ROLE OF DVC DAMS IN FLOOD MANAGEMENT

By

K N Keshri [1] ***R K JAIN*** [2] ***V D ROY*** [3]

Synopsis

The Damodar, an interstate river with its drainage area in Jharkhand (earlier Bihar) & West Bengal, was known as “The River of Sorrow” for West Bengal. Voorduin’s (W L Voorduin, an expert from Tennessee Valley Authority -TVA) Plan, drawn for overall development of water resources of the Damodar Basin, titled as “Preliminary Memorandum on the Unified Development of the Damodar River (1945)” envisaged construction of seven storage dams across the Damodar and its tributaries at Tilaiya, Konar, Maithon, Panchet, Bokaro, Balpahari and Aiyar, a diversion dam at Bermo, and a barrage at Durgapur with network of canals. The first stage of the plan consisting of construction of four dams at Tilaiya, Konar, Maithon and Panchet and the Barrage with Irrigation System at Durgapur was completed in 1959, except full land acquisition corresponding to highest designed level. Construction of one of the projects envisaged for the second stage i.e. Tenughat dam *(Aiyar)* by the Government of Bihar (now under Government of Jharkhand) on river Damodar upstream of Panchet Dam was completed in 1981. The Balpahari Dam on Barakar upstream of Maithon dam is in DPR stage. Bokaro dam and Bermo Diversion Dam have not been taken up so far for implementation. The dams were constructed with specific flood storages for flood moderation, as well as conservational storages for irrigation, municipal and industrial needs. During the last five decades, major floods of more than 5,00,000 cusec (14160 cumec) were observed during 1958, 1959, 1961, 1973, 1978, 1995, 2006 & 2009 and these got considerably moderated ranging between 42% &

79%. However, the good effects of the dams could not be felt / appreciated by the local people because of gradual reduction of downstream channel capacity due to encroachment. Also, incomplete land acquisition upto designed levels and siltation of reservoirs are coming in way of optimum utilisation of storages. Integrated operation of all reservoirs, land acquisition upto designed levels, increasing downstream channel capacity, removal of encroachment, construction/strengthening of embankments are some of the measures worth implementing in the basin for more effective flood moderation and providing adequate relief.

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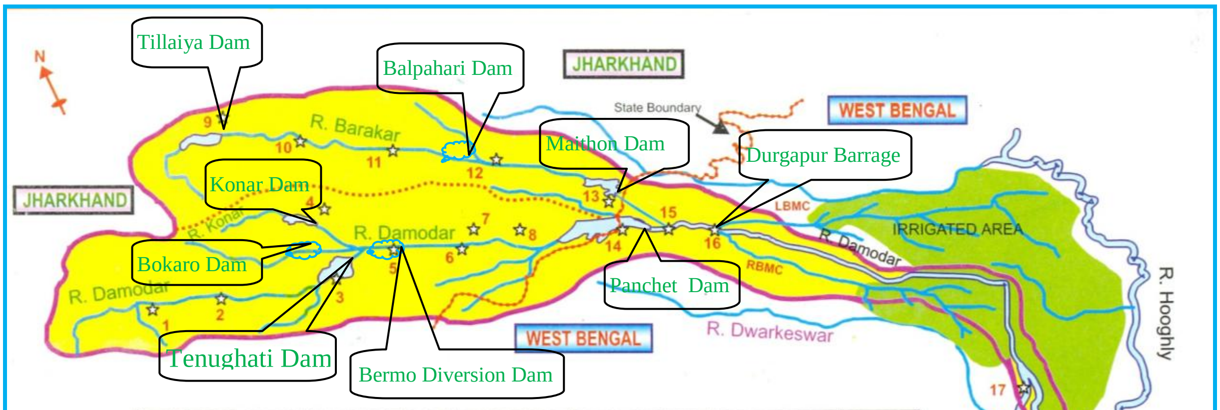
1. INTRODUCTION

Location:- The Damodar basin is located between longitudes 84^0 45' & 88^0 10' East and between latitudes 22^{0}15' & 24^{0}30' North, entirely situated in the two states of Jharkhand (earlier Bihar) and West Bengal. An index map of the basin is presented below:



Sl No.	STATION	RIVER	Sl No.	STATION	RIVER	Sl No.	STATION	RIVER
1	Hendegir	Damodar	7	Gansadih (DVC)	Damodar	13	Maithon Dam	Barakar
2	Ramgarh	Damodar	8	Bhawrah	Damodar	14	Panchet Dam	Damodar
3	Tenughat Dam	Damodar	9	Tilaiya Dam	Barakar	15	Asansol (Rainfall)	Damodar
4	Konar Dam	Konar	10	Barkisuraiya	Barakar	16	Durgapur Barrage	Damodar
5	CTPS(DVC)	Damodar	11	Palganj (DVC)	Barakar	17	Horinkhola	Damodar
6	Putki (Rainfall)	Damodar	12	Nandadih	Barakar			

Catchment:- The area drained by the river at its mouth is about 22,015 Sq. Km of which 17,818 Sq. Km is the catchment of the upper Damodar above its confluence with Barakar. Damodar discharges its flow mainly through two channels namely the Amta channel (main channel) and the Mundeswari. The total length of river Damodar from origin to outfall is about 541 Kms.

Climate :- The climate of the area is characterised by moderate winters and hot & humid summers. Like the rest of India, the region experiences two principal seasons. In the winters from December to March there is little rain. In the summer months, June to September, the flow of air is from sea to land and the season is characterised by high humidity, clouds and rain due to South-West Monsoon which is the main season producing rains. Between these two principal seasons are the transition seasons of the hot weather months of April & May and the retreating monsoon months of October & November.

