CHAPTER 8

"Water is the earth's eye, looking into which the beholder measures the depth of his own nature[1]."

SYSTEMIC CAUSES OF BREACH[2]

- *Absence of Flood Plain Management*
- *Absence of Hill Torrent Management*
- *Weak I & P Department*
- *Ineffective role of Federal Flood Commission*
- *Lack of integration & coordination between other key departments*

1. INTRODUCTION

1.1. Direct causes of breach have been discussed in detail in the earlier chapters. Without belittling their importance, our inquiry has revealed that there are latent structural disconnects and omissions which, by and large, stem from an indifferent and disinterested I & P Department. Some of these areas (discussed below) have been on the Provincial and Federal Governments' agenda for many years supported by substantial funds but no tangible results have come forth. Today, there is no policy for flood plain management or hill torrents management. Federal Flood Commission hasn't lived upto to its objectives and has morphed into a post office, which simply complies flood schemes of various irrigation departments in the country. I & P Department has fast deteriorated over the years, its lackluster performance during the recent floods establishes. I & P Department, as it stands today, lacks expertise, research, innovation, vision and the dynamism befitting a department that has to lead the largest contiguous irrigation network in the world for the welfare and uplift of the people of Pakistan and its heavily dependent agro-economy. Other connected departments have failed to gravitate around I & P Department to evolve a collective charter for flood resilience. The overall flood governance seems to be in disarray. It is a low priority item for the Provincial leadership, I & P Department and the policy makers.

2. ABSENCE OF FLOOD PLAIN MANAGEMENT

2.1. FLOOD PLAIN or ACTIVE FLOOD PLAIN means a flat or nearly flat land adjacent to a stream or river that stretches from the banks of its channel to the base of the enclosing valley walls and experiences flooding during periods of high discharge[3]. It includes the

[1] Henry David Thoreau
[2] We are of the view that these systemic deficiencies persisting over years contributed and added to the causes of breach discussed in this Report.
[3] Goudie, A. S., 2004, Encyclopedia of Geomorphology, vol. 1. Routledge, New York.

floodway, which consists of the stream channel and adjacent areas that carry flood flows, and the flood fringe, which are areas covered by the flood, but which do not experience a strong current.

2.2. *INQUIRY & FINDINGS*

2.3. The prime revenue authority of the Province[4] i.e., Board of Revenue describes the flood plains to be KHADAR area or SELABI AREA. According to the I & P Department, flood plains is the area which is not under a canal command and is irrigated by the river. Revenue Officers who presented maps of the districts in Punjab had clearly marked the boundaries of the flood plains, which was helpful to assess the impact of the recent flood on the human settlements in and outside the flood plains.

2.4. According to Senior Member Board of Revenue, Punjab (SMBR)[5]: "There is no law at the present regulating the inhabitants within the River Land i.e., Area/active flood plain or Khadar Area". He submitted that presently, there is no ban on the construction on the privately owned area which falls in the active flood plain / Khadar area. In the light of present position, Government of the Punjab is now considering this issue to introduce legislation to prohibit the construction, which can be a hazard in the normal flow of river water, and also to ban un-authorized bunds to avoid any loss/damages in future. He, however, did not place on record the proposed draft bill or any summary establishing the initiation of such a proposal.

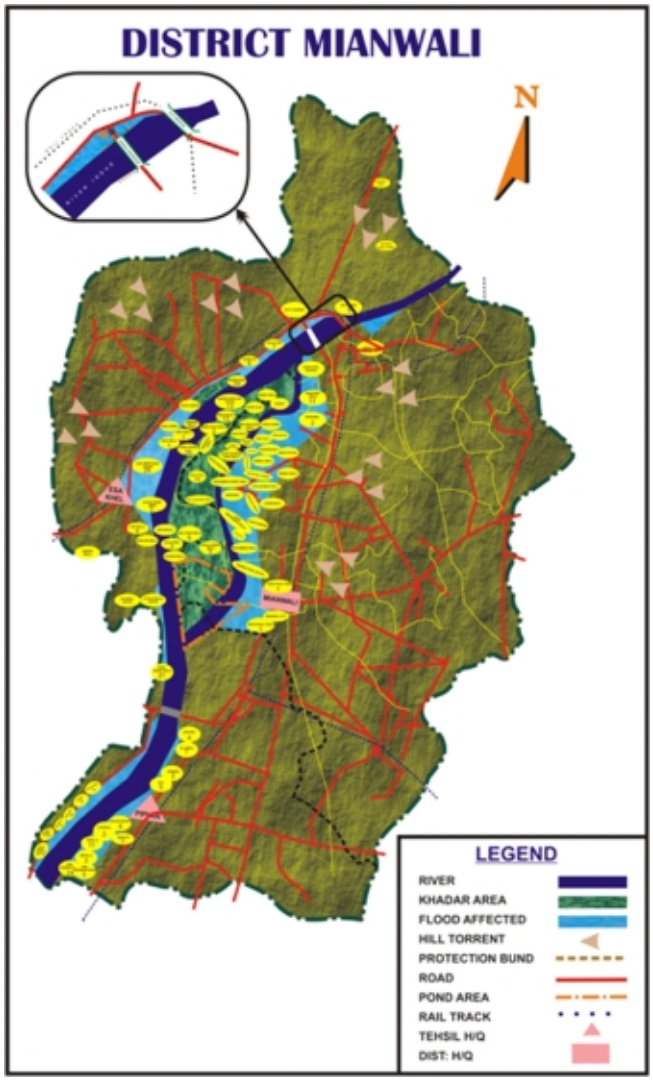
2.5. According to the Secretary I & P Department[6]: " It is true that the active flood plain/riverine area/"khaddar area" has become sizably populated over the years. Construction has been raised by the people in the said area and also electrification has been done by PEPCO/WAPDA. Under the law, the said land belongs to the respective people in the area, however, if rules are made under the Canal & Drainage Act, 1873, the encroachment in the flood plains can be regulated but no such effort has been made so far. In the recent flood, a large number of people were affected who were residing within the flood plain… The population that has been affected by river Indus was settled within the active flood plains."

2.6. Evidence reveals that majority of the population affected by floods lives in the flood plains[7]. Indus passes touching seven[8] district of the Punjab. Revenue record of all the districts has been closely monitored and statements of the District Revenue Officers recorded in order to understand more fully the size of the flood plains, the impact of floods and the character of human settlement within the active flood plains.

2.7. District wise detail is as follows:

[4] Senior Member Board of Revenue, Punjab. (I.W.1 0)
[5] I.W.10. Mr. Akhlaq Ahmed Tarrar
[6] I.W.6
[7] except in Muzzaffargarh where the almost entire District got inundated due to the breach of LMB.
[8] MIANWALI, BHAKKAR, LAYYAH, MUZZAFARGARH, D G KHAN, RAJANPUR AND RAHIMYAR KHAN.

2.7.1. DISTRICT MIANWALI



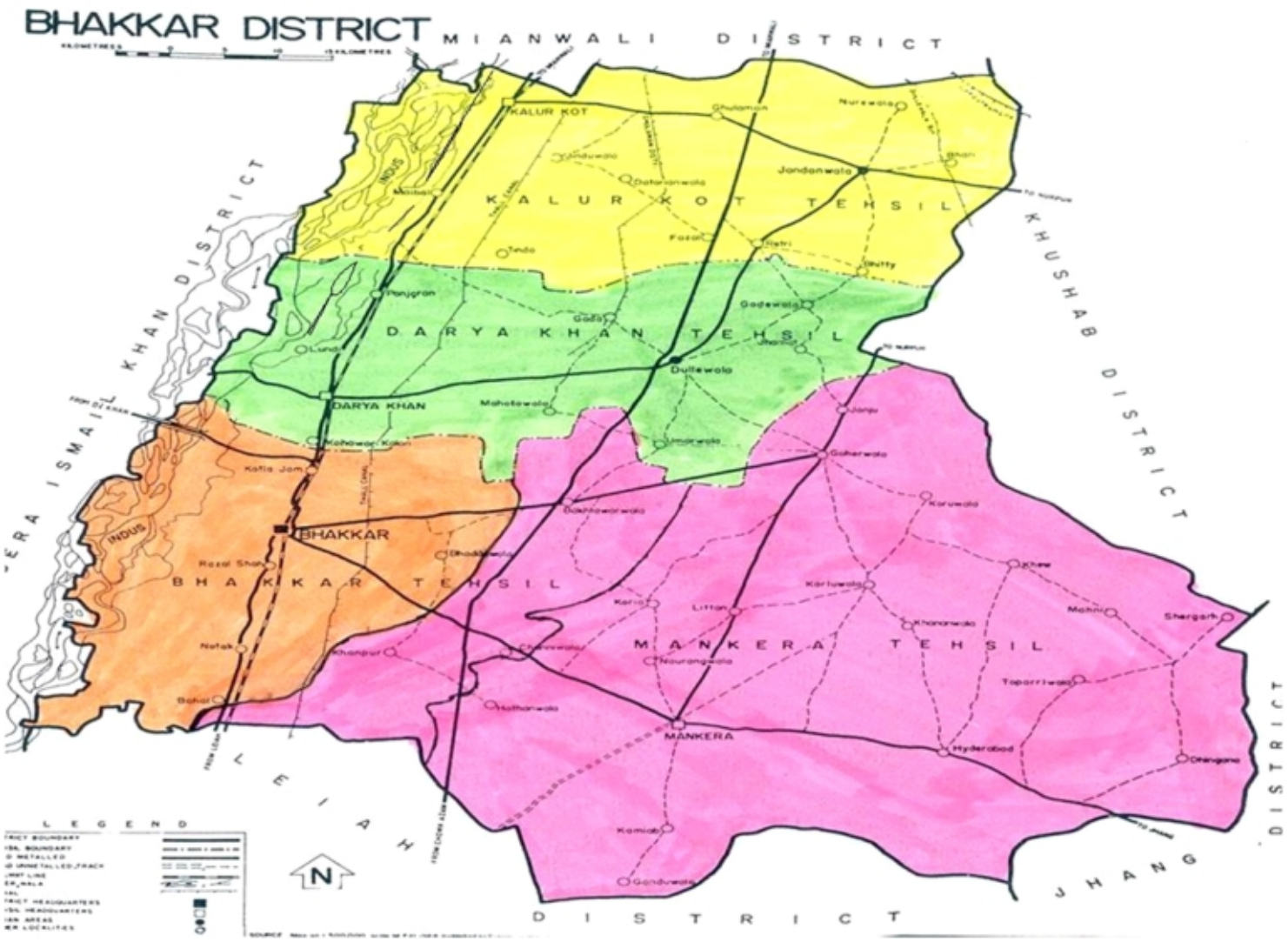
2.8. Details[9] of Flood Plains:

a)	Total Population of the District?	1,056,620 (according to 1998 census
b)	Total Population residing within the Active Flood Plain (Khadar Area)?	61,280
c)	Estimate of the % of the areas of the District outside the Active Flood Plain that were inundated in the recent floods?	12.11%
d)	Total number of deaths reported in the Active Flood Plains due to the recent floods as well as in the remaining part of the District?	Total: 12 Deaths One occurred in the Active Flood Plains and remaining 11 in the other parts of the District Mianwali.
e)	Percentage of the area of Active Flood Plains compared with the overall area of the District?	9.4% (134,149 Acres) 14,26000 Acres (Total area of the District Mianwali.

[9] Mark 92

2.9. The District has three tehsils namely: Mianwali, Isakhel and Piplan. According to the revenue record of District Mianwali placed before the Tribunal by Deputy District Officer (Revenue)[10], Mianwali, the villages affected in the recent floods were the villages within the active flood plain (i.e., 42 revenue estates). According to the details placed on the record[11] total area used for farming in the active flood plain in District Mianwali is 33,107 acres and the population residing within the flood plains is 61,280. According to the DDOR, 25,861 people (within the flood plains) have been affected by the recent floods and 67.5% of the crops has been affected. It has been reported that people carry out agriculture and have housing within the active flood plain.

