average discharge} = Q – = \sum Q/N = 67499/34 = 1985.3 \text{ cumec}$$

Standard Deviation = Sd n-1 $\sqrt{\sum}$ (Q – -Q) 2/$\sqrt{}$N-1 = $\sqrt{}$ 13488000/$\sqrt{}$34-1=$\sqrt{}$408727.27=639.32 cumec.

$$\text{Now Gumble's Frequency Factor } K = (Yt-Y– n)\ Sn$$

(WhereY–N = expected mean, Sn = expected number)

Standerd Deviation collected from Gumble's table and

Yt = -(in.in T/T-1) = - (0.834+2.303logLogT/T-1)

From the table , the magnitude of food having frequency of 10,20,30,40,50,80 and 100 years have been calculated as 2956, 2727, 3609, 3757, 3896, 4152 and 4299cumecs respectively.

So above 40 thousand cumec, high magnitude of flood discharge is noted at Agradweep location. A very little distortion in the curve is noted which indicates that the evidence of very little influence of Farakka Reservoir-discharge on this river in the fluctuation of regular flow during flood period. It is also proved that the river is highly perennial almost after construction of the barrage.

Table-3 : Peak Annual Flood Flow

YEAR	Annual Peak Discharge cumec (Q)	Order(m)	Q–-Q	(Q–Q)2	Frequency (T=N+1m)	Max Probable Flood (in%)P=100/T
1971	3359	1	-1374	1887876	35	2.85
2000	3243	2	-1258	1582564	17.5	5.71
1987	3234	3	-1249	1560001	11.67	8.57
1996	3079	4	-1094	1196836	8.75	11.43
1984	3062	5	-1087	1181569	7	14.29
1999	2781	6	-796	633616	5.83	17.15
1991	2504	7	-519	269361	5	20
1990	2303	8	-318	101124	4.38	22.83
1989	2264	9	-279	77841	3.89	25.707
1978	2255	10	-270	72900	3.5	28.57
1993	2238	11	-253	64009	3.18	31.44
1986	2207	12	-222	49284	2.91	34.36
1988	2054	13	-60	3600	2.69	37.17
1969	2037	14	-52	2704	2.5	40
1998	2014	15	-29	841	2.33	42.91
1995	1975	16	10	100	2.18	45.87
1973	1782	17	203	41209	2.06	48.54
2001	1774	18	211	44521	1.94	52.36
1980	1695	19	290	84100	1.84	54.35
1976	1630	20	355	126025	1.75	57.14
1992	1590	21	395	156025	1.67	59.88
1983	1559	22	426	181476	1.59	62.89
1970	1556	23	429	184041	1.52	65.789
1974	1516	24	469	219961	1.46	68.49
1979	1511	25	474	224676	1.4	71.43
1997	1480	26	505	255025	1.35	74.07
1994	1457	27	528	278784	1.3	76.92
1968	1426	28	559	212481	1.25	80
1981	1373	29	612	374544	1.21	82.64
1985	1367	30	618	381924	1.17	85.47
1977	1356	31	629	395641	1.13	88.495
1982	1347	32	638	407044	1.1	90.9
1975	1282	33	709	502681	1.06	94.33
1972	1189	34	796	633616	1.03	97.08
Sum	67499			13488000		

V. PROCESS OF FLOOD RISK REDUCTION:

In Flood controlling measures are to be taken from physical, Economic and social aspects applicable for Agradweep in Bardwan district. These are as follows:

1. Physical Measures:

A) River Channel Improvement:

After construction of Farakka Barrage, the river bank erosion at upstream (before berhampore) of Bhagirathi is increased due to high velocity and discharge of water which provides siltation problem at the southern part of the district because of very gently gradiant. Maximum stagnation occurs due to narrow and single outflow path of Mayurakshi and Dwarka through Hijol and Bhagirathi River. The river Bhagirathi is getting maximum silt from the rivers of the Rarh region which clogs the Bhagirathi outlet starting from Kalyanpur (Confluence of Mayurakshi). This silt can be reduced by destroying sand bars in the river beds.

B) Proper and Scientific Reservoir control:

a.Controlling Measures of Farakka Barrage:
According to Bibhas Barman, Director in Charge, Haringhata Central Library, River Research Institute, siltation reduction from the Farakka barrage can be done by alternative opening of the lock gates by regulators in different sides of the barrage. The change of flow from different sides of the pond may clear silt by reducing water in a systematic interval by controlling regulators. With the help of early flood prediction water may be released gently with increasing rainfall intensity.

b. Controlling Measures of Messanjore Dam:

i). Reduction of siltation from the Massanjore Dam storage.

ii) Reduction of water throughout the cyclonic period which above danger level to reduce pressure from the dam.

iii) Increasement of carrying capacity of Tilpara Barrage as the substitute water storage.

iv) Several smaller dams may be constructed in the upstream of Massanjore Dam to reduce pressure from the main Dam. These smaller dams can be utilized for generating hydro-electricity due to its situation in greater elevation by their alternative use etc.