Rainfall :- The mean annual rainfall in different catchments of the Damodar Valley ranges between 1200mm and 1400mm (Barakar 1260mm, Damodar 1272mm, and lower valley 1329 mm). 82 percent of the mean annual rainfall occurs during the four monsoon months. The annual rainfall is highest, 1650 mm in the southern part of the lower valley whereas Amta has recorded upto 1690 mm. The rainfall gradually decreases to less than 1050 mm in the northern part of the Barakar catchment.

Temperature:- The highest maximum temperature exceeding 46^{0}C has been recorded in the valley in the past. Normal temperature swings between 40 to 42 degrees Celsius in the summers (May & June) and 23 to 26 degrees Celsius in the cold months (Dec. & Jan.). Mean relative humidity varies between 80% during July to September and 40% during March to May.

Streamflow :-Streamflow in Damodar river was recorded at Rhondia weir from 1933 to 1959.Thereafter, on completion of Durgapur barrage and the Dams, the discharges were recorded at these structures. The year 1966-67 was the poorest on record and the annual inflow into the four reservoirs at Maithon, Panchet, Konar and Tilaiya was as low as 0.197 million ha-m. The maximum flood recorded in the pre-dam period was in 1913 with a total volume of 0.3944 million ha-m. The worst flood recorded in the valley, occurred in 1978.

Flood Problem:- The hilly terrain is almost within the state of Jharkhand and the flatter portion lies within the state of West Bengal. Due to this peculiar topography of the catchment area, River Damodar used to inundate large tracts of districts of Burdwan, Hooghly and Howrah in the state of West Bengal every year. Its destructive properties had earned the Damodar, the sobriquet of "the river of sorrow" for West Bengal.

The entire left bank area which includes important industrial towns and coal mines was protected by an embankment since long. Vital means of communications like the Grand Trunk Road (NH-2) and main arterial railway line connecting Kolkata with Delhi and other important places in India lie in the vicinity of the river. Heavy floods in Damodar River often breached the embankment causing breaches in the G.T.Road and the main railway line in the state of West Bengal.

The congestion in the lower valley becomes acute when there is local rainfall in the Trans-Damodar Mundeswari area. The uncontrolled catchment below Maithon and Panchet dams and up to Durgapur barrage is 886 Sq. miles (2,295 Sq. Km) and below Durgapur is 950 Sq. miles (2,460 Sq. Km) which by itself can produce a flood intensity of 2,00,000 cusec (5,663 cumec). If there is heavy rainfall in the Dwarkeswar catchment (an adjoining river on the right side), and Rupnarayan (into which the Mundeswari channel outfalls) is under the influence of spring tide or apogee tide, drainage from the lower Damodar Valley area is practically impossible and any release from dams tends to aggravate the flooding in this area

2. DEVELOPMENT OF WATER RESOURCES PROJECTS IN THE BASIN

Voorduin's (W L Voorduin, an expert from Tennessee Valley Authority -TVA) plan submitted by him vide "Preliminary Memorandum on the Unified Development of the Damodar River (1945)" envisaged construction of seven storage dams across the Damodar and its tributaries at Tilaiya, Konar, Maithon, Panchet, Bokaro, Balpahari and Aiyar, a diversion dam at Bermo, and a barrage at Durgapur with an accompanying network of canals. The first stage of the plan consisting of the construction of four dams at Tilaiya, Konar, Maithon and Panchet and the Barrage and Irrigation System at Durgapur was completed in 1959 except full land acquisition. Construction of one of the projects envisaged for the second stage i.e. Tenughat dam *(Aiyar)* by the Government of Bihar (now under Government of Jharkhand) on river Damodar upstream of Panchet Dam was completed in 1981. The Balpahari Dam on Barakar upstream of Maithon dam is in DPR stage. Bokaro dam and Bermo Diversion Dam are not taken up so far for implementation. The line diagram showing completed and proposed dams/barrages is shown in figure 1 below:

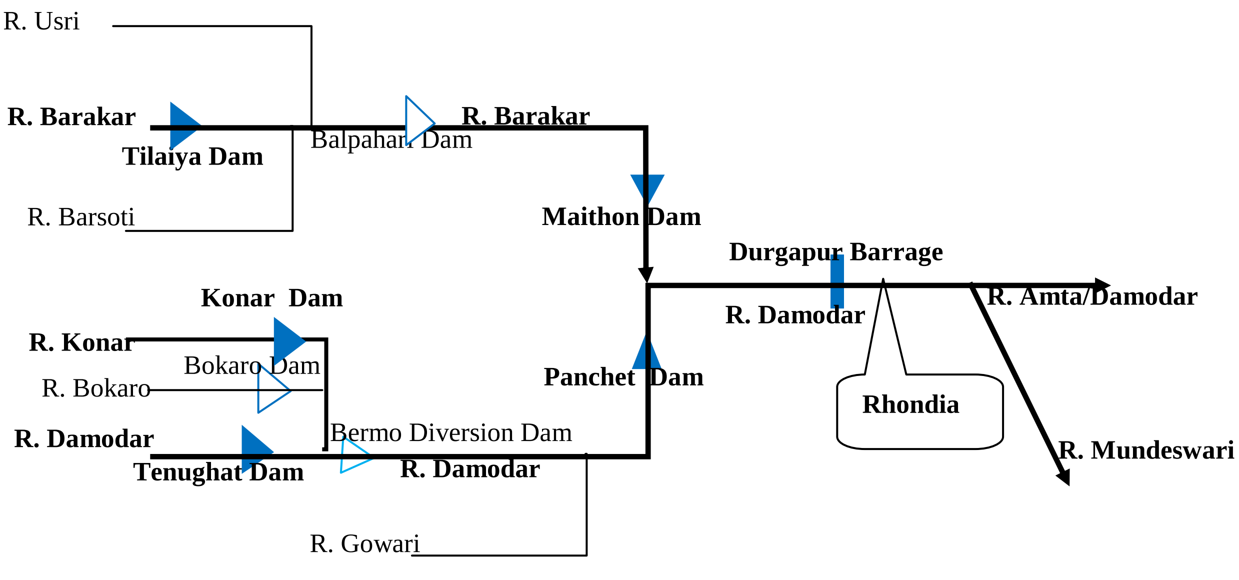


Figure 1: Line diagram showing completed and proposed dams/barrages in Damodar Basin