2.10. DISTRICT BHAKKAR



[10] I.W. 85
[11] Ex.I.W.85/3


MAP SHOWING
FLOOD AREA IN
DISTRICT
BHAKKAR.
2010
N
W
E
S
REFERENCES.
1. DISTRICT BOUNDARY.
2. TEHSIL BOUNDARY.
3. VILLAGE AND RAKH BOUND...
4. RAILWAY LINE W. STATION.
5. METALLED ROAD.
6. RIVER AND NALA.
7. FLOOD AREA
8. KHADDAR/ACTIVE FLOOD AREA
9. PROTECTIVE BUND
10.
11
12
R.S. KALLUR KOT.
R.S. MAIBAL.
R.S. SHAHALAM.
R.S. PANJGRIAN.
R.S. DARYA KHAN.
R.S. KOTLA JAM.
R.S. BHAKKAR CITY.
R.S. CHHINA
R.S. NO TAK.
R.S. BEHAL
D.I. KHAN AREA
D.I. KHAN DISTRICT
D.I. KHAK AREA.
BHAKKAR AREA
LAYYAH DISTRICT.
CONCEIVED BY.
MOHAMMAD AJMAL BHATTEE
DISTT: OFFICER (REVENUE)
BHAKKAR.
D. BY NAZIR NAJMI.
MO. NO. 03336841331.

2.11. Details[12] of the flood plains are:

(a)	Total population of the district.	10,43,586 Persons (Census: 1998)
(b)	Total population residing within the active Flood Plain (Khadar area).	2880 persons
(c)	Estimate of the percentage of the area of the District outside the Active Flood Plain that was inundated in the recent floods	3.29%
(d)	Total number of death reported in the Active flood plain due to the recent floods as well as in the remaining part of the district.	Nil.
(e)	Percentage of the area of Active Flood Plains compared with the over all area of the District.	7%

2.12. The District has three Tehsils namely: Bhakkar, Darya Khan and Kalur Kot. Total population of active flood plain (District Bhakkar) is 2880 out of which population of 2358 has been affected in the recent floods. Total pacca structure within the active flood plain is 382 houses. 20% of the active flood plain of Bhakkar and 15% of the active flood plain of Kalur kot is electrified[13]. No bund has been breached within District Bhakkar including Kalur Kot Bund. There has been some spill over alongside the riverine area and around 5,756 kacha houses and 305 pacca houses have been damaged and around 24,325 persons have been affected. No death has been reported in the district. Major crops in the area are wheat and sugarcane but no substantial damage to agriculture has been reported in the District[14].

2.13. DISTRICT LAYYAH

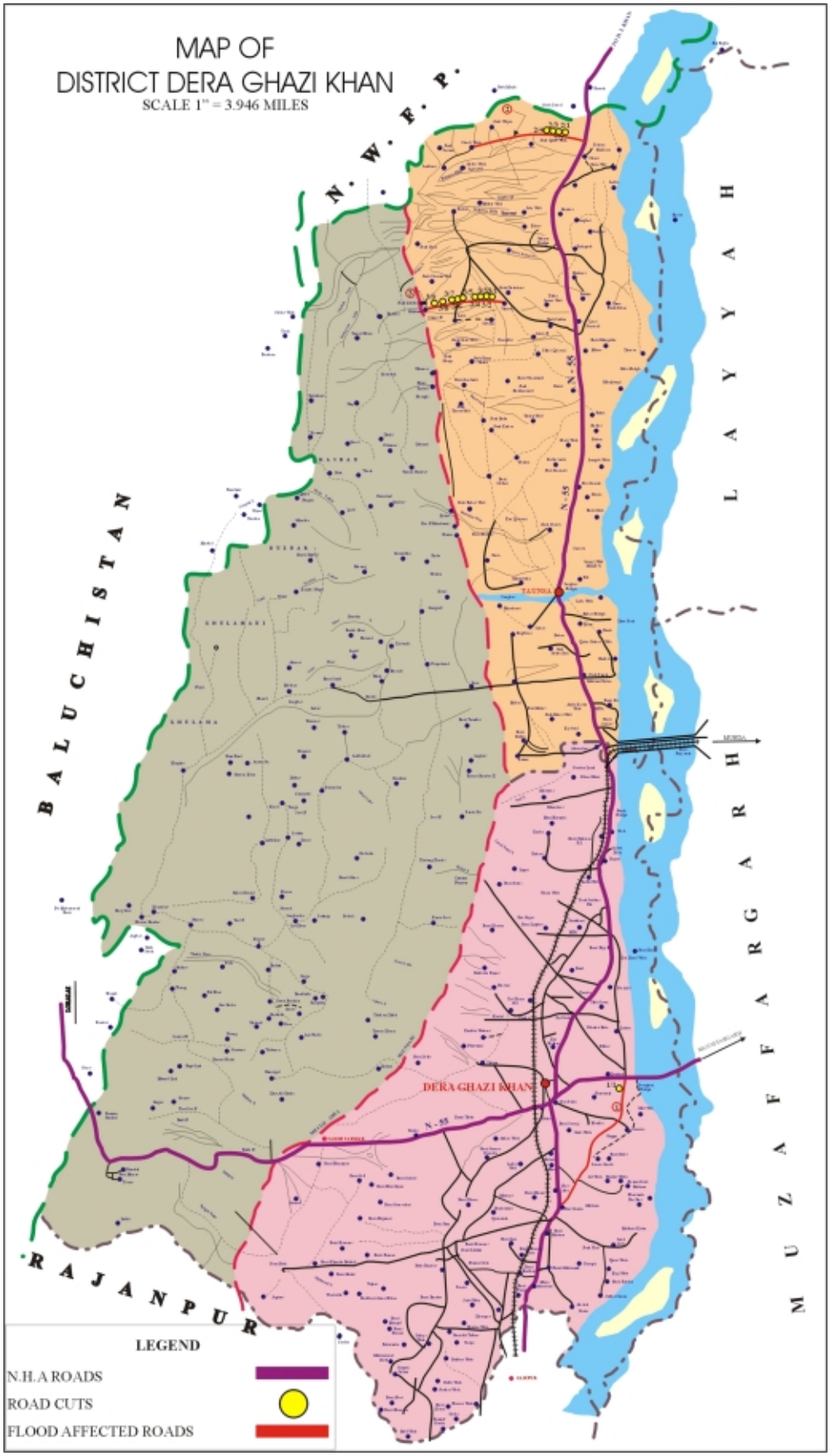
2.14. District Layyah has three tehsils namely: Layyah, Karor and Choubara. According to the DOR[15], Layyah during the recent floods the water remained within the active flood plain of District Layyah and did not overspill.

2.15. Details[16] of the Flood Plains.

[12] Mark 144
[13] Ex I.W. 104/1
[14] I.W. 86
[15] I.W.14
[16] Mark 127

(a)	Total population of the District as per census 1998	11,20,951
(b)	Total population residing within the Active Flood Plain (Khadar area) as per census 1998	2,10,236
(c)	Estimate of the percentage of the area of the District outside the Active Flood Plain that was inundated in the recent floods.	Affected area = 58,411 acres Total area of Distt =15,52,6448 acres Percentage = 4%
(d)	Total number of death reported in the active flood plains due to the recent floods as well as in the remaining part of the District	19
(e)	Percentage of the area of Active Flood Plains compared with the overall of the District.	Active Flood Plan area = 2,45,151 acres Total area of District =15,52,648 acres Percentage = 16%

2.16.DISTRICT D.G.KHAN



2.17. Details[17] of the Flood Plains:

a)	Total Population of the District?	1,527,890
b)	Total Population residing within the Active Flood Plain (Khadar Area)?	2,81,802
c)	Estimate of the % of the areas of the District outside the Active Flood Plain that was inundated in the recent floods?	50 % in Tehsil D G Khan and 16 % in Tehsil Taunsa
d)	Total number of deaths reported in the Active Flood Plains due to the recent floods as well as in the remaining part of the District?	3 due to Rod Kohi (Hill torrents)
e)	Percentage of the area of Active Flood Plains compared with the overall area of the District?	53% in Tehsil D G Khan and 11% in Tehsil Taunsa.

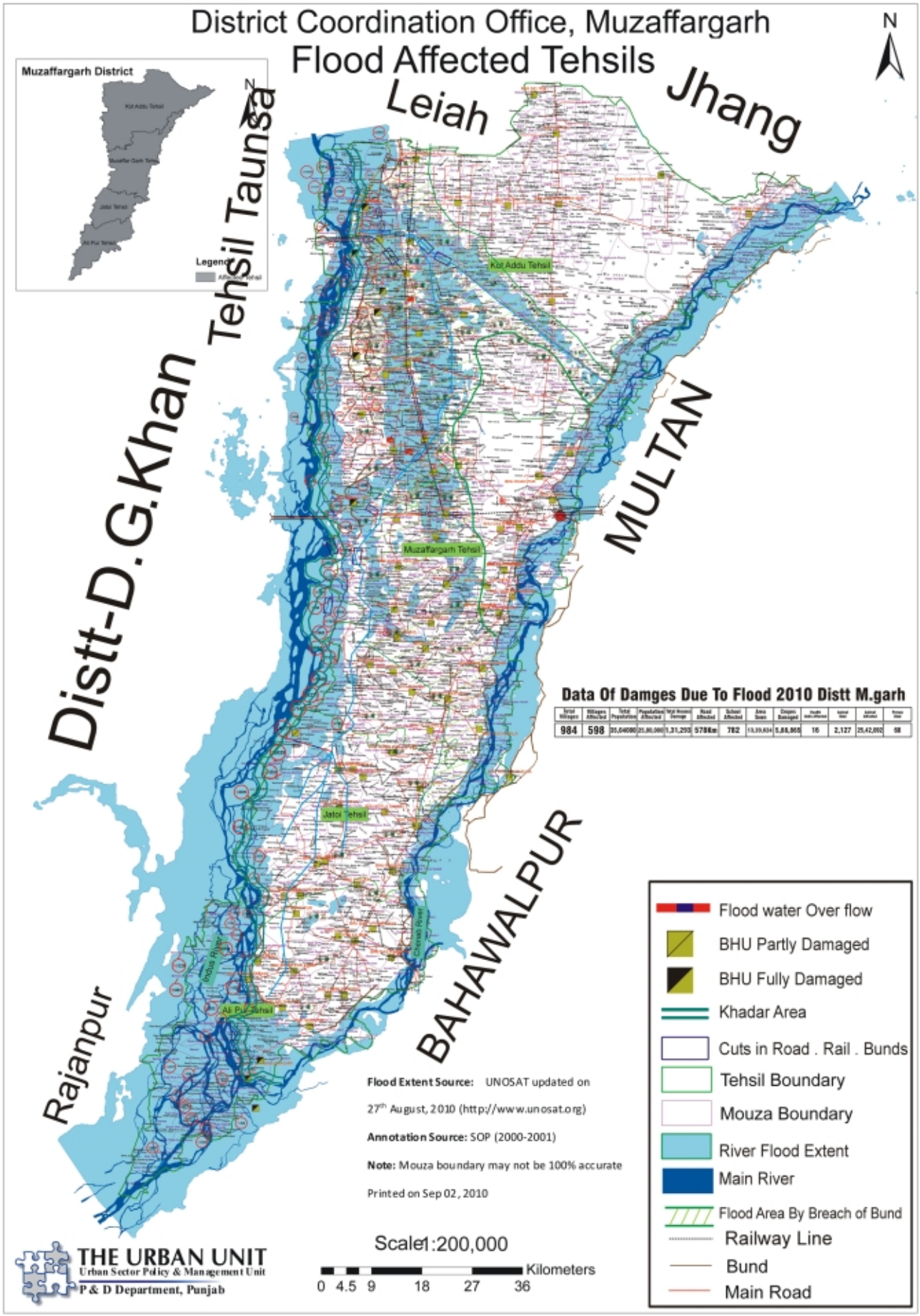
2.18. According to the DOR[18], DG Khan, the entire Active Flood Plain including actual riverbed is owned by private people. The Khader Area/Active Flood Plain/Selabi area is permanently demarcated and shows that the said land is not irrigated through the canal network. According to him *Khadar* area is defined as the land along the River Indus which is not cultivated by canal water but through river water or through Tubewells and Pumps. *Khadar* area is also referred as the Selabi/riverine area[19].