By this way proper and scientific reservoir control can manage Bardwan's flood sustainably.

C) Embankment maintenance:

To be effective, embankments must be adequately maintained even when there has been no severe flood for several years and local, and even official, perception of flood risk has perhaps lessened compared with other, more immediate demands on scarce resources. Many embankments have unplanned uses, particularly on roads, but also for growing trees, as temporary shelters during floods, and as permanent shelters for people displaced by erosion.

D) Sheet Erosion Control and Soil Conservation by River Bank Protection:

(i) Construction of dyke:

Construction of dyke in the river bank can control it's erosion due to getting more rigidity and diversion of river's turbulence from the sidewalls towards the middle. So it reduces pressure from river bank and the chance of erosion becomes less. This is applicable for the non-perennial rivers of the district like Bhagirathi, because here erosion occurs only in rainy season and in summer construction can be done properly.

(ii) Geo web Method:

Geo Web method for river bank protection was introduced by Markin Corporation at Agradweep near katwwa in Bhagirathi River. Some landscape patches in Murshidabad district namely, Jangipur, Beldanga, Kashimbazar and Saktipur where river bank erosion is maximum, this methods can also be used for protection.

(iii) Concretization of River Bank:

It is a very costly method. But it is useful method. Occasionally, this method is used to save the important place of the study-area. It may be applied to save other towns and bigger villages or the danger zones (where is a chance to connect Bhagirathi with Padma) of this district to protect them. It should be done with boulder and cement for its longevity.

2. Flood Plain Planning:

The main aim of flood plain planning is to use of floodplain properly and to reduce destruction during flood. The study of flood intensity, discharge, volume, duration etc. are very important to reduce destruction and damage in the floodplain. It needs regional

division of the flood as it is suggested by Central Water Commission (CWC) of India in 1975. The suggestions are also permitted by Central Flood Control Commission and Central Bar Ayog in 1980. According to the recommendation of these commissions, 1:15000 scale map was prepared with a contour interval of 25c.m. for the country. In India, 1 lakh km square area was specified in this project.

After preparation of map it is noted that about 30,268 km2 areas in West Bengal is identified as flood prone area including the Bardwan district which may be highly considered for such mapping. The National Remote Sensing Agency (NRSA) has been working hard to prepare such maps accurately at micro-level. It will certainly be meaningful for saving the loss of socioeconomic property of the district. Ultimately, it is useful in land use planning of the study-area.

A) Cut-off channel:

The effects of a cut off channel are somewhat similar to those of channel improvement. In fact, it increases the channel improvement, channel slope and velocity. In a meandering channel, the land between the two portions of a bend may dwindle to a narrow neck, which may easily be cut across by natural flood flow.

B) Flood Moderation by construction of terraces:

Terraces are ditch type excavation following the contour of the ground having a base of about 1.5m to 2m and a usual height of 15cm. to 20cm. these are closely spaced and significant to store surface run-off without over-topping. The water remains in these ditches till it infiltrates into the sub-surface zone. This requires a short time and becomes dry. It is also ready for the next rain. They thus serve to reduce flood flow, prevent soil erosion, and increase ground water supply. (Garg2077, pp500). This method can be applied for Bhagirathi river flood control.

C) Removal of Human Encroachment along river bank:

From the Bhagirathi river Bank, the Agradweep village is to be shifted as well as the embankment should be made wider to increase water carrying capacity so that large volume of water can get Discharged to 'Katwa'. The other villages namely, Daihat , bethua have also been obstructing flood water discharge and responsible for maximum damages in the study-area. Thus, there is an urgent need to shift these villages at appropriate locations.

Along the river Bhagirathi the villages like Agradweep,Daihat,Bethua should be uprooted with a view to protect them from flood damage. These measures will certainly help flood water for its quick discharge in the study-area.

D) Early warning Early warning:

As a means of reducing a flood hazard, has been a strategy followed throughout history with the aim of living with floods. A flood early warning system includes the components like Prediction, Interpretation, Massage construction, Communication, Response, Review and examining the various aspects of the system with a view to improving their performance. If flood warning is properly done then the loss of property and lives can be saved on time.

E) Role of flood insurance:

Insurance has three main role in flood management. First, it provides a means of reimbursement of damage costs, allowing the victims to get recovered from their loss. Second, it confines irregularity in cost assessment and flood losses over both time and space. Third, it can be used to encourage actions, at individual and collective levels for reducing the exposure of flood loss. If it is done with international agencies then, flood losses in one country may therefore be ultimately spread across the global financial market. Thus, there is a need of integrated efforts between national and international agencies for the environmental management.

F) People Awareness:

Greater awareness is needed among the people with commitments to restore the ecological balance. In fact, mental upliftment programmer formulation and implementation is the immediate need among the population of the study-area.Flood has a strong impact to create socio-economic problems in the district. From the above discussion, it is concluded that the district Bardwan is highly flood prone area in the Deltaic Region of the Water and sediments which develops a variety of landforms over the flood plain.