The brief salient features of dams and reservoirs in Damodar basin with figures of storages based on latest capacity survey are as under:

2.1 MAITHON DAM AND RESERVOIR

a Project Basin, Description and Hydrology

Drainage area	2,430 Sq. miles (6,293.7 Sq. Km) including area intercepted by Tilaiya dam.
Elevation at dam site (stream bed)	340 ft (103.63 m)
Average annual basin precipitation	44.95 in (114.17 cm)
Average annual runoff	2,120,000 Ac-ft (261,499 Ha-m)
Minimum flow (Nov to May)	NIL
Spillway design flood (inflow)	5,20,000 cusec (14,724 cumec)
Maximum observed flood peak (27.9.1978)	3,69,000 cusec (10,449 cumec)

b Reservoir Data

Feature	Elevation above m.s.l.		Water surface area		Storage (capacity survey of 2001-02)	
	ft	m	Acre	Hectare	Ac-ft	Ha-m
MDDL	435.00	132.59	6,000	2,428	75,550	9,317
Spillway Crest level	460.00	140.21	11,220	4,541	2,10,590	25,949
Conservation level	480.00	146.31	17,630	7,135	4,33,410	53,481
Minimum flood management pool	480.00	146.31	17,630	7,135	4,33,410	53,481
Maximum flood management pool	495.00*	150.88	24,600	9,955	7,03,980	89,679
Full and maximum pool	500.00	152.40	26,480	10,716	8,86,540	1,09,354

*Land acquired up to 495 ft only.

c Storage allocation

Dead storage	75,550 Ac-ft	9,317 Ha-m
Conservation storage	3,57,860 Ac-ft between 435 ft and 480 ft	44,164 Ha-m between 132.59 m and 146.31 m
Flood management storage	2,70,570 Ac-ft between 480 ft and 495 ft	36,198 Ha-m between 146.31 m and 150.88 m

d Spillway

Type	Ogee	
Crest elevation	460 ft	140.21 m
Design discharge	4,80,000 cusec	13,592 cumec
Elevation, top of gates	500 ft	152.40 m

2.2 PANCHET DAM AND RESERVOIR

(a) Project Basin, Description and Hydrology

Drainage area	4,234 Sq. miles (10,966 Sq. Km) including catchment area intercepted by Konar and Tenughat reservoirs.
Elevation at dam site (stream bed)	320 ft (97.54 m)
Average annual basin precipitation	44.95 in (114.17 cm)
Average annual runoff	36,80,000 Ac-ft (4,53,923 Ha-m)
Minimum flow (Nov to May)	NIL
Spillway design flood (inflow)	6,30,000 cusec(17,840 cumec)
Maximum observed flood peak (on 04.10.1959)	4,39,000 cusec (12,432 cumec)

(b) Reservoir Data

Feature	Elevation above m.s.l.		Water surface Area		Storage*	
	ft	m	Acre	Hectare	Ac-ft	Ha-m
MDDL	392.00	119.48	6,900	2,792	96,590	11,914
Spillway Crest level	405.00	123.45	11,900	4,816	1,89,790	23,410
Conservation level	410.00	124.97	14,500	5,868	2,45,560	30,289
Minimum flood management pool	410.00	124.97	14,500	5,868	2,45,560	30,289
Maximum flood management pool	435.00**	132.59	30,100	12,181	7,61,410	93,919
Full and maximum pool	445.00	135.64	37,900	15,338	1,101,010	1,35,808

*Based on capacity survey of 1995-96. Capacity survey also done during 2011 but final report is awaited.
** Full land at Panchet reservoir could be acquired upto R.L. 425 ft (129.5 m) and only houses could be acquired in between R.L. 425 ft (129.5 m) and R.L. 435 ft (132.59 m).

(c) Storage allocation

Dead storage	96,590 Ac-ft	11,914 Ha-m
Conservation storage	1,48,970 Ac-ft between 392 ft and 410 ft	18,375 Ha-m between 119.48 m and 124.97 m
Flood management storage	5,15,850 Ac-ft between 410 ft and 435 ft	63,630 Ha-m between 124.97 m and 132.59 m

(d) Spillway

Type	Ogee	
Crest elevation	405 ft	123.45 m
Design discharge	5,86,500 cusec	16,608 cumec
Elevation, top of gates	445 ft	135.64 m

2.3 TILAIYA DAM AND RESERVOIR

(a) Project Basin, Description and Hydrology

Drainage area	380 Sq. miles (984.2 Sq. Km)
Average annual basin precipitation	44 in (111.76 cm)
Average annual runoff	3,50,000 Ac-ft (43,172 Ha-m)
Minimum flow (Nov. to May)	NIL
Spillway design-flood (inflow)	1,35,000 cusec (3,823 cumec)
Maximum observed flood-peak (17.9.1976)	1,94,000 cusec (5,994 cumec)

(b) Reservoir Data

Feature	Elevation above m.s.l.		Water surface area		Storage (based on capacity survey of 1997)	
	ft	m	Acre	Hectare	Ac-ft	Ha-m
MDDL	1192.00	363.32	3,820	1,546	60,625	7,478
Conservation level	1210.00	368.81	9,500	3,845	1,74,505	21,525
Minimum flood management pool	1210.00	368.81	9,500	3,845	1,74,505	21,525
Maximum flood management pool	1222.00	372.47	14,600	5,908	3,08,645	38,071
Full and max. pool	1230.00	374.90	18,400	7,446	--	--