2.19. District Officer (Revenue), D.G. Khan has proposed that there should be law enacted to restrict the local land owners to cultivate their land or raise constructions including Government buildings, Livestock, Dispensaries, BHU, Schools, PEPCO installations in the flood plains and awareness of the public in this regard is also essential.

DAMAGE ASSESSMENT INSIDE AND OUTSIDE KHADAR AREA OF D.G.KHAN DISTRICT[20].

Name of Tehsil	Description	No. of Mauza	Houses Damaged	Total Affected Area of villages (Acre)	Affected Cropped Area (Acre)
D.G. Khan	Inside Khadar Area	64	7004	124749	57538
Taunsa		45	5480	075349	28060
TOTAL		109	12484	200098	85598
D.G.Khan	Outside Khadar Area	30	6024	060051	31171
Taunsa		29	0534	116880	35460
TOTAL		59	6558	176931	66631

[17] Mark 95
[18] I.W.84
[19] Ex I.W 84/4
[20] Ex I.W.84/4


District Coordination Office, Muzaffargarh
Flood Affected Tehsils
N
Muzaffargarh District
Leiah
Jhang
Tehsil Taunsa
Distt-D.G.Khan
MULTAN
Kot Addu Tehsil
Muzaffargarh Tehsil
Jatoi Tehsil
Ali Pur Tehsil
Rajanpur
BAHAWALPUR
Indus River
Chenab River
Data Of Damges Due To Flood 2010 Distt M.garh
984
598
782
2,127
Flood water Over flow
BHU Partly Damaged
BHU Fully Damaged
Khadar Area
Cuts in Road . Rail . Bunds
Tehsil Boundary
Mouza Boundary
River Flood Extent
Main River
Flood Area By Breach of Bund
Railway Line
Bund
Main Road
Flood Extent Source: UNOSAT updated on
27th August, 2010 (http://www.unosat.org)
Annotation Source: SOP (2000-2001)
Note: Mouza boundary may not be 100% accurate
Printed on Sep 02, 2010
Scale 1:200,000
0 4.5 9 18 27 36
Kilometers
THE URBAN UNIT
Urban Sector Policy & Management Unit
P & D Department, Punjab

2.21. Details[21] of Flood Plains:

Sr. No.	Questions	Department Reply
1.	(a) Total population of the District?	35,04,000
2.	(b) Total population residing within the Active Flood Plain (Khadar area)?	1,78,962
3.	(c) Estimate of the percentage of the area of the District outside the Active Flood Plain what was inundated in the recent flood?	Total area of the district 2052571 (acre) Total affected area of District 394855 (acre) Percentage inundated area 288068 (acre) outside Khadar area 14%
4.	(d) Total number of death reported in the active flood as well as in the remaining part of the District?	68
5.	(e) Percentage of the area of Active Flood Plains compared with the overall area of the District?	Total area of District 20,52,571 (acre) Active Flood Plain Area 1,06,787 (acre) Percentage of Khadar area 8.72%

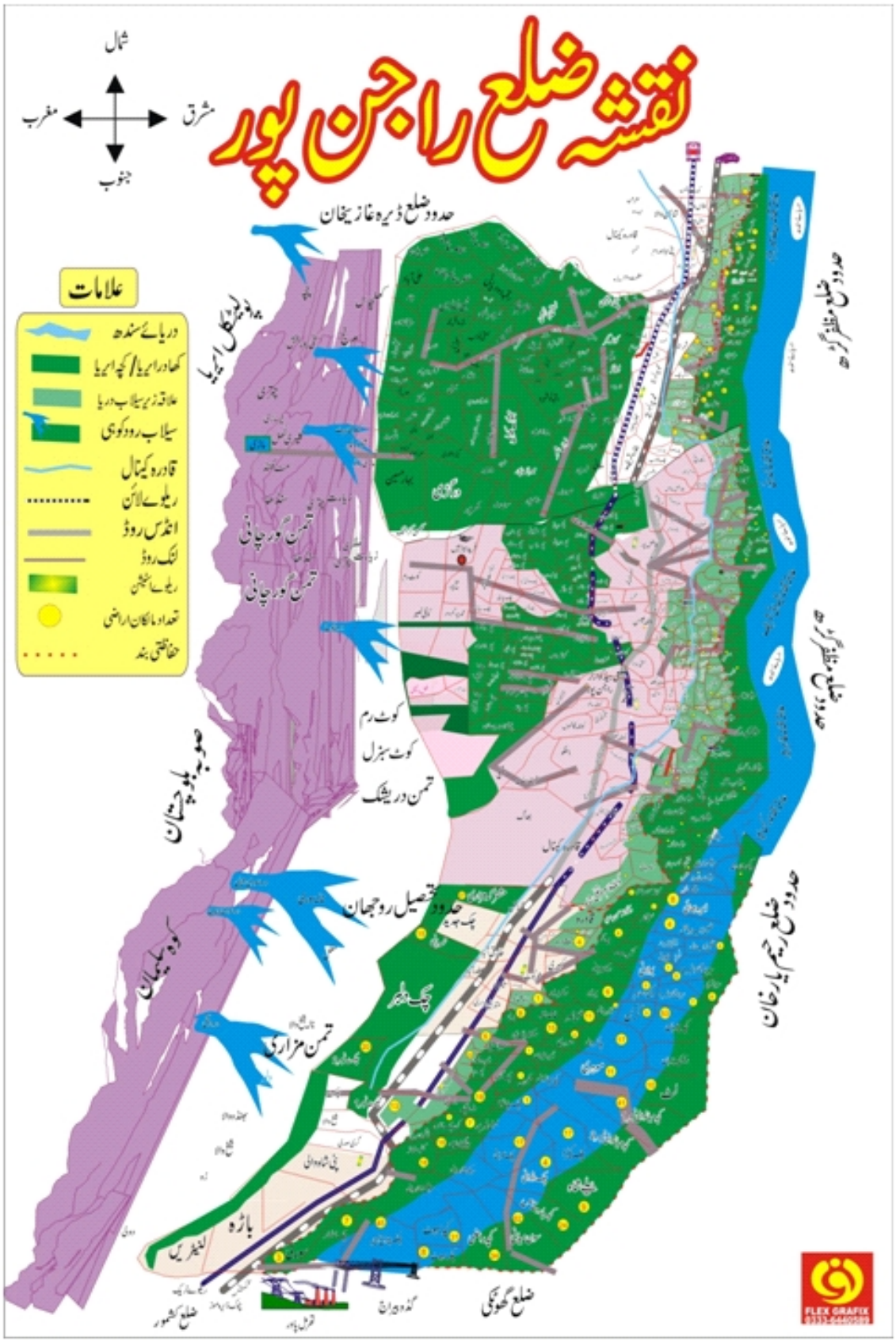
2.22. District Muzaffargarh has four tehsils namely: Kot Addu, Muzaffargarh, Jatoi and Ali Pur.

[21] Mark-113.

2.23.DETAIL OF FLOOD DAMAGES IN ACTIVE FLOOD PLAIN (Muzzafargarh)

Name of Tehsil	No. of villages	Total population	Population affected	% age	Total Area in Acre	Area Affected				Un affected area	Crops Affected									Total Houses	Damages Houses				Total	% age
						Under Khadar Area	% age	Out of Khadar Area	% age		Under Khadar Area					Out of Khadar Area						Under Khadar Area		Out of Khadar Area			
											Cotton	S. cane	Rice	Other	Total	Cotton		Rice	Other	Total		Kacha	Pakka	Kacha	Pakka		
Tehsil Total Of Tehsil Kot Addu	33	99749	96399	97%	91463	69733	76%	14381	16%	7349	20162	6003	0	11100	37265	1545	431	458	1783	4217	17138	12541	2764	825	297	16427	96%
Total of Tehsil M. Garh Total	2	1678	1290	77	3998	1137	28	2435	61	426	715	20	18	37	790	1160	145	65	972	2342	440	78	13	150	40	281	64%
Total of Tehsil Jstoi	9	32235	22095	69	54937	16627	30	25087	46	13223	8592	847	154	638	10235	8312	820	602	2961	12695	10632	1657	104	2304	458	4523	43%
Total of Alipur	12	45300	17530	39	46669	19290	41	6547	14	20832	12810	0	0	1217	14027	3475	80	70	183	3808	8370	2154	146	1148	255	3703	44%
G. Total District Muzaffargarh	56	178962	137374	77%	19767	106787	54%	48450	25%	41830	42279	6870	172	12992	62313	14492	1476	1195	5899	23062	36580	16430	3027	4427	1050	24934	68%

2.24. DISTRICT RAJANPUR



2.25. Details[22] of active flood plain.

Sr. No.	Tehsil	(a) Total Population	(b) Total population residing within Active Flood Plain (Khadar Area)	(c) Estimate of % age on Area out side Active Flood Plain that was inundated in Recent Flood	(d) Total No. of Death Cases reported due to recent flood	(e) %age of Area of Active Flood Plain compared with overall Total Area
1	Jampur	544088	156218	52%	18	31%
2	Rajanpur	565426	142610	46%	15	29%
3	Rojhan	223589	144684	61%	11	35%
Total of District		1333103	443512	53%	44	32%

2.26. Rajanpur district clearly highlights that active flood plain and the torrent flood plains are the worst hit areas. The area inundated other than the active plain is rather limited and a result of the breaches in the Jampur bund.

2.27. PEPCO'S POSITION ON ELECTRIFICATION OF FLOOD PLAINS: Pakistan Electric Power Company submits[22-A] that under the Rural Electrification Program, electric connections are extended to people living in the vicinity of the river i.e, active flood plains. PEPCO stated that electricity being the basic necessity, demand for electric connection cannot be turned down. In the recent floods close liaison was established with the local administration regarding flood warning and the electricity supply of the affected area was disconnected in time. Therefore no fatal accident took place on account of electrification network during the recent flood. Even the Active Flood Plains are electrified by WAPDA under the Rural Electrification Program. This encourages habitation within the Active Flood Plains. Any policy relating to Active Flood Plains will have to also address the extension of utility services to the said people.

2.28. *INDUSTRIES DEPARTMENT AND FLOOD PLAINS;* According to the Industries Department[23], list[24] of industries in the active flood plains is as under:

[22] Mark 128
[22-A] IW.97/1
[23] I.W. 19
[24] Mark 120

Districts	*Nos.*
Muzaffargarh	162
Mianwali	19
Rajanpur	99
D.G.Khan	194
Bhakkar	14
Layyah	21
R.Y.Khan	291

2.29. The revenue record reveals that flood plain is the most vulnerable area in a district. The record also shows that it forms a small percentage of the District with a limited population. The damage in the recent floods has been mostly in the flood plains and the adjoining areas have been affected due to overspill due to poor flood plain management.

2.30. There is no law or policy that deals with flood plain management. The land use within the flood plain requires regulation. The maintenance and regulation of embankments abutting the flood plains falls under the flood plain management.

2.31. Flood Plain management should also plan other non structural and if possible ecologically friendly measures for flood mitigation e.g., development of river forests, retention pools or lakes can be developed alongside the flood plains to enhance resilience against damage caused by floods.

3. *RECOMMENDATIONS*

3.1. Government should urgently develop Flood Plain Management Plan as a part of the larger integrated Flood Management Plan.

