ON THE STUDY OF 1992 FLOODS AND ITS EFFECTS ON PUNJAB

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ABSTRACT

A study is reported on the 1992 floods by giving the possible reasons for their occurrence. Relevant data in terms of major floods in the Indus Basin and maximum discharge measuring sites etc. is presented. Some possible measures for flood management are suggested alongwith a short relevant back-ground. Generally speaking flooding problem in our country often arises due to severe rainfall in monsoon season but the occurrence of 1992 floods may be shortly attributed to the peculiar timing and sequence of rains in the valleys and plains of two western rivers namely Jhelum and Chenab which have their main catchments in adjacent valleys such that the same storm can initiate floods in both the rivers. This really forms the basic and particular issue regarding the 1992 floods. In the past floods have also occurred due to over-topping of banks and due to deliberate breaching of banks in order to save our vital hydraulic structures.

INTRODUCTION

Our country has experienced some major floods in year 1929, 1955, 1959, 1973, 1976, 1980, 1988 and 1992. Before Indus Basin Treaty, Punjab had five rivers including Upper Indus, Jhelum, Chenab, Ravi and Sutlej. After the treaty, we are left with three rivers - Indus, Jhelum and Chenab which are of relevance as far as flooding in concerned. The general direction of rivers in Punjab is from East to West while the topography of area slopes towards South-West [1] Table - 1 gives the major characteristics of the rivers.

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Table - 1 : Details of major characteristics of rivers [1]

Name of River	Total length (miles)	Catchment Area (sq.miles)	Number of			Highest flood Discharge	
			Tributaries*	Barrages	Dams	Year	cusecs x 1000
Ravi	559	15500	5	2	--	1955	680
Sutlej	964	47100	8	2	--	1955	597
Chenab	772	26079	12	5	--	1957	1100
Jhelum	513	24500	10	1	1	1929	1100
Indus (upto Guddu)	1469	375000	27	3	1	1992	1087

* including in India.

Table - 2 presents the discharge measuring sites of the rivers upto 1986 [1].

Table - 2 : Discharge measuring sites on Rivers

River	Sites	Start of period of record
Ravi	Jassar Bridge	1984
	Shahdara Bridge	1922
	Balloki Barrage	1922
	Sidhnai Barrage	1922
Sutlej	Sulemanki Barrage	1928
	Islam Barrage	1928

Chenab	Marala Barrage	1925
	Alexandra Bridge	1932
	Khanki Headworks	1922
	Trimmu Barrage	1939
	Shershah Bridge	1930
	Punjnad Barrage	1922
Jhelum	Mangla Dam	1922
	Rasul Barrage	1922
Indus	Attock Bridge	1968
(upto Guddu)	Kalabagh Barrage	1928
	Taunsa Barrage	1956

Various flood limits at different gauging sites of rivers in the Punjab are given in Table - 3.

Table - 3 : Flood limits at different gauging sites of rivers in the Punjab.

S. No.	Name of River	Gauge Site	Flood limits (000 cusecs)				
			Low	Medium	High	Very High	Exceptionally high
1.	Indus	Kalabagh	250	375	500	650	900
		Taunsa	250	350	500	650	800
		Guddu	200	350	500	700	900
		Sukkur	200	350	500	700	900
		Kotri	200	300	450	650	800
2.	Jhelum	Mangla	75	110	150	225	330
		Rasul	75	110	150	225	330

3.	Chenab	Marala	100	150	200	400	600
		Alexandra	100	150	200	400	600
		Qadirabad	100	150	200	400	600
		Rivaz	100	150	200	400	600
		Trimmu	150	200	300	450	600
		Shershah	150	200	300	450	600
		Panjnad	150	200	300	450	600
4.	Ravi	Jassar	80	75	100	150	200
		Ravi Syphon	40	65	90	135	180
		Shahdara	40	65	90	135	180
		Balloki	40	65	90	135	180
		Sidhnai	30	45	60	90	120
5.	Sutlej	Sulemanki	75	110	150	225	300
		Islam	75	110	150	225	300

SUMMARY OF EXISTING EMBANKMENTS

NESPAK while preparing National Flood Protection Plan 1978, made some physical checks on pre-selected embankments, most of which are very old. Most of the existing flood protection bunds in Punjab are mainly marginal or guide bunds which have been provided in the vicinity of barrages/headworks. Existing flood protection facilities in the Province of Punjab are mainly aimed at protecting existing barrages and some major cities. Most of the embankments consist of poorly compacted earth and have been provided on thumb-rule practice rather than hydrometerological considerations. They contain breaching sections on the right marginal bunds possibly to release water pressure due to heading up of waters on the left marginal bunds.

BASIC STEPS IN FLOOD STUDIES

These have been briefly given below. The section considered should be large enough, should have had its share of floods and should have been sufficiently gaged.

As a first step, the methodology for the prediction of watershed runoff is to be developed as it is vital for the design of surface water control facilities, economic appraisal of flood prevention programmes etc. The phenomenon of runoff generation from a particular rainfall is a very complex issue and has received major impetus with the advent of digital computers. This is usually overcome by using modelling techniques broadly falling into two categories, viz, material modelling (laboratory or analog) or theoretical/experimental (dynamic modelling), based on time variance or time invariance. The modelling techniques basically address the identification of principles and mechanisms governing runoff generation (rainfall excess) which is obtained by subtracting the infiltration from rainfall with assumption that as soon as rainfall ceases to exist, infiltration also ceases simultaneously. This is clearly not exact but is extensively used. Based on outputs daily rainfall-runoff relationships for various reaches of rivers are to be developed and hydrologic flood routing in confluent reaches of rivers may be done on the basis of inflow and outflow hydrographs of previous historic floods. Alternatively following procedure may also be adopted.