(c) Storage allocation

Dead storage	60,625 Ac-ft	7,478 Ha-m
Conservation storage	1,13,880 Ac-ft between 1192 ft and 1210 ft	14,047 Ha-m between 363.32 m and 368.81 m
Flood management storage	1,34,140 Ac-ft between 1210 ft and 1222 ft	16,546 Ha-m between 368.81 m and 372.47 m

(d) Spillway

Type	Ogee	
Crest elevation	1212 ft	369.42 m
Design discharge	47,600 cusec	1,348 cumec
Elevation, top of gates	1222 ft	372.47 m

2.4 KONAR DAM AND RESERVOIR

(a) Project Basin, Description and Hydrology

Drainage area	385 Sq. miles (997.1 Sq. Km)
Average annual basin precipitation	52 in (132.08 cm)
Average annual runoff	4,50,000 Ac-ft (55,507 Ha-m)
Minimum flow (Nov – May)	Nil
Spillway design flood (inflow)	2,40,000 cusec(6,796 cumec)
Maximum observed flood peak (16.09.1976)	1,25,000 cusec (3,540 cumec)

(b) Reservoir Data

Feature	Elevation above m.s.l.		Water surface area		Storage (based on capacity survey of 1997)	
	ft	m	Acre	Hectare	Ac-ft	Ha-m
MDDL	1347.00	410.57	1,850	749	27,888	3,440
Spillway Crest level	1372.50	418.34	3,617	1,464	78,281	9,656
Conservation level	1397.00	425.81	5,720	2,315	1,70,182	20,992
Minimum flood management pool	1397.00	425.81	5,720	2,315	1,70,182	20,992
Maximum flood management pool	1404.00	427.94	6,400	2,590	2,01,021	24,796
Full and maximum pool	1408.00	429.16	6,900	2,792	--	--

(c) Storage allocation

Dead storage	27,888 Ac-ft	3,440 Ha-m
Conservation storage	1,42,294 Ac-ft between 1347 ft and 1397 ft	17,552 Ha-m between 410.57 m and 425.81 m
Flood management storage	30,839 Ac-ft between 1397 ft and 1404 ft	3,804 Ha-m between 425.81 m and 427.94 m

(d) Spillway

Type	Ogee	
Crest elevation	1372.50 ft	418.34 m
Design discharge	2,40,000 cusec	6,796 cumec
Elevation, top of gates	1404 ft	427.94 m

2.5 TENUGHAT DAM AND RESERVOIR

(a) Project Basin, Description and Hydrology

Drainage area	1,730 Sq. miles (4,480.7 Sq. Km)
Elevation at dam site (stream bed)	729.98 ft (222.5 m)
Average annual basin precipitation	52 in (132.08 cm)
Average annual runoff	19,90,000 Ac-ft (245,500 Ha-m)
Minimum flow (Nov to May)	NIL
Spillway design flood (inflow)	6,47,000 cusec(18,310 cumec)
Maximum observed flood peak (on 17.9.1976)	2,80,000 cusec (7,929 cumec)

(b) Reservoir Data

Feature	Elevation above m.s.l.		Water surface Area		Storage (capacity survey of 2001)	
	ft	m	Acre	Hectare	Ac-ft	Ha-m
MDDL	817.00	249.02	4,517	1,828	1,30,492	16,096
Spillway Crest level	843.00	256.95	7,500	3,035	2,81,835	34,764
Conservation level	865.00*	263.66	12,024	4,866	5,01,165	61,818
Full and maximum pool	882.00	268.83	--	--	--	--

*Land acquisition was reported to be done up to 865 ft but land is fully acquired only up to 852 ft. So, conservation level is now only at 852 ft.

(c) Storage allocation

Dead storage	1,30,492 Ac-ft	16,096 Ha-m
Conservation storage	3,70,673 Ac-ft between 817 ft and 865 ft	45,722 Ha-m between 249.02 m and 263.66 m

(d) Spillway

Type	Ogee	
Crest elevation	843 ft	256.95 m
Design discharge	5,65,000 cusec	15,990 cumec
Elevation, top of gates	882 ft	268.83 m

2.6 DURGAPUR BARRAGE

(a) Project Basin, Description and Hydrology

Drainage area below Maithon-Panchet dams.	886 sq. miles (2295 sq. Km)
Average annual basin precipitation	52 in (132.08 cm)
Spillway design flood (inflow)	5,50,000 cusec (15,574 cumec)
Maximum observed flood peak (September 1978)	3,80,000 cusec (10,760 cumec)

(b) Barrage

		Remarks
Type	Glacis	
Top of gates	212 ft (64.62 m)	
Height above river bed	42.5 ft (12.95 m)	
MDDL	208.0 ft (63.4 m)	Pool level is maintained at constant level of 212 ft as water supply into the DVC water supply gets affected if it is lowered*.
Maximum pool level	211.5 ft (64.4 m)	Pool level is now maintained at 212 ft to enable flow in the DVC water supply canal*.
Submergence area	4,000 acre (1,619 hectare)	
Capacity between min. & max. pool	4,977 Ac-ft (614 Ha-m)	As pool level is constant, there is no balancing capacity in barrage at present*.

* The work of de-siltation of water supply canal is proposed to be done by DVC in near future after which it will be possible to lower the pool level.

3. FLOOD ASPECT OF PROJECTS

Earlier, the primary consideration in the flood management aspect of the DVC dams was to provide adequate protection to the left flood embankment along the Damodar river which protects the arterial Railway, Grand Trunk Road, Industrial establishments etc. below Burdwan by restricting the flows at Durgapur to 2,50,000 cusec (7,079 cumec). Protecting the lower valley consisting mainly of agricultural and low lying land, from floods was not considered in the original plan. However, in the absence of frequent floods of higher intensities due to low releases of less than 1,00,000 cusec (2,832 cumec) from the dams, the lower valley has gained attention of local public, and there has been extensive encroachment into the flood plains and in some cases even on the regular river course itself. Due to this, combined releases of even more than 50000 cusec from Maithon and Panchet reservoirs are now being resisted by the people and the State Government.

Voorduin's original plan of development provided for a total storage of 4.68 million Ac-ft (0.58 million Ha-m) in seven storage dams, of which 2.915 million Ac-ft (0.36 million Ha-m) was earmarked for moderating a 10,00,000 cusec (28,317 cumec) flood to the safe channel capacity of 2,50,000 cusec (7,079 cumec) at Rhondia (downstream of Durgapur barrage) so as to provide adequate flood protection to the left flood embankment along the Damodar river below Burdwan. Only four dams with a total storage capacity of 2.9 million Ac-ft (0.36 million Ha-m) were built in the first stage. Flood management was maintained as the primary objective of the scheme providing a total flood retention capacity of 1.51 million Ac-ft (0.186 million Ha-m) in these dams. With this flood reserve it was expected that all known floods with a peak flow of 6,50,000 cusec (18,406 cumec) could be moderated to 2,50,000 cusec (7,079 cumec).

4. INSTITUTIONAL ARRANGEMENT FOR FLOOD MANAGEMENT

The Tilaiya, Konar, Maithon and Panchet reservoirs are under the control of DVC whereas the Tenughat reservoir and the Durgapur barrage are under the control of Governments of Jharkhand and West Bengal respectively. The Maithon and Panchet reservoirs are the downstream most reservoirs and the water released from these reservoirs enter the territory of West Bengal. Thus, these two reservoirs act as control reservoirs for the purpose of providing flood relief as well as water supply for different purposes to West Bengal. All the four dams of DVC are operated in accordance with Damodar Valley Reservoir Regulation Manual. The Superintending Engineer of CWC at Maithon is the Member Secretary of Damodar Valley Reservoir Regulation Committee (DVRRC). The day to day operation of Maithon and Panchet reservoirs is done by DVC on the advice of Member Secretary, DVRRC where as other two reservoirs namely Tilaiya and Konar are operated by DVC on their own. The DVRRC has been making efforts to bring regulation of Tenughat reservoir also (which also plays an important role in moderation of floods in the valley) under the purview of DVRRC so that all the reservoirs in the valley could be operated in an integrated manner.

CWC provides inflow forecasts for Tenughat, Maithon, Panchet and Durgapur and level forecasts for Harinkhola located on Mundeswari channel in the lower Damodar almost 20 hours in advance during the times of flood. The DVC unit of Indian Meteorological Department (IMD) located at Kolkata provides weather and Quantitative Precipitation Forecasts (QPF) for next 24 hours. These forecasts provide assistance in operation of the reservoirs.

Government of West Bengal takes necessary action towards relocation of the people and providing relief to them during floods. Central Government also helps by providing relief funds and by deploying army in demanding situations.

5. FLOOD MODERATION BY DVC DAMS

Primarily dams attenuates Flood Peaks and induces time lag and thus helps in flood management. This has been proved in case of Damodar dams as explained below.

The maximum flood recorded in the pre-dam period was from 6th to 12th August in 1913 with a peak flow of 6,50,000 cusec (18,395 cumec) and a total volume of 3.238 million Ac-ft (0.3994 million Ha-m) at Durgapur. The flood passed through the river without moderation. The details of devastation caused are not available. It is worth mentioning that the population density in the river plains was relatively very low during those days.

After construction of dams in the valley, the floods got significantly moderated ranging between 33% & 87 % and the devastation caused in the flood plains was appreciably reduced despite growing population density. The frequency of heavy floods has been minimised providing sense of security and opportunity for development. In the post-dam period, role of Maithon & Panchet dams combined together in moderation of floods during 1958 to 2011 as shown in figure 2 below:

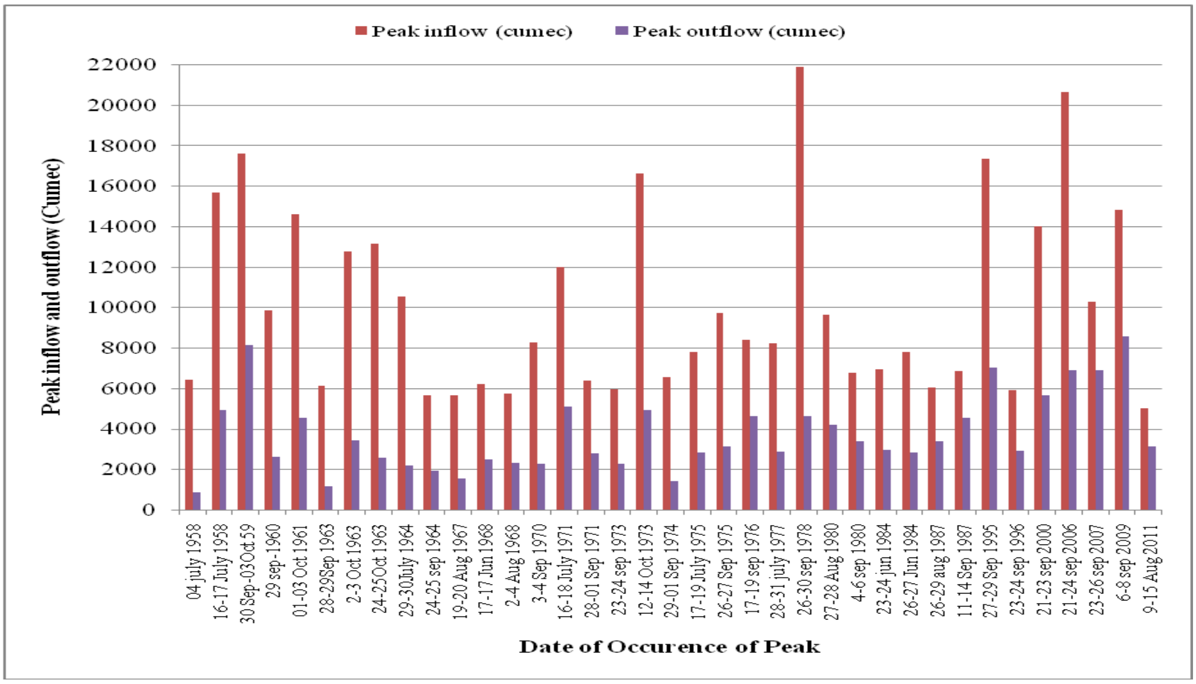


Figure 2: Flood Moderation by Maithon & Panchet Dams in Damodar Basin

From the above chart, it is seen that major floods of more than 5,00,000 cusec (14160 cumec) was observed during 1958, 1959, 1961, 1973, 1978, 1995, 2006 & 2009. The moderation of those major floods was in the rage of 42% to 79%. Yearwise details are as under:

Year	1958	1959	1961	1973	1978	1995	2006	2009
Flood Moderation (%)	68	54	69	70	79	59	67	42

The Flood moderation was achieved by storing inflow in the flood pool of reservoirs temporarily and releasing the same in controlled manner when inflow starts falling. The peak attenuation and peak time lagging by Maithon & Panchet Dams during 1961, 1973, 1978, 1995, 2006 & 2009 are shown in the following figures 3 to 8**:**

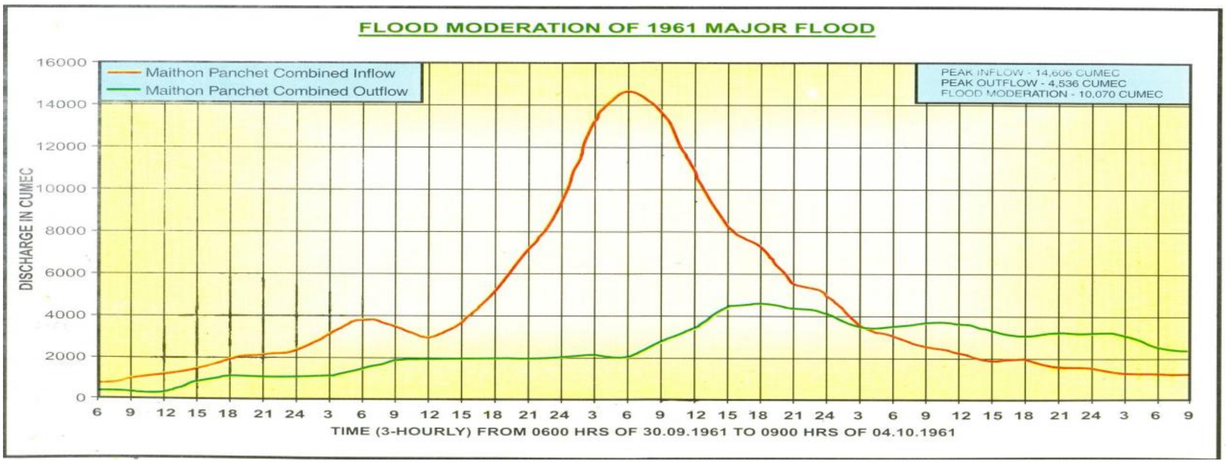


Figure 3: Flood Moderation of 1961 Major Flood

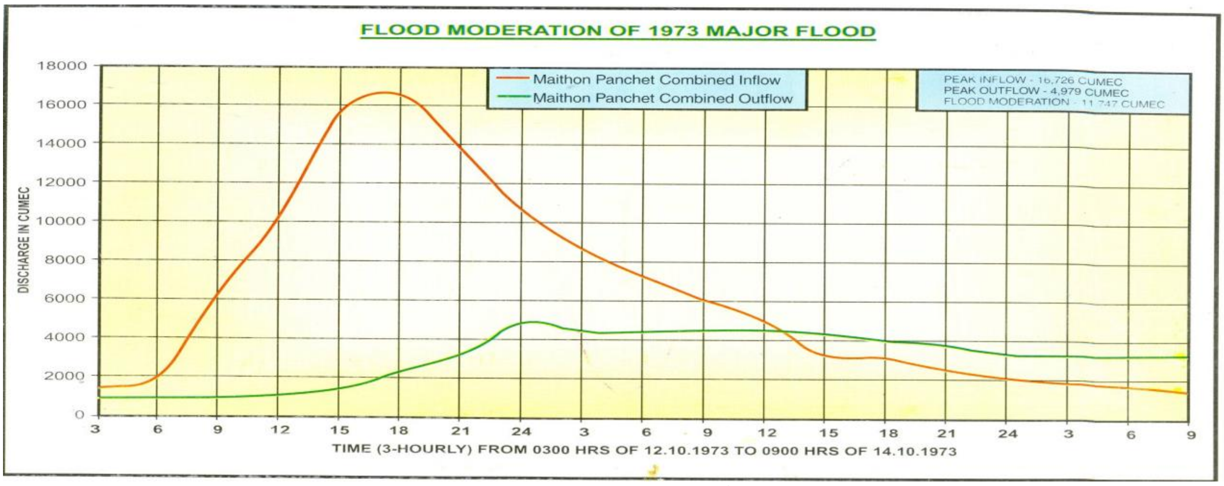


Figure 4: Flood Moderation of 1973 Major Flood

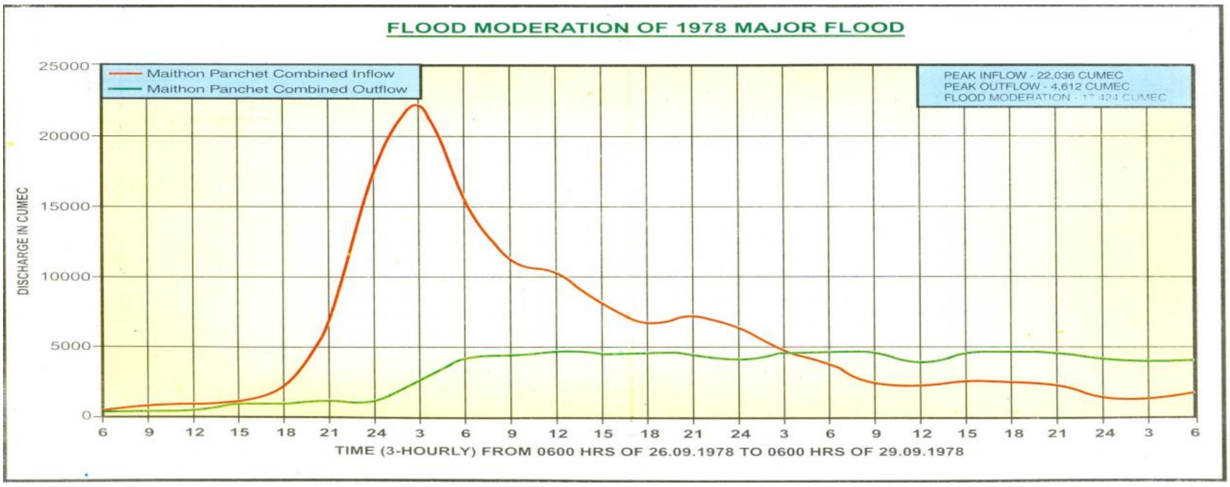


Figure 5: Flood Moderation of 1978 Major Flood

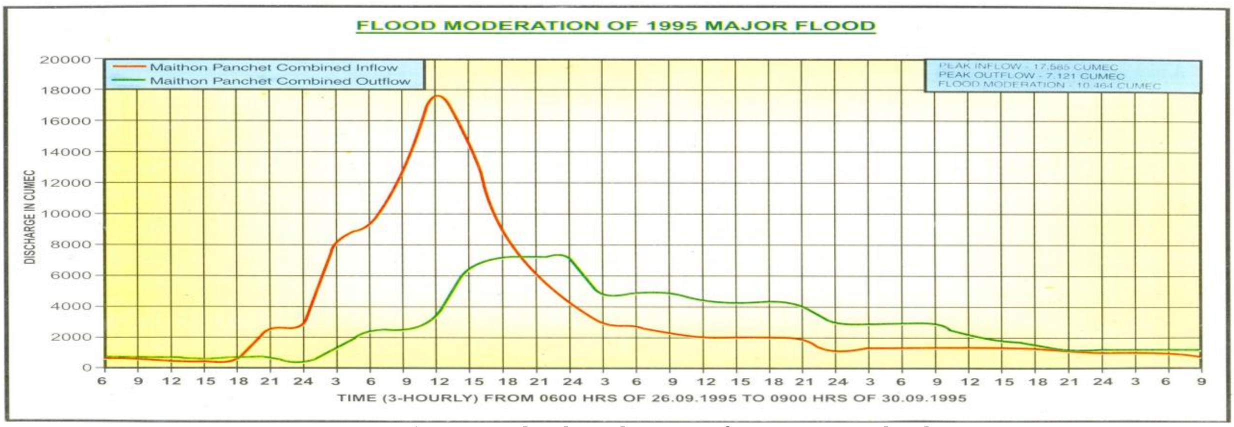


Figure 6: Flood Moderation of 1995 Major Flood

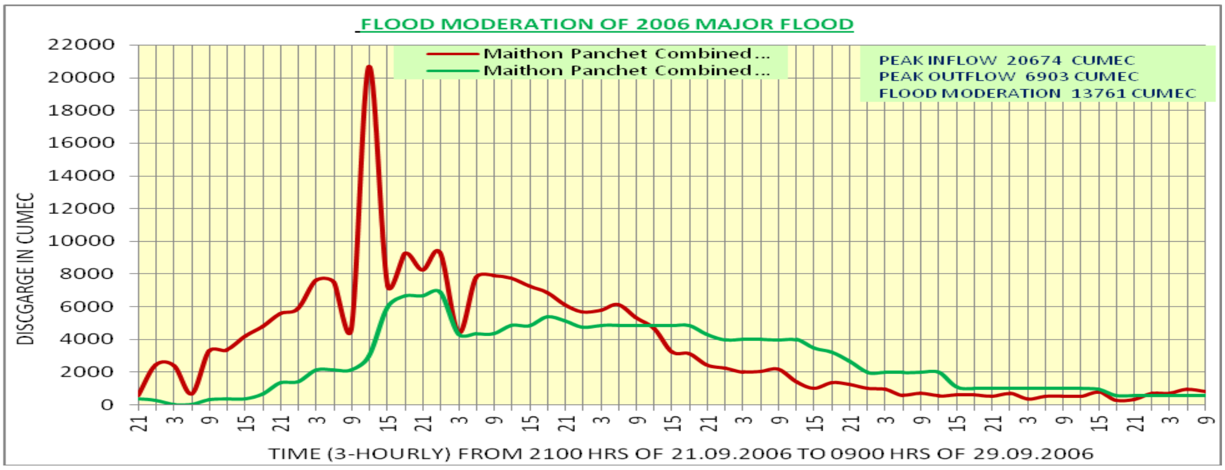


Figure 7: Flood Moderation of 2006 Major Flood

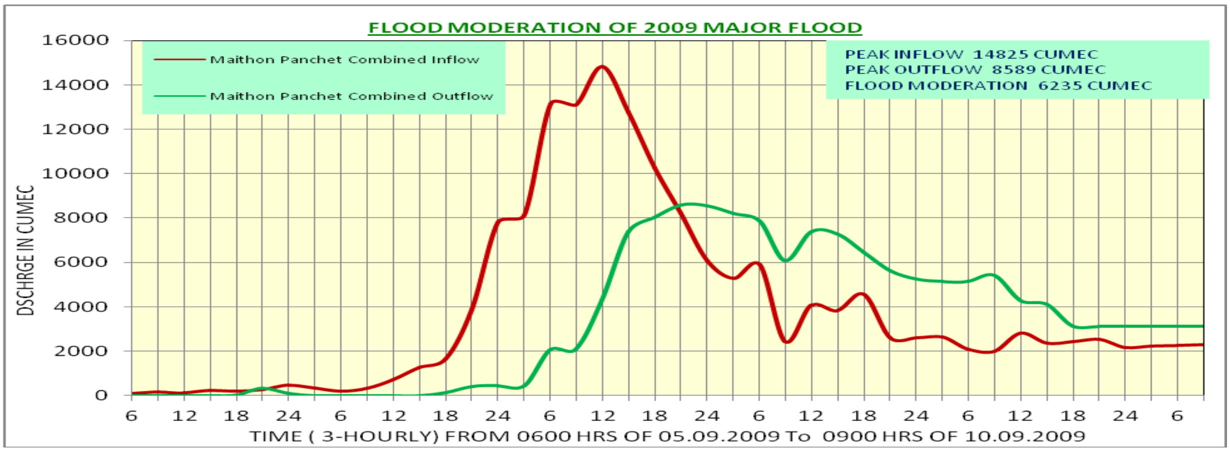


Figure 8: Flood Moderation of 2009 Major Flood

After the dams were constructed there was a major flood from 30th September to 3rd October in 1959 with a combined inflow peak of 6,23,000 cusec (17641 cumec) and volume of 1.15 million Ac-ft (0.1419 million Ha-m) and had there been no moderation by the dams a probable peak flow of 8,10,000 cusec (22,937 cumec) would have arrived at Durgapur. It is worth mentioning that the peak flood was moderated to 2,88,000 cusec (8155 cumec) by the Maithon & Panchet Dams. Flood routing studies have been carried out with the schedule of operations in current use, with the present land acquisition levels as the limits, and receiving the flood into an empty pool. The 1959 flood with a probable peak flow of 8,10,000 cusec (22,937 cumec) at Durgapur got moderated to 2,96,000 cusec (8,382 cumec). If the entire flood storage is available by land acquisition up to design levels, the flood would have got moderated to 1,60,000 cusec (4,531 cumec).

The worst flood recorded in the valley occurred from 26th to 30th September in 1978 with a combined inflow peak (Maithon + Panchet) of 7,74,000 cusec (22,036 cumec) and flood volume of 1.23 million Ac-ft (0.1517 million Ha -m). If this flood were allowed to pass without any moderation, it would have generated a probable peak of 11,80,000 cusec (33,414 cumec) at Durgapur Barrage (against the design flood of 5,50,000 cusec). It is worth mentioning that the peak flood was moderated to 1,63,000 cusec (4616 cumec) by the Maithon & Panchet Dams.

6. OTHER ASPECTS

The land in the foreshore of the Maithon and Panchet reservoirs could not be acquired up to design levels. Further, with passage of time, the capacity of reservoirs has decreased considerably and as per the latest sedimentation survey of these reservoirs (carried out from 1995 to 2002) there has been a loss of 49.5%, 24.1% and 8.2% in the dead storage, live storage and flood storage zones respectively. As a result, against the flood absorption capacity of 2.915 million Ac-ft (0.36 million Ha-m) contemplated in the original plan, and 1.51 million Ac-ft (0.186 million Ha-m) created so far only 0.95 million Ac-ft (0.117 million Ha-m) was available till 2002 which must have reduced further by now.

The bed of the main channel of the Damodar downstream of Durgapur Barrage viz. Amta channel has aggraded considerably due to siltation. The capacity of same is, therefore, restricted to 30,000 cusec (849 cumec) in favourable condition when there is no congestion at outfall due to effect of high tide in the river Hooghly. The other channel leads to the important branch, the Mundeswari that receives all the spilled water of river Dwarkeswar as well. Its bankful capacity is of the order of 1,00,000 cusec (2,832 cumec) only. The safe carrying capacity of the Damodar below the Durgapur barrage can be taken as 1,30,000 cusec (3,681 cumec) in favourable condition. But this capacity gets reduced to as low as 1,00,000 cusec (2,832 cumec) in the lower areas when there is heavy rainfall in the area coupled with high tide period and spilling of adjoining river Dwarkeswar over its left bank.

In view of the above, moderation of 10,00,000 cusec (28,317 cumec) flood or the known floods with a peak flow of 6,50,000 cusec (18,406 cumec), to the present safe carrying capacity of 1,30,000 cusec (3,681 cumec) of the channels in the lower Damodar is not possible at present. Therefore, the good effects of the dams are not being felt by the population of the area.

7. CONCLUSION

The dams in Damodar valley have played great role in reduction of flood intensity in the plains of West Bengal resulting in appreciable development in the area. Most of the times, the floods were moderated by more than 50%. However, the good effects of the dams could not be appreciated by the local population due to downstream uncontrolled development along river channels, siltation of reservoirs and incomplete land acquisition upto planned levels.

There is an urgent need to increase the capacity of the lower Damodar by measures such as, desiltation & re-sectioning, construction/raising & strengthening of embankments and control of encroachment by enforcing flood plain zoning.

Silt control through construction of silt arrester dams upstream of Panchet & Maithon dams may be taken up at the earliest. Land acquisition upto designed levels for accommodating more flood water may be achieved on priority. In extreme cases, submerging areas around reservoir rim temporarily for few days upto maximum pool level to moderate very high floods to the extent possible may have to be resorted to.