3.2. Flood Plains must be clearly zoned and demarcated. Inhabitants and built up structures within the flood plains be subjected to special regulation which ensures extra protection for their life and property.

3.3. Construction in the said area to be regulated and special building codes to be developed. Architecture and design within flood plains need to adapt to frequent flooding. One option can be of raised structures, preferably stilted (or built on stilts) to withstand the heavy flood discharge.

3.4. Towered Emergency centers or shelters can also be of huge benefit to the resident population that is invariably displaced and finds shelter on the dry tops of the embankments or high roads. One suggestion can be that the architecture of the government schools and basic health units in the area can be such that they are used as emergency shelters and also act as early flood warnings centers. Local schools and hospitals carry more credibility amongst the local population than the seldom seen irrigation officers and might take early warnings more seriously than they do now[25]. One of the reasons being poor trust and confidence in the flood managers.

3.5. Provincial Government through legislation or executive order must provide for the following :

- Demarcation of the flood plains duly GIS mapped.
- No future construction to be allowed in the flood plain
- Flood Plains be allowed for agriculture with proper advice on the kinds of crops to be sown.
- Provide regulations to control/manage deforestation and use for livestock grazing.
- Flood Insurance to be encouraged in the flood plains for agriculture.
- Converting existing structures into flood resistant structures. Stilted or raised architecture to be used.
- Government schools or government hospitals within the flood plains to be made flood resistant by raising their structures and using them as shelters and early warning centres during floods.
- Local participation to be encouraged in decision making and reform process.

[25] During our inquiry we discovered on location that flood warnings issued by the I & P Department did not move the people.

4. ABSENCE OF HILL TORRENT MANAGEMENT

4.1. Hill torrents contribute to the flood peaks and have not been harnessed or tamed over the years. This rich water resource can be channelized and stored for agriculture in one of the most backward districts of Punjab i.e., DG Khan and Rajanpur. Even though there is no reliable data of the hill torrents discharge that gets added to the peak discharges in river Indus, it is most certain that a portion of this high velocity discharge finally flows into Indus after playing havoc with the infrastructure that comes in the way.

4.2. Hill torrent-irrigation systems is traditionally called *Rod-Kohi* or Indigenous Spate Irrigation. Rod means water channel and Kohi pertains to mountains. In these areas major constraint is the use of flood flow which is highly variable in quantity and distribution, both in time and space. Annual rainfall is low, uncertain and patchy. Flow is laden with high silt in each flood. It is unfortunate that inspite of scarcity of water, we fail to capitalize (store and use) this large water resource in the shape of hill torrents. In Punjab, major part of the system falls in the districts of D.G.Khan and Rajanpur. According to the study done by NESPAK in 1998 the potential area that can be covered by hill torrents in Punjab is 1.41 (MA) where the potential water 2.71 (MAF).

4.3. Spate Irrigation is traditionally used system for diverting hill torrents into cultivable command areas for growing seasonal crops. The farming system is characterized by extreme events of floods and droughts. It usually entails the construction of an earthen diversion weir across the torrent with large channel on one or both sides of the river to convey flood water across large distances. These earthen diversion structures and water conveyance system has traditionally been constructed by the beneficiaries / communities themselves, making use of traditional technology. Farmers construct embankments from 3 to 6 feet high to store the water depending upon the soil type, share in water and various other factors. The economic significance of Rod-Kohi Irrigation agriculture is centered around subsistence agriculture and live-stock raising which are the main sources of income.

4.4. Major Rod Kohi areas traversed by hill torrents constitute nearly 48[26] percent of the total area of Pakistan and encompass entire Balochistan. The other major hill torrent areas include D.G.Khan and D.I.Khan, FATA and AJK. In Sindh province, the systems are spread in Dadu district (Kirthar range). There are around 17.13 million acres as the potential area under hill torrent / Rod-Kohi / Sailaba fanning excluding riverine areas. Spate irrigation is being practiced in piedmont plains of Kohat, D.I. Khan (KPK), D.G. Khan, Rajanpur (Punjab), Larkana, Dadu (Sindh), Barkhan and Kachhi plaits (Balochistan). Heavy rains in the catchments areas i.e., Sulaiman range and Bhattani range, result into various torrents toward the foothill plains. The Rod Kohi system is being practiced since centuries. However, it is still less understood and improperly managed due to lack of resources and high water velocities. Spate irrigation based on floodwater is the major source of irrigation for Rod-Kohi farming in the district of D.G. Khan.

[26]Mark 26

4.5. More than 0.2 Million hectares (Mha) of the cultivated area is irrigated by seven major hill torrents which emerge from the adjacent Sulaiman ranges. These torrents, from North to South, are: Kaura, Vehowa, Sanghar, Sori Lund, Vidore, Sakhi Sarwar and Mithawan. The command area adjacent to the mountainous region is called "Pachadh" and is irrigated by these torrents. The total catchment area of these hill torrents is 10,180 km square that receives annual average rainfall of 250 mm with average run off ranging from 17 million m^3 for Sakhi Sarwar to 784 million m^3 for Sanghar. In addition to the non-perennial torrents, there are perennial spate irrigation systems prevailing in the area. The perennial Rod-Kohi systems are named as "Kalapani or Aab-e-Siah". Water Resources Research Institute ("WRRI") of Pakistan Agricultural Research Council ("PARC") Islamabad has developed earthen reservoirs for storage of water, few sites were selected in various Mauzas to harness rainwater. The said stored water is used for human and livestock consumption besides providing supplemental irrigation.

4.6. The above details pertain to the project title Rod-Kohi System Development and Management Project, which was implemented in Mithawan watershed area of D.G. Khan from June 1995 to June 2004 with a total cost of Rs.8.95 million. It is surprising that Water Resources Research Institute ("WRRI") Pakistan Agricultural Research Council ("PARC") had annual budget of approximately Rs.2.7 million in 2009-2010 and now has a budget of Rs.2.6 million in the year 2010-2011, however, nothing concrete or material has been done by WRRI[27].

4.7. There are 200 hill torrents originating from the Suleman Range. 13 hill torrents have large catchment areas and flood flow potential. The details of the hill torrents and the area cultivated by them are as under:-

4.8. SALIENT FEATURE OF MAJOR HILL TORRENTS[28]

Sr. No.	Name	CATCHMENT AREA		CULTIVATED AREA	
		Sq. Km.	Sq. Miles	Hectare	Acres.
	DISTRICT D.G.KHAN				
1.	Kaura	523	202	17310	42773
2.	Vehova	2634	1017	26730	64874
3.	Sanghar	4913	1897	25770	63678
4.	Sori Lund	500	193	15660	38696
5.	Vidore	772	298	13348	32983
6.	Sakhi Sarwar	158	61	4190	10353
7.	Mithawan	710	274	11010	27206

[27] Mark 26
[28] Mark 102

Sr. No.	Name	CATCHMENT AREA		CULTIVATED AREA	
		Sq. Km.	Sq. Miles	Hectare	Acres.
	DISTRICT RAJANPUR				
8.	Kaha	5716	2207	36253	89581
9.	Chachar	710	274	17100	42254
10.	Pitok	231	89	---	---
11.	Sori Shumali	332	128	---	---
12.	Zangi	394	154	9080	22437
13.	Sori Janubi	1707	659	16180	39980
	TOTAL			**192131**	**474755**

4.9. *FEDERAL FLOOD COMMISSION'S (FFC'S) MANUAL* fully provides for flood management of hill torrents[29]. The Manual was developed in the year 2001 but is still unused and nothing substantial has been done on the ground by the I & P Department.

4.10. The following passages are from the FFC's manual, which we think have not even been read by the provincial flood managers.

> 4.10.2. *General.* Hill Torrents have been the cause of widespread devastation in downstream areas. Although some catchments areas are being managed, it is only on a small scale. For maximum utilization of the hill torrents, some effective training works will have to be introduced. These schemes may include channelization, distribution structures, dispersion structures and check dams (or delay action dams).
>
> 4.10.3. The catchment areas of hill torrents mostly consist of hills which have little soil cover and very sparse vegetation. A major part of the balance area is covered by torrent bed, gravelly and stony lands, gullies and mounds etc. Only a very small portion, about five (5) percent of the area, is terraced or form valley land which is under use by sparse population for limited agricultural and residential purposes. The downstream areas of hill torrents consist of piedmont plain alluvial deposits formed of alluvium brought by the hill torrent and dropped as the flow spreads over the area.
>
> 4.10.4. *Water Rights.* According to age-old-agreements among the residents of the area, the flood waters are shared in agreed ratios, the upper riparian on a torrent has the first right to use water to his need before releasing it to the downstream users. Implementation of the water rights is overseen by the Government Administration. The water-right will be an essential factor to be considered while locating, type

[29] Ex I.W. 103/2

selecting and designing of hydraulic structures to control/improve the overall flood/water management of the area.

4.10.5. *Existing Management of Hill Torrents:* The hill torrents are diverted by constructing temporary earthen dams/dispersion structures across the bed of torrents to store and raise water which is led directly into the embanked fields through shallow channels and trail dykes. Quite often the temporary dams breach by the flood water or often these are not completely constructed before the rains set-in and the torrents are flooded. The flood waters continually cut out new channels and ravines and whole area is affected by the flood flows. Sometimes, floods of different torrents accumulate in certain ravines, rendering the flow unmanageable and cause large devastation in the area.

4.10.6. At places, the main torrent divides into branches; there a distributor structure controls the agreed flow share to each branch. These branches then become independent torrents. The new flood control system will be developed by satisfying the existing management system for a particular hill torrent scheme. The new designing may include appropriate channelisation of the torrent, dispersion / distribution structures and check dams. Flood prone dwellings may be protected by providing the appropriate training and protection structures.

4.10.7. *Design Flood Discharges;* In remote areas where hill torrents get generated and contained in downstream channels there are no existing flow gauges on torrents or any precipitation recording stations in the area for obtaining the base data for hydrological assessment of design flood discharge in the torrent.

4.10.8. MANAGEMENT IN MOUNTAINOUS AREAS

4.10.9. Generally, the non-structural measures like soil and water conservation techniques and watershed and range management practices are carried out in such areas. These help in the utilization of flood waters, stabilizing the slopes, reducing the sediment yields and flood peaks. However, these measures are not in the scope of this project.

4.10.10. Structural measures like check dams (or delay action dams) may be provided to subside flood peaks. The check dams would be located in headwater areas depending upon the topography and sediment concentration.

4.10.11. MANAGEMENT IN SUB-MOUNTAINOUS AREAS

4.10.12. The hill torrents in sub-mountainous areas repeatedly erode large portions of land and carry with them high silt load. Structural measures like distribution/dispersion structures and retaining walls may be provided to subside land erosion.

4.10.13. MANAGEMENT IN PLAIN AREAS

4.10.14. In plain areas the hill torrents possess the maximum agriculture land use potential. At the same time it causes highest flood damages. The following structural measures may be provided to reduce the flood impact:

i. Flood distribution / dispersion structures in order to utilize maximum flood flows for agriculture.
ii. Flood training structures like guide banks and spurs and auxiliary weirs for controlled channelisation of flood flows.
iii. Protection of flood prone dwellings by providing the appropriate training and protection structures.

4.10.15. PLANNING OPTIONS

4.10.16. The evolving of a comprehensive, optimal and cost effective of the flood control planning for hill torrents and ultimate utilization of flood flows for developing maximum agriculture areas essentially requires the consideration and evaluation of all the possible planning options. For this purpose the following possible alternatives may be considered:

- Flood dispersion structure;
- Flood distribution structure;
- Channelization of torrent;
- Check dam (or delay action dam);
- Combination of various alternatives.

4.10.17. FLOOD DISPERSION STRUCTURE

4.10.18. The flood dispersion structure would ensure the utilization of flood flows by directly diverting them into the irrigation channels without storage arrangement. A sizeable flood dispersion structure located at the start of natural distributary could reduce the flood peaks in main torrent

4.10.19. FLOOD DISTRIBUTION STRUCTURE

4.10.20. Where the main torrent branches off into natural distributaries a flood distribution structure would ensure the sharing of flood flows in accordance with the existing water rights. A sizeable flood distribution structure could reduce the passing of undue flood peaks into the only one distributary.

4.10.21. CHANNELISATION OF TORRENTS

4.10.22. The channelization of torrent would involve the improvement of its

existing course by raising its banks and introducing training and protection structures at appropriate locations along the torrent. These measures will be recommended only for specific reaches where flood flows need controlling and new structures could be effective for long period by contravening the high silt loads. The selection and designing of various types of training and protection structures will conform to the criteria already described under relevant sections.

4.10.23. CHECK DAM (OR DELAY ACTION DAM)

4.10.24. A single or successive check dams across the torrent and / or tributaries bed may be provided to reduce the flood peaks in the main torrent by temporary storage or delay action. The synchronization of entry of peak discharges from the contributing tributaries into the main torrent can be broken, thus further reducing the flood peaks in the main torrent. The check dams include deposition of sediment till the upstream reservoir is almost filled up and the erosion valley widened and slope flattened. If the valley remains still active, additional check dams can be inserted in between the existing check dams to reduce the slopes further and achieve a stable erosion valley. Sometimes a large number of such check dams has to be provided for stabilizing a very steep valley.

4.10.25. GABION STRUCTURES

4.10.26. Maximum use of stone-crates (Gabions) will be made in the hydraulic structure components. Gabions are very well suited for the hill torrent conditions because of their flexibility and also to make full use of readily available local stone. In order to protect crate-wires, concrete layer will be provided on all exposed surfaces, except for the floor aprons where it is liable to get damaged during de-silting operation and also due to uplift pressure. Nearly all of the hydraulic structures made of Gabions, except check dams, will be of minor type.

4.10.27. CHECK DAM

4.10.28. The check dam does not conserve water and control of seepage through the body of the dam. A porous structure made of Gabions will therefore serve the purpose for temporarily holding water for a few hours to reduce the flood peaks in the torrent. Another major advantage is that the structure height can be modified as desired, simply by building up or removing courses of Gabions of the existing structure. The overflow section can be adjusted within the dam body, without any expensive arrangement. In case of floods larger than the design flood, the whole structure could act as overflow weir. Due to the porous nature of the structure, horizontal and vertical pressures are less. With proper embedment, they can be safely used even where firm abutment conditions are not available. Any damage to the structure can be conveniently repaired.

5. RECOMMENDATIONS

Immediate Action

5.1. It is recommended that the Government sets up Hill Torrent Management Policy, as soon as possible and preferably before the start of the Flood season 2011. This will not only act as flood mitigation measure but will also bring agriculture and prosperity to the "barani" area in the foothills of the Suleman Range.

5.2. A detail audit be conducted before the next flood season to assess the allocation and utilization of funds and verify the results achieved through various heavily funded hill torrent projects done till date. The audit must give elaborate reasons why these projects failed. The audit report must be put up before the Chief Minister of the Province so that firm action be taken against the delinquents and road to flood and hill torrents management in this country be paved in stone, once and for all.

Reform

5.3. Large quantity of fresh water resource that comes down as hill torrent is not being tapped and harnessed. In the modern water scarce world this passes for criminal neglect. There can be no other national or provincial priority more urgent and pressing than finding ways and means of conserving fresh water resources of our country. The sustainability of our future generations depends on the water management and planning we do today.

5.4. Any future Flood Management Plan will be incomplete without Hill Torrent Management. Detailed planning and mechanism is provided in FFC's Manual. Government needs to start implementation.

Additional Recommendation (even though outside our TORs)

5.5. During our inquiry we visited[30] the hill resort of Fort Munro[31]. The climate, beauty and serenity of the resort left an impression on us. We were informed that several such peaks exist in the Suleman Range which can be developed into wonderful hill resorts of the likes of Murree. Any development in this direction can provide a huge economic uplift to the less prosperous districts of Punjab and provide healthy entertainment to the people of Southern Punjab. It will also open multiple avenues between Baluchistan and Punjab, which will further cement national development and cohesion.

[30] On a private visit for the members of the Tribunal and its secretariat which was completely funded by the Chairman of the Tribunal in his personal capacity.
[31] an hour and half drive from D G Khan.

6. WEAK I & P DEPARTMENT – institutional structure and capacity

6.1. According to the position paper submitted by SPRU, I & P Department[32], the irrigation system serves as the lifeline for sustained agriculture in the province which has arid to semi arid climate. There are 24 main canal systems which off-take from 14 headworks / barrages and irrigate 21.5 million acres of fertile land in the heart of Punjab. The total length of main, branch and distributary canals is 36,000 Km, while the total off-take capacity of canals is 120,000 cusecs. In addition, the Punjab farm lands are drained by 8000 Km of surface drains and protected by 2600 Km of flood embankments and spurs. The irrigation system is over 100 years old with ageing structures and inadequacies to meet the growing water needs. Aware of the crucial importance of water for sustainable socio-economic development, the present government is according the highest priority to the water resources development and management with the vision to provide adequate, equitable and reliable irrigation supplies to the cultivable lands of Punjab aiming at enhanced agricultural productivity and sustainable development with focus on holistic management and broad based institutional reforms.

6.2. The above position paper further states that the way forward for the Irrigation has reached a stage in which increased investment, both public and private, is needed simply to maintain the current level of efficiency. This investment is required to support measures such as modernization of barrages, lining and remodeling of irrigation conveyance network and introducing on-farm drainage. In addition, a very considerable amount of investment will be required to build water storage capacity to levels that would provide greater security against fluctuations of rainfall and snowmelt as well as cater for seasonal variations in water demands. Focus on broad-based policy and institutional reforms in the sector will continue, with appropriate refinements in the light of experience gained so far. Towards this end, the way forward is;

- Build large scale multi-purpose dams (for water storage and hydro power generation)
- Improve water use efficiency at farm level.
- Develop asset management plan and rehabilitate irrigation infrastructure
- Ensure transparency of flows through telemetric technology (inter and intra provincial levels)
- Develop groundwater management framework for sustainable use of the resource base
- Develop small and medium scale hydro power projects
- Realign mandates, organizational and governance models and build capability and relevant knowledge base for water sector institution.

6.3. Irrigated agriculture is the major determinant of economic growth potential of the province as it accounts for 26 percent of the GDP and caters for over 40 percent of the

[32] Ex I.W.141/1

province's work force. Over 90 percent of agricultural output in Punjab comes from farmlands irrigated by one of the largest contiguous irrigation system in the world. The colossal irrigation conveyance network is serving 21 million acres (8.4 million hectare) cultivable command area with cropping intensities generally exceeding 120 percent. The vast irrigation system in the province, however, faces major irrigation and drainage challenges with serious economic, environmental and social implications. Hydraulic infrastructure has deteriorated and large deficits in O&M maintenance have led to sub-optimal service delivery levels characterized by low water conveyance efficiencies and inequitable water deliveries. Replacement costs for Punjab's irrigation infrastructure including barrages and conveyance network is estimated as Rs.1600 billion whereas the estimated cost for rehabilitation and deferred maintenance needs is Rs.170 billion. Consequently, development in the sector needs to enshrine rehabilitation, improvement and modernization of infrastructure coupled with holistic reforms aiming at integrity and sustainability of the system through improved management and service delivery levels[33].

6.4. *According to the MTDF 2009-2012,* one of the holistic strength for the irrigation sector is to extend and approve drainage and flood protection as well as hill torrents management. The total outlay for the year 2009-2010 for irrigation sector is Rs.10 billion. According to the MTDF, Government of the Punjab is cognizant of the safety of major hydraulic structures for sustained supply of canal water to crops and mitigation of flood hazards has planned to rehabilitate and modernize the barrages being linchpin of irrigation system. According to the MTDF rehabilitation of Taunsa barrage has been completed in December 2008. The amount allocated for the flood work for the year 2009-2010 is in the sum of Rs 1156 million[34].

6.5. Some of the ongoing flood works schemes are the management of hill torrents in CRBC area D.G.Khan since 2007 at a cost of Rs 1605 million. One of the approved new schemes is the management of hill torrents in D.G. Khan Irrigation Zone Sori Lund, Vidore, Mithawan, Kaha and Chachar (Kaha Hill Torrents) at the costs of Rs 200 million[35].

6.6. *According to the MTDF 2010-2013*[36] Irrigation sectors total outlay for the year 2010-2011 is planned at Rs.11.005 million.

6.7. The sub-sector allocation is as follows:

Irrigation	67%
Drainage	4%
Flood	5%
Small Dams	13%
Power	6%
Surveillance and Investigation:	3%
Miscellaneous	2%

[33] Ex I.W. 137/2/2
[34] approximately.
[35] Ex I. W. 137/3/2
[36] Ex.I.W.137/3/2

6.8. *According to Vision 2030,*[37] Planning Commission, Government of Pakistan (2007) while dealing with the efficiency of the bureaucracy states that the professional civil services which facilitates and implements the policies should be free of clientilism, be it political, donor related, or even cadre centered. Extensive administration reforms are needed in Pakistan to attract and retain competent officers.

6.9. *INTERNATIONAL EXPERTS:*

6.10. *JOHN BRISCOE,*[38] Gordon McKay Professor of the Practice of Environmental Engineering, Harvard University Schools of Engineering and Applied Sciences, Public Health and Kennedy School of Government, USA submitted before the Tribunal that 'since 1958, with the transfer of major development works to WAPDA, provincial irrigation departments' functions were reduced mainly to the operation and maintenance of the systems. PID managers have not been finding these functions sufficiently challenging, and over the years have lost much of their initiative, innovativeness, and morale. The PIDs' attention remains almost exclusively focused on the irrigation distribution network. Let alone the flood protection works, even the river barrages have been in a state of neglect. Whenever a major problem of a catastrophic nature takes place on a barrage or a flood protection embankment, lack of adequacy of maintenance funds is given as a standard cause which in several cases would be valid while in others not quite so. Deferred maintenance has become a routine practice with PIDs, which eventually results either in a disaster or in a major repair and restoration undertaking in the shape of an independent project.'

6.11. *ADIL NAJAM,*[39] Director and the Frederick S. Pardee Professor of Global Public Policy, Boston University,[40] USA deposed before the Tribunal that "while it is important for the future to improve the quantity of data generated, it is probably more important to strengthen the institutional abilities to analyze the data in time and over time. The current structures of data calculation and dissemination related to extreme climatic events such as floods are disbursed in multiple institutions, which have not had a history of effective coordination or communication amongst them. Improving the analytical capacity and the ability for cross-institutional connections is a key challenge in this regard. Within this challenge the role of the Irrigation Department is particularly important not only as a recipient of Meteorological Department from the PMD but also as a partner in the analysis of real time use of that data."

6.12. In the *"Case Study of the Punjab Irrigation Department" by Asrar-ul-Haq,*[41] the history of the Irrigation Department's performance has been traced in an exclusive report regarding the reorganization of the Punjab Irrigation Department that was edited by Mazhar Ali

[37] Ex.I.W.137/5.
[38] John Briscoe spoke with the Chairman of the Tribunal over phone from USA and got recorded the above statement. On his visit to Lahore he also met the other members of the Tribunal on 6-12-2010. The above statement is transcribed from the recording made over the phone. The statement was sent to Mr. Briscoe over email which was confirmed with slight modifications on 24-12-2010. Therefore, there is no signature on the statement.
[39] I.W. 150
[40] The Frederick S. Pardee Center for the Study of the Longer-Range Future 67-Bay State Road Boston, Massachusetts -02215
[41] Mark-107, (Ilmi, September, 1998, Pakistan National Program, International Irrigation Management Institute, Lahore.)

(1981). The report highlights the factors that have been influencing the working of the Department into sharp focus. Some selected reflections from the above report are reproduced below:

> "…..In the past, the Irrigation Department of the Punjab occupied a top position in the Government's power hierarchy and in national development. Young engineers entering the department had a sense of pride and senior engineers had a feeling of deep professionalism and achievement. They worked with dedication under harsh and difficult environments and made the deserts bloom. The outlook then was progressive and forward looking…..During the One Unit period, the department successfully planned, designed, executed and operated two major irrigation projects, viz; the Guddu Barrage Project and the Taunsa Barrage Project. The department had a strong Central Design Office to conceive, plan, design and oversee major projects and to undertake major changes and improvements in operating works. It had also a large construction team to execute major projects expeditiously and economically. It carried out all the complex and difficult studies which subsequently became the basis of the Indus Basin Replacement Plan. Tripartite negotiations on the Indo-Pakistan water dispute among India, Pakistan and the World Bank were successfully handled…….In 1960, planning, design and construction activities connected with the development of water and power resources underwent a major change. All resources in materials and manpower were diverted to timely completion of the Replacement Works under the Indus Basin Plan. WAPDA was created in 1958 as an autonomous organization to execute the Indus Basin Plan, mostly with the help of foreign consultants and foreign contractors due to Pakistan's obligations under the foreign assistance for the Indus Basin plan. Policy decisions for the execution of the Indus Basin Plan were based on advice of foreign consultants with Pakistani engineers playing only a secondary role…Due to pressure of work of the Replacement Plan, a large number of experienced engineers of the Irrigation Department were assigned to WAPDA. No major canal irrigation project outside the Replacement Plan was undertaken during the period 1960-70 as the entire emphasis was on the timely execution of the plan works. The engineers in the Department found themselves at a disadvantage as compared to their colleagues in WAPDA, where they had much better career and professional opportunities. WAPDA was a young, expanding and powerful organization for the Power Sector and execution of all replacement works. Major new projects in the water sector were also assigned to this organization. The transfer of responsibilities for irrigation development to WAPDA adversely affected the professional competence of the Irrigation Department. The engineers in the department were forced into an environment of the inactivity with little chances of professional growth. An organization can blossom only in the face of challenges; inactivity can destroy even the best organizations.
>
> Slowly, but steadily, the Punjab Irrigation Department, which was once the pride of engineers in the field of development and enjoyed a high status in the government hierarchy, went sliding down into near inactivity and stagnation. There were no

major projects where the personnel could get important field experience and professional maturity. Departmental promotions became slow as new jobs were not forthcoming. The whole climate became rather stale as there were fewer changes for exposure to modern knowledge and experience. As such, the engineers greatly lost their initiative and confidence."

6.13. Commenting on the relevance of the present role structures of the Punjab Irrigation Department in the changed socio-political environments of the society, Bandaragoda and Firdousi (1992)[42] have observed

".....Organizational structures, distribution of responsibilities and even the size of organizations basically remain in the same form as left by the colonial administration. Minor sporadic changes have resulted only in some appendages, and consequent administrative anomalies…

For instance, the PID, which was created about a hundred years ago, despite its expansion with some new disciplinary wings such as Drainage, SCARP, Mechanical, etc., has not changed in its basic structure of the Open Canal Circles since its creation. Since then, the demand for water has increased manifold due to fragmentation of lands, changes in cropping patterns and expanded irrigable areas, all leading to increased problems concerning distribution of water and disputes among the irrigators.....

Among the institutional factors that affect Pakistan's irrigation performance are the problems of complex and outdated formal rules and procedures compounded by the over riding effect of several socially evolved information institutions, and the associated management deficiencies of a static administrative structure……

It is recommended to review the present organizational structure of the Punjab Irrigation Department with a view to removing present administrative anomalies and making them more effective in supporting and monitoring irrigation management at divisional level where greater framer participation can be achieved in decision making."

6.14. The "Case Study of the Punjab Irrigation Department" further states that: The Punjab Irrigation Department, which once led the world in development of the science and art of irrigation engineering, is now left far behind in the fields of research and development, and the use of modern tools in irrigation management. Rather than acquiring the modern technologies for improving irrigation performance, the department has not been able even to sustain the old practices and systems. Despite some individual brilliance and isolated efforts to transform the system management, the general trend has followed the pattern of adhocism and status quo. This has been mainly due to the prevalence of a culture of indifference and stagnation in the organization, inadequate incentives for performance enhancement and a lack of forward planning and imagination on the part of the leadership.

[42] reference Mark 107

6.15. In Flood Control & Management, Asif H Kazi[43] The provincial irrigation authorities are the custodians of their respective irrigation, drainage and flood protection networks. They are supposed to carry out not only the operation and maintenance of these systems but also design and development of new works. Since 1958, however, with the transfer of major development works to WAPDA, provincial irrigation departments' (PIDs') functions were reduced mainly to the operation and maintenance of the systems. PID managers have not been finding these functions sufficiently challenging, and over the years have lost much of their initiative, innovativeness and morale. This is further compounded by their unenviable role as a target of fair as well as unfair criticism by others, including the federal government, WAPDA, the agriculture departments and the international financing agencies. The large land owners with political clout have choked the small landholders to the extent that there is no such thing left, in certain Provinces, as an equitable distribution of water. The tail ends of distributary channels remain perpetually dry. In these circumstances, the PID's attention remains almost exclusively focused on the irrigation distribution network. Let alone the flood protection works, even the River Barrages have been in a state of neglect. Whenever a major problem of a catastrophic nature takes place on a Barrage or a flood protection embankments, lack of adequacy of maintenance funds is given as a standard cause which in several cases would be valid while in others not quite so. Deferred maintenance has become a routine practice with PIDs, which eventually results either in a disaster or in a major repair and restoration undertaking in the shape of an independent project. Some recent events in the form of breaches in the first line of protective embankments in Sindh and the current situation at Sukkur Barrage, are clear evidence of accumulative neglect. In Punjab as well, at present some six (6) Barrages have deteriorated to a point that deferred repairs are now being undertaken as major “Remodeling Projects”.

6.16. Recommended Institutional Reform:[44] A rational though radical solution to the aforementioned problems would lie in creating a “River Management Authority” that would be responsible for integrated planning, engineering design, construction, operation and maintenance of all hydraulic structures on the major Rivers. These may include Dams, Barrages Hydropower Stations etc and, of course, all Flood Protection Works. WAPDA's entire Water Wing and the Federal Flood Commission would need to be merged together to form the proposed River Management Authority. Experts from PIDs on Barrages may also have to be arranged on temporary or permanent basis as would be considered appropriate. It stands to reason that the headquarters of this River Authority should be in Islamabad, but it should have strong presence in the four Provincial Metropolis. Funding would initially be provided by the Federal Government, while recovery arrangements through a water charge on hydropower and a storage charge on irrigation water supplied to offtaking canals, can be levied to make the Authority financially autonomous. A nominal flood protection charge may also be recovered from the City Administrations and Industrial areas to whom protection has been specifically provided.

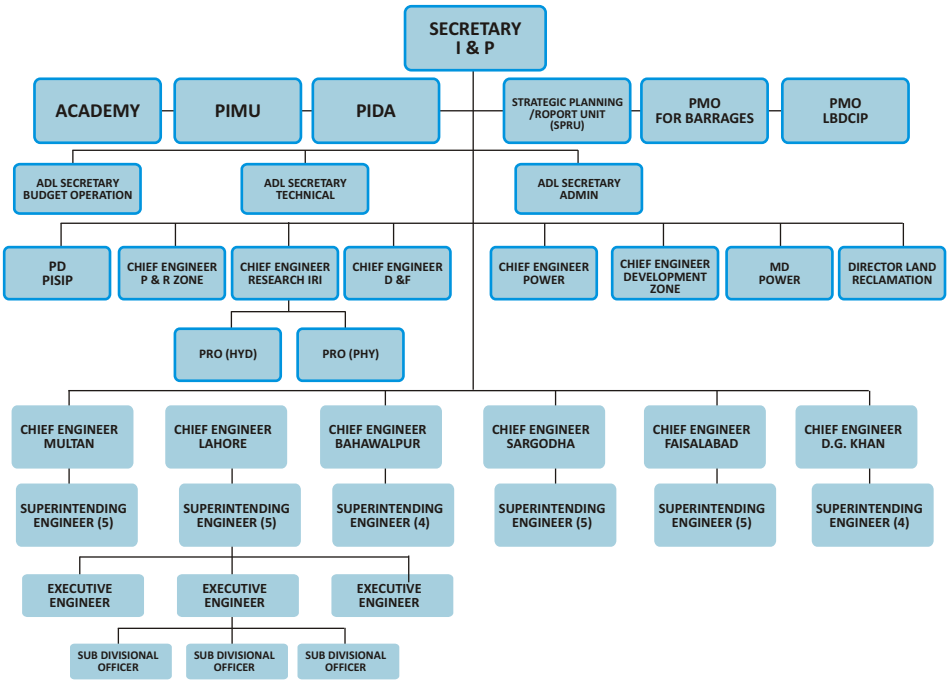
[43] Mark 134 (Appendix 85 - page 5603)
[44] ibid.

6.17. *INQUIRY & FINDINGS*

6.18. Our inquiry has left us amazed and shocked at the poor quality and faltering standard of the I & P Department. This is the Department that is supposed to run and mange the Indus Irrigation System i.e., the World's largest contiguous irrigation network. Pakistan's agro-economy is largely dependant on our Indus basin Irrigation System. I & P Department should therefore be the premier department of the provincial government and irrigation as a frontline sector. Sadly, this is not so. The I & P Department (in the context of flood management) does not possess the capacity or the standard to head and manage the Indus Irrigation System.

6.19. I & P department is devoid of research and future thinking, it lacks systematic decision making structure, has poor and unskilled human resource, it lacks training and development, the organogram shows a large sluggish structure which is victim of its own inertia.

ORGANOGRAM OF PUNJAB IRRIGATION & POWER DEPARTMENT



6.20. The department has no capacity or the requisite resilience to manage floods in the future. Unless of course this premier department is reengineered , its capacity improved drastically and brought up to speed with the world in irrigation practices. We have also noticed that the department is driven by corruption rather than innovative and well researched irrigation practices. The department has no vision of the flood sector. Little research, planning or thinking goes into flood protection schemes developed by the irrigation department. These schemes, find way to Islamabad and become part of the National Flood Protection Plan (a misnomer). These flood protection schemes are propelled by political interests of the locals with no correlation with any integrated flood sector master

plan. In fact there is no flood sector master plan. The schemes are independent and isolated work of zonal offices of the Irrigation Department. There is no peer review (and if any it is totally ineffective) and only its budgetary limits are looked into by the P & D Department. These schemes hardly get verified for their technical or strategic insight or vibrance.

6.21. I & P Department sadly appeared to be a vacuous and vision less department. There is neither a drawing board at the I & P Department nor the initiative to use one. There is no holistic flood management planning within the Department. There is no knowledge, study or research on climate change and the changing weather patterns which will have a direct impact on the future floods in the country. This is very worrying!!!

6.22. The Barrages according to the Secretary I & P Department[45] must show case the best officers of the Department. Barrages are the flagships which deserve the best of the best. Much to our disappointment the officials posted at the Barrages cut a sorry figure. They exhibit poor capacity, scanty knowledge of the regulations and most of them are mechanical engineers by training working on posts cut out for civil engineers. A useful snapshot is the team of officers looking after Jinnah Barrage and the Jampur Bund during the floods of 2010. The two tops slots at Jinnah Barrage and one senior slot at D G Khan is held by a Mechanical Engineer.

SARGODHA IRRIGTION ZONE SARGODHA

LIST OF OFFICERS WHO PERFORMED DUTIES AT JINNAH BARRAGE OF KALABAGH HEADWORKS DURING FLOOD 2010

Sr.#	Name of officer/official	Date of joining the Department	Qualification	Discipline	Date of Posting	Posted As	Remarks
1	**Rao Irshad Ali Khan s/o Rao Abdul Aziz Khan**	**25/01/1975**	**B.Sc. Egn.**	**Mechanical Engineer**	**31/10/2008**	**Chief Engineer Irrigation Zone, Sargodha**	**-**
2.	**Mr. Khalid Iqbal**	**22/03/1983**	**M.Sc, Diploma UK, B.Sc Eng:**	**Mechanical Engineer**	**19/01/2010**	**SE Thal Canal Circle Mianwali**	**Relieved on 01/08/2010**
3.	Mr. Muhammad Afzal S/o Fazal Mehmood	24/12/1987	B.Sc Eng:	Civil	25/07/2009	XEN Kalabagh H/W Division Daudkhel	Relieved on 01/08/2001
4.	Mr. Ghulam Asghar Mirani S/o Ghulam Hussain	10/08/1983	B.Sc. Eng:	Civil	22/07/2010	XEN Bhakkar Division Bhakkar	Took over charge as SE Thal on 02/08/2010
5.	Mr. Abid Masood Aamir S/o Mian Dilmir Khan	20/11/1983	M.Phil Eng:	Civil	16.09.2010	EXN Shahpur Division Sargodha	Took over charge as XEN Kalabagh on 01/08/2010
6.	Mr. Nawazish Khan	Faisalabad Zone	B.Tech (Hon)	Civil	08/07/2009	SDO H/W Sub Division Daudkhel	Relieved on 05/10/2010
7.	Muhammad Younas	26/04/1979	DAE	Civil	23/07/2007	SEN Headworks Section	Relieved on 22/12/2010

[45] I.W.6

LIST OF OFFICERS/OFFICIALS INCHAREG OF JAMPUR AND FAKHAR FLOD BUND DURING FLOOD 2010.

Sr.No.	Name of Flood Bund	Name of officers/officials	Qualification	Remarks.
		Regular		
		Mahr Muhammad Amin, Chief Engineer/S.E.	B.Sc (Civil Engg) M.Sc. (Irrigation Engg:)	
1.	Jampur	**Abid Rasheed XEN**	**BSC (Mechanical Engineering)**	
2.	Jampur	Sh. Saif Ullah SDO	DAE Civil, DPE pass	
3.	Jampur	Tufail Rizvi, Sub Engineer	DAE (Civil)	
4.	Jampur	**Muhammad Bilal Ali Sub Engineer**	**DAE (Mechanical**	
5.	Jampur	Ejaz Hameed, Sub Engineer	B.Tech	
6.	Jampur	Muhammad Ali, Sub Engineer	B.Tech	
7.	Jampur	Asif Mehmood Fida, Sub Engineer	DAE Civil	
8.	Jampur	Muhammad Rafique Gabol, Sub Engineer.	DAE Civil	

6.23. The Secretary[46], Irrigation & Power Department deposed before the Tribunal that: "According to details of posting held by Muhammed Afzal XEN, he was appointed at Kalabagh Head Works on 24-7-2009 on current charge basis. He had no past experience of a Barrage and was never appointed as an SDO on any of the Barrages earlier in his entire career which starts in the year 1990. Ideally an XEN appointed at a Barrage should have worked on a Barrage as SDO but this was not the case here. Service profile [of Khalid Iqbal S.E.] shows that he is B.S. 19 (current charge) with degree in Mechanical Engineering and was promoted in the year 1992 as XEN, however, through out his career he has never held the posting on Barrage except once in the year 2008-2010 at Sidhnai." The Secretary further submitted that "there is a tradition that best of the lot has to be appointed on the Barrage. In my view Muhammed Afzal XEN did not fit the qualifications". "….. posting of a Mechanical Engineer on a Barrage was considered to be a sin." "Traditionally Mechanical Engineers are not even posted on the canals." Inspite of the same, Muhammed Afzal XEN was not removed, no reason has been placed on the record for this grave inefficiency by the Secretary I & P Department.

6.24. The officer appointed are either on current charge or look after charge. Muhammed Munir Anjum, XEN , Taunsa Barrage during floods was on a look after charge. What level of seriousness and commitment comes with a look after charge and that too while holding additional charges i.e., SDO Headworks and SDO Bunds. Performance of Muhammed Munir Anjum leaves little doubt that the service structure and service rules within the Irrigation Department require a serious overhaul. There is also serious shortage of good professionals. When Munir Anjum was suspended by the Chief Minister on 1-8-2010, the Department did not have a pool of Barrage experienced XENs awaiting postings. This reflects poor governance and human resource management within the I & P Department.

6.25. The Strategic Planning & Research Unit (SPRU) has done no planning. They had no thought about the Flood Management strategies or Flood Risk Management. The Drainage and Flood Zone is headed by the least informed officer as he failed to tell us the formula and

[46] I.W.6

the regulation which provides for the quantity of reserve stones required at the barrages during floods.

6.26. The Irrigation Research institute (IRI) set up in 1924 has a rich history which the department needs to emulate. The C.E. (Research) heading IRI being mechanical engineer had little understanding of research and left a poor impression on us. Similarly, Director Design is also holding a degree in mechanical engineering. The PRO, IRI on the other hand was reasonably satisfying. This institute needs to be enriched into a strong research wing of the department and reliance on foreign consultants to be reduced.

7. RECOMMENDATIONS

7.1. In order to proudly manage the "World's largest contiguous irrigation network," I & P department requires immediate reengineering and reform. It has to be the flagship department of the Government of the Punjab.

7.2. "Water" being the most valuable resource of the future (not so distant future) – Irrigation Department must procure and acquire the best of the best human resource available within the Provincial bureaucracy. Able, educated and well trained officers need to fill this department. The current state of affairs is destined for a disaster if nothing is done soon.

7.3. Irrigation department must be known for its technical ingenuity and avant garde research capabilities. Irrigation in the modern world by any measure is a highly technical field requiring constant innovation and research besides selection of the best minds.

7.4. Our economy rests on Agriculture and cannot progress unless complimented by a robust, modern and innovative irrigation system. I & P Department cannot be equated with just any other department and therefore requires immediate reform and uplift.

7.5. The administrative Secretary has been most useless in the recent floods. The top managerial structure needs a rethought. A Secretary and a special secretary team might be more effective, with the special secretary being a technical irrigation person.

7.6. The historic Irrigation research Institute must be strengthened and its lost glory be restored. Reliance on consultants must be successively reduced. Development must be sustainable, driven by passion and must factor in homespun wisdom.

7.7. Irrigation Department must closely work with the engineering universities of the country to attract its best minds and be current with the recent developments in science, climatology, irrigation and agriculture.

7.8. Best officers (civil engineers only) must be posted on the Barrages. This field formation must be immediately revisited so that a team of abler men is holding guard at the barrages before the start of the Flood Season 2011.

7.9. The job description of various engineering cadres must be clearly defined (if not already done) alongwith required minimum qualification. No officer should be posted to any position without having requisite minimum qualification (for example Mechanical Engineer to be posted on post suited for a civil engineer and vice versa).

7.10. We noticed that XEN appointed at Taunsa Barrage to be on LOOK AFTER charge and holding other charges as SDO. Secretary I & P Department deposed that most of the officers have adhoc promotions. Munir Anjum held the posts of SDO Headworks and Bunds besides

a look after charge as an XEN. This needs to go. Proper Service Rules need to be introduced and team heading Barrages must be confirmed and duly promoted officers holding just one charge. Officers appointed must not be transferred or disturbed during the Flood Season. The suspension of the XEN at Taunsa Barrage on 1-8-2010[47] during the height of the flood season by the Chief Minister, Punjab on a complaint of a local is deprecated.

7.11. Postings on the Barrages must be incentivized and made more attractive.

7.12. XENs and SDOs on Barrages must pass the Fit And Proper Test.

7.13. Continuing local and international training/ capacity building in Barrage regulation and flood management be conducted.

7.14. Severe departmental penalties to be provided for gross negligence in managing floods.

7.15. Vacant posts of engineers must be filled immediately through Punjab Public Service Commission and process should be regularized in future so that there should not be discontinuity for any trained engineer on the job.

[47] when the Barrage was faced with exceptionally high flood.

8. INEFFECTIVE ROLE OF FEDERAL FLOOD COMMISSION ("FFC").

8.1. After creation of Pakistan, Central Engineering Authority was constituted under Chief Engineer Advisor to deal with the issues of water, power and allied engineering matters at national level. It was re-designated as Chief Engineer Advisor after establishment of Water & Power Development Authority (WAPDA) in 1958. Prior to 1976, Provincial Governments were responsible for the protection works. Disastrous floods of 1973 and 1976 resulted in heavy losses indicating that existing flood protection facilities and planning were inadequate to provide effective protective measures for the country. Consequently, in January 1977, Federal Flood Commission was established for integrated flood management on country wide basis[48].

8.2. FFC was constituted through Resolution No.W-II3(23)/76 dated 4.1.1977 for formulating a National Flood Protection Plan to be implemented by the Provinces[49].

8.3. Under the said Resolution the functions of the FFC are as follows:

I. Preparation of flood protection plan for the country.
ii. Approval of flood control/protection schemes prepared by Provincial Government and Federal Line Agencies.
iii. Recommendations regarding principles of regulation of reservoirs for flood control.
iv. Review of damages to flood protection works and review of plans for restoration and reconstruction works.
v. Measures for improvements of flood forecasting and flood warning system.
vi. Preparation of research programme for flood control and protection
vii. Standardization of designs and specifications for flood protection works.
viii. Evaluation and monitoring of progress of implementation of National Flood Protection Plan.

8.4. *National Flood Protection Plan 1978*[50]: The Plan set the tone for strategic planning was back in 1978. Chapter 1 provided the vision in the following words:

> "Population growth and economic expansion bring with them increasingly complex resources problems requiring increasingly greater efforts in planning and coordination. The wide range of uses and functions that must be considered in planning for water resources development must include flood management and flood plain management. Interests of government agencies at all levels and of private enterprises need to be integrated in comprehensive water and related land resource planning."

8.5. The Plan providing the relationship of flood planning to overall planning states:

[48] www.ffc.gov.pak (website)
[49] Ex.I.W.103/1
[50] Mark 60/2

"Flood management planning must be in harmony with the overall water and land resources planning for the Nation."

8.6. According to the National Flood Protection Plan 1978 (Main Report)[51] the goal of flood management planning is to reduce;

- situation threatening the life and health of the people;
- economic losses;
- costs of emergency evacuation and relief;
- loss of public revenues; and
- impairment of national security by fostering a unified programme of structural and non-structural flood management.

8.7. Towards meeting this goal, the specific objectives adopted by the FFC for flood management planning are as follows:

i. To reduce flood losses
ii. To give priority for Flood protection to areas of greatest economic flood damage hazard and/or greatest potential for human suffering, as far as possible;
iii. Protection from flood damages to areas lying outside active flood plains and also vital infrastructural installations.
iv. Maintaining standards of the existing flood control/protection facilities
v. Promoting appropriate land use by avoiding the growth of flood vulnerable development in flood hazard areas and adjusting land use to be compatible with the frequency and duration of flooding.
vi. To minimize adverse affects on natural ecosystem and on environmental values.

8.8. Flood management in Pakistan requires a balance of flood control by reservoirs, flood protection by bunds, nonstructural measures, operation and maintenance and flood watch and flood fighting.[52]

8.9. Plan 1978 frankly states that proposals for specific flood protection objectives generally originate in field offices by local irrigation officials without special training in flood protection planning. The proposal most likely is in response to the problems highlighted by the most recent flood. These schemes then pass upward through the organization usually, with minimum additional technical input. Eventually, PC-1 Proformas are prepared.

[51] Mark 60/2
[52] National Flood Protection Plan 1978, Chapter-2. (Mark 60/2)

8.10. According to National Flood Protection Plan, 1978 following improvements in flood management have been recommended.

8.11. *COMPREHENSIVE FLOOD MANAGEMENT PLANNING.* A comprehensive flood management for Pakistan is required to identify priority problems to be studied and scheduled priority projects to be implemented within available resources. The comprehensive flood management plan should consider the Indus River in major tributaries as a single system so that changes in one reach of the system will be reflected in other reaches. Compatible structural and nonstructural projects and plan elements must be efficiently coordinated over the entire system to achieve maximum flood loss reduction. The investigations undertaken to prepare the 1978 National Flood Protection Plan are only the initial steps towards preparing a Comprehensive Flood Management Plan (CFMP)

8.12. *PLANNING FOR FLOOD PROTECTION.* Planning of individual component of flood planning system by the Irrigation department has been essentially on a judgment basis. There are no formal criteria or guideline for planning of flood protection systems. Systematic procedures have not been used for determining priorities of flood protection needs or for evaluating the economic justification of flood protection works. Sizing of facilities has been almost completely based on highest experience flood event.

8.13. Three levels of investigation and planning should be under taken in the planning process for flood protection project, reconnaissance, appraisal and feasibility.

- **Bund design and construction practice.**
- **Reservoir Operation.**
- **Nonstructural measures.**

8.14. Effective flood management requires structural and nonstructural measures applied in balance. Structural measure such as dams, bunds, channelization and diversions attempt to control or modify floods on a large scale. Nonstructural measures attempt to modify or adjust flood susceptible structure or areas on an individual or limited area basis. Principal nonstructural measures include flood forecasting and warning, permanent, relocation, flood proofing, flood insurance and land use regulation. Three areas have been identified where nonstructural measures could be the most effective means for reducing flood damages.

i. Active Flood Plain of the major rivers
ii. Area downstream from intentional breaching sections;
iii. Hill torrents flood plains.

8.15. NATIONAL FLOOD PROTECTION PLAN PHASE-II (MAIN REPORT)[53]

[53] Mark-61

8.16. Proceeds from the same premises as the National Flood Protection Plan Phase-I (1978) while it gives guidelines for planning projects and over all strategic planning of flood management.

8.17. NATIONAL FLOOD PROTECTION PLAN PHASE-III (1998-2008)[54] and COMPREHENSIVE NATIONAL FLOOD PROTECTION PLAN-IV (2008-2018)[55] & Report of Sub Group on Flood Control Management and Development (2005-06 to 2009-10)[56]

8.18. The comprehensive and integrated flood management programme lists existing problems of Punjab to be (a) inundated bank erosion, (b) hill torrents, (c) integrated river management and (d) flood forecasting warning and preparedness.

8.19. The first National Flood Protection Plan ("NFPP-I") was prepared by Federal Flood Commission ("FFC") in 1978. The master plan have problems relating to the flood sector and presented viable solution for the immediate requirement as well as further long term plans, which would be up-dated after every 10 years. The master plan was firstly updated in 1988 as NWFPP-II and was followed by the formulation of the first Flood Protection Sector Project ("FPSP-I) in 1988. FPSP-I was completed in 1998 at a cost of Rs.4,820 million with the assistance of Asian Development Bank. FPSP-I emphasis on immediate flood protection needs of the country through implementation of structural and non-structural measures. However, there were many gaps in the network and certain rivers and streams could not be included in the first project. FPSP-II was an urgent follow up of FPSP-I. PC-1 for FPSP-II was prepared and approved by ECNEC on 22.01.1998 for a capital cost in Pak Rs.8,000/- million. The project estimate for offer of cost of works and services were US$ 200 million.

8.20. The prime objective of FPSP-I was to reduce flood damages in the areas and communities settled along major rivers and streams in the country. Estimated area of 18,000 sq, kms of flood prone tracts of agriculturally productive land would receive the benefits of the protection and security against flood hazards. The collective objective of the project was aimed to reduce damages due to flooding in the designated areas of the project, which would be achieved by (a) constructing flood protection and river training works in and along the main rivers as well as secondary and tertiary rivers including hill torrents; (b) Extent and gravity weather data collection system. Weather and flood forecasting techniques, in order to increase the response time required to mitigate the damage; (c) Strengthen the knowledge base on the process involved in the constantly changed behaviour of the main rivers. FPSP-II was finally completed in May 2007.[57]

8.21. National Flood Protection Plan according to FFC are the Flood Protection Schemes prepared by the respective provinces. Three National Flood Protection Plans starting from 1978 till 2008 have been approved and implemented. NFPP-IV was submitted with the Ministry of Water and Power Department on November, 20, 2006 for approval by the

[54] Mark-62
[55] Mark-63
[56] Mark 58
[57] Second Flood Protection Center Projects, Project Plan Report Volume-I (Main Report)

competent authority, however, this plan has not yet been approved by the Planning Commission.

Sr. No.	Planning	Duration	Programme	No. of Schemes	Costs in millions.
1.	National Flood Protection Plan -1	1978-88	GOP funding	350	1,630
2.	National Flood Protection Plan -II	1988-98	GOP Funding ADB funding	182 256	1,454 4,860
3.	National Flood Protection Plan -III	1998-2008	GOP funding ADB funding	362 90	2360 3,603
4.	National Flood Protection Plan-IV	2008-2018	Not yet approved	863	30,000

8.22. The role of FFC is to technically examine the flood protection schemes prepared by Provinces, Federal Line Agencies and recommended them for approval by higher forum i.e. DDWP/CDWP/ECNEC. FFC has the Scrutinizing Committee which comprises representatives of Federal and Provincial Governments to technically examine and clear schemes.

8.23. According to FFC they have undertaken a number of research studies aiming at effective flood control measures including master feasibility studies for harnessing of flood flows of hill torrents in Pakistan (However, no progress in this regard has been made).

8.24. According to Mr. Zarar Aslam, Chairman, FFC[58] " for the preparation of National Flood Protection Plan all the Provincial Irrigation Departments prepare their schemes and submit it to the FFC. Once the said schemes are received by Federal Flood Commission they are compiled and called the National Flood Protection Plan….**the role of FFC is [merely] that of coordination.** We help in the approval of schemes which are approved by ECNEC and Central Development Working Party (CDWP). FFC also ensures timely disbursement of funds for execution of schemes."

8.25. According to the Chairman, FFC has also prepared a design criteria and methodology in the year 2001 (referred to as the FFC Manual in this Report) which studies standards of flood protection works. The said Code has been sent to the Irrigation Department, however, there is no survey conducted to find out whether existing protection works have been brought in conformity with the FFC Manual.

8.26. According to Naseer Ahmad Gillani[59], Chief (Water) Planning Commission, Government of Pakistan, Islamabad: **"the prime role of developing integrated and holistic Flood Management Plan is the sole responsibility and mandate of the Federal Flood**

[58] I.W.103
[59] I.W. 143

Commission ("FFC") and it is for this primary purpose that FFC was established. The Planning Commission has funded FFC, Rs.4.8 Billion for FPSP-I and Rs.4.5 Billion approximately for FPSP-II. The Planning Commission has also advised Departments of the Federal as well as Provincial Governments to build their in-house research capacity and to place less reliance on outside consultants."

8.27. *INQUIRY & FINDINGS*

8.28. National Flood Protection Plan (1978) clearly laid down the foundation and framework for the development of a Flood Management Plan way back in 1978 as seen above. However, since then FFC has miserably failed to provide the vision and the plan it was set out to give.

8.29. Since then FFC has been reduced to a post office, stamping away flood protection schemes prepared and developed after every flood season by the zonal chiefs of the I& P Department.

8.30. There is no master plan or a holistic flood management plan, which controls the scope or tests the usefulness of the schemes. Besides the schemes generated by the zonal heads of the I & P department lack research, innovation and ingenuity. The schemes that go through are usually the one that are pushed by the local political patronage. The result is, a series of haphazard, unstructured and ineffective flood protection scheme go through at a heavy financial cost borne by the State exchequer.

8.31. Guidelines set out in the National Flood Protection Plan, 1978 need to be strictly followed. FFC has to perform its real role i.e., of developing a national flood management plan and implementing the same.

9. *RECOMMENDATIONS*

9.1. The current Chairman and the previous Chairmen are accountable for their failed stewardship of the Commission since 1977. The country does not have an Integrated Flood Management Plan - this omission is criminal and the Chairmen must be held accountable for it. We recommend the Federal Government to hold a detail audit of FFC by panel of experts including members of the civil society to assess the performance of FFC since its inception. Why has FFC failed to develop a Flood Management Plan and how and why has the FFC continued to approve localized flood sector schemes[60] without first assessing their need in the larger context of the Flood Management Plan ?

9.2. FFC needs to be pulled out of its cocoon – it is not to act as a lame secretariat or a post office for the PIDs but must immediately assume its real role of a principal flood sector authority of the country. It is recommended that Federal Government must ensure that FFC develops the first ever National Flood Management Plan before the start of the next flood season and shares it with the flood managers of the provinces. In doing so, FFC is to have a participatory approach and should involve the local residents of the area. FFC must display the said PLAN on its website for wider dissemination.

9.3. Federal Flood Commission has to be made accountable for failing to develop a National Flood Management Plan since its inception in the year 1977.

9.4. Federal Flood Commission simply rubber stamps flood sectors schemes prepared at the end of every flood season by the zonal officers of the irrigation department. This is not the role of FFC. Federal Government must immediately pull up this apex flood sector institution to perform its role under the law.

9.5. FFC must have a regular technical and financial audit so that all the approved flood protection schemes and the flood management plans remain under strict accountability.

9.6. FFC must also place on its website all the schemes approved along with their budget so that flood sector work remains within public domain and subject to open criticism.

[60] mostly driven or supported by the local politicians.

10. LACK OF INTEGRATION & COORDINATION BETWEEN OTHER KEY DEPARTMENTS

10.1. INTRODUCTION

10.2. Other key departments and institutions who also combat flood within their own spheres have no symbiosis with each other. They operate independently without drawing on the each others synergies.

10.3. *INQUIRY & FINDINGS*

10.4. *NATIONAL DISASTER MANAGEMENT AUTHORITY, ISLAMABAD:* Written submissions[61] dated 19.10.2010 filed by the Director Administration, National Disaster Management Authority (NDMA) states that the subject matter of the Flood Inquiry Tribunal does not relate directly to the National Disaster Management Authority, established under National Disaster Management, Ordinance, 2009, however, in his statement[62] before the Tribunal, he submitted that "National Disaster Management Authority is formulating the national disaster management plan with the help of JICA and the said plan has a detailed component on flood management."

10.5. Under the Ordinance, National Disaster Management Authority has, inter alia, the following functions

- Prepare the National Plan to be approved by the National Commission;
- implement coordinate and monitor the implementation of the National policy;
- lay down guidelines for preparing disaster management plans by different Ministries or Departments and the Provincial Authorities;
- provide necessary technical assistance to the Provincial Governments and Provincial Authorities for preparing their disaster management plans in accordance with the guidelines laid down by the National Commission;
- coordinate response in the event of any threatening disaster situation or disaster;
- lay down guidelines for, or give directions to the concerned Ministries or Provincial Governments and the Provincial Authorities regarding measures to be taken by them in response to any threatening disaster situation or

[61] Ex.I.W.95/1
[62] I.W.95
[63] section 9 of the Ordinance.

disaster;

- promote general education and awareness in relation to disaster management; and

10.6. National Disaster Management Authority will also develop[64] a National Plan which shall include:

- measures to be taken for the prevention of disasters or the mitigation of their effects;
- measures to be taken for the integration of mitigation measures in the development plans;
- measures to be taken for preparedness and capacity building to effectively respond to any threatening disaster situations or disaster; and
- roles and responsibilities of different Ministries or Divisions of the Federal Government in respect of measures specified in clauses (a), (b) and ©.

10.7. *PROVINCIAL DISASTER MANAGEMENT AUTHORITY