(1) Investigation of climatological features of surrounding section within limits where there features may be considered same.

(2) Determine flood records at the section.

(3) Plot enveloping curves by using following equation or any other suitable equation :

$$q = 46\ CA\ (0.894^{-0.048}) - 1$$

where

q = the flood in sec. ft. square mile

A = drainage area in square miles

C = constant usually C = 100 gives enveloping curves which gives a general trend of maximum floods.

(4) Determine whether flood peak producing characteristics are as great or greater than the maximum characteristics of that district.

It has taken almost 150 years to country like America to make independent study and to make necessary legislature through congress regarding floods problems in the valleys of Ohio, Mississippi and Tennessee rivers and come up with suitable recommendations and legislations [3].

As discussed earlier the main causes of 1992 floods were timing and sequences of rains in the confluent valleys of rivers Jhelum and Chenab which have main catchments in adjacent valleys and have almost same flood producing characteristics.

The first widespread rains stared on 30/31 July 1992 and continued till almost the 3rd week of August 1992. The second widespread rains took place in first ten days of September, 1992 thereby generating heavy runoff resulting in unusual flooding in the valleys and plains of two western rivers Jhelum and Chenab [4]. Although their combined effect at Trimmu does not appear as high as one would expect but even then it caused heavy damage due to extremely high floods. At Rasul, Trimmu and Punjnad, the maximum discharges exceeded their designed capacity and therefore, to save these hydraulic structures, embankments at Trimmu and Punjnad were breached while at Rasul overtopping of left bank took place. However, the floods in these rivers passed safely through barrages on Indus namely, Guddu, Sukkur and Kotri. The main peaks which started from Mangla and Marala on September 9, 1992, ultimately fell into Arabian sea during the last week of September, 1992. Table - 4 presents maximum discharges at various places during 1992 floods.

Table - 4 : Maximum discharges in the rivers at different sites during 1992 floods.

River	Site	Maximum discharge (cusecs x 1000)
Indus	Kalabagh	846
	Taunsa	655
	Guddu	1087
	Sukkur	1068
	Kotri	689
Jhelum	Mangla	932
	Rasul	952

Chenab	Marala	839
	Khanki	910
	Qadirabad	949
	Trimmu	888
	Shershah	393
	Punjnad	872
Ravi	Jassar	149
	Balloki	102
Sutlej	Sulemanki	193
	Islam	183

Due to these heavy floods, huge losses were suffered by various Government/Public departments and installations in all the Provinces, which are estimated to the tune of billions of rupees. Table - 5 presents the summary of losses occurred in different parts of the country during 1992 floods.

Table - 5 : Summary of losses due to 1992 floods [4]

Region	Villages affected x 1000	Persons affected x 1000	Area affected acres x 1000	Crops affected acres x 1000	Houses damaged kacha/ pacca x 1000	Houses collapsed kacha/ pacca x 1000	Persons died	Cattles lost x 1000
Punjab	6.47	4192	5741	2155	145/67	108/38	381	39
Sindh	5.00	3233	3844	3845	251/00	276/00	223	85
N.W.F.P.	0.945	120	87	63.8	8/11	13/0.4	386	5

Baluchistan	0.50	--	--	--	--	--	--	--
Azad Kashmir	0.261	33	N.A.	N.A.	12/2	4/1	304	5
Northern Areas	N.A.	43	15	14	6/0	9/0	37	26
Total :	13.176	7621	9687	6077.8	422/80	410/40	1331	160

A detailed study on 1992 flood damaged infrastructure restoration project has been carried out by NESPAK [4]. The restoration costs pertaining to Irrigation and Power Department, Roads of Communications & Works Department, educational buildings and basic health units of all Provinces/Regions comes out to be Rs. 6236.92 million which would be provided through ADB/IDA and financing from other relevant line agencies.

RECOMMENDED METHODS FOR THE CONTROL OF FLOODS

The following methods are globally used for the flood control purposes and are therefore recommended for flood control in Pakistan:

1. Building of earth walls (levees) along streams/rivers along the areas where protection is required.
2. Widening, deepening and plain cleaning up of streams/rivers.
3. Construction of temporary multi-purpose detention reservoirs at upstream tributaries.
4. Provision of permanent relief and diversion outlets at critical sections or near hydraulic structures.
5. By-pass channels to protect hydraulic structures.
6. Flood plain management/flood zoning.

7. Upstream forestation.

8. Flood insurance to be paid by the communities involved according to the magnitude of risk.

It may be mentioned here that the methods of flood control from 1 to 5 are very costly and are to be made if they are found economically justifiable, both in the short as well as in the long term.

SPECIFIC CONCLUSIONS AND RECOMMENDATIONS

1. These floods occurred due to the peculiar timing and sequence of rains during August-September 1992 in the valleys of Jhelum, Chenab and Indus which have adjacent catchments.

2. It will be a good approach if methods of flood control are applied in a planned fashion well before being hit by yet another bigger future floods.

3. Identify areas where flood control is needed and the level of protection required.

4. Flood zoning and flood insurance to be done through appropriate legislation, could also serve towards flood control.

5. Flood control projects should be carried out only if they prove economically justifiable both in the short as well as in the long term after making detailed studies by all relevant bodies spreading over years but certainly not on the basis of previous losses incurred.

6. Construct temporary multi-purpose detention reservoirs along upstream tributaries.

7. Provide permanent relief or diversion (by-pass) outlets where required.

8. Formation of a joint task committee on flood problems consisting of engineers engaged in research, professionals from NESPAK, Irrigation Department, WAPDA and Universities.

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