The changing nature of river and its resultant landforms as well as high intensity of flood are responsible for high risk and mental pressure among the people of the region throughout the year. So people starts migrating or leaves themselves on God's bless which creates their mentality superstitious.Different measures like, flood warning at proper time, proper establishment of embankment, canal and barrages, awareness, building structure modification etc can give sustainable management of flood. Such measures can give the Bardwan district a sound environmental planning.

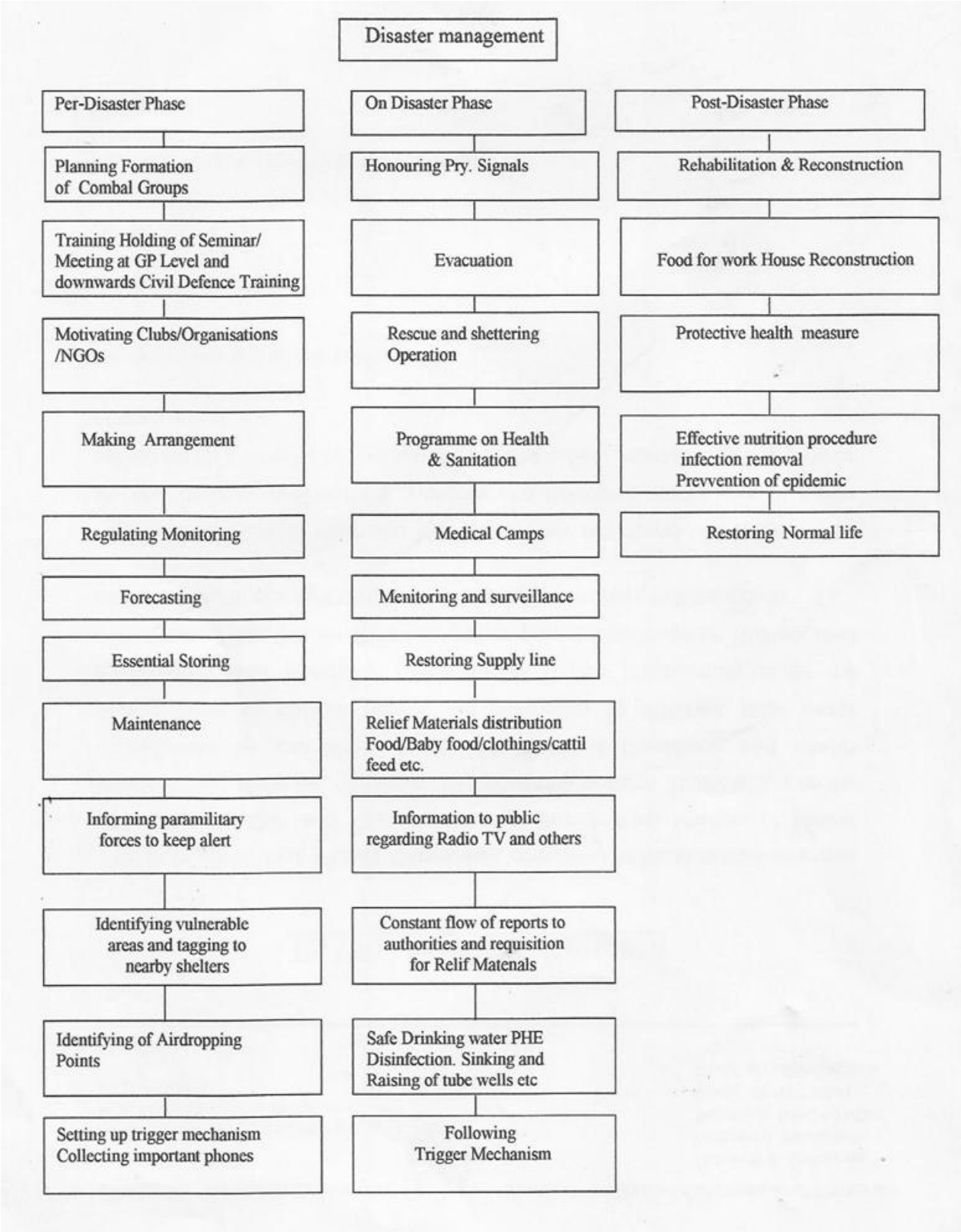

Table-4 : Flowchart of Managerial action for Flood Reduction Process of Ichamati River

VI. CONCLUSION:

Irrigation and Waterways Department (I& WD) Govt. of West Bengal has already taken up disiltation works in some major reaches of the river. However. Managing flood in any tropical and developing country is difficult for any single agency/organization. Flood has a multidisciplinary dimension where society plays a vital role. With limitation in prediction of rainfall, flood forecasting also cannot be very accurate. If we can involve local people and use their knowledge for devising a disaster management plan where all available scientific data are also taken as input then surely we can over come some of the indeterminate factors of disaster management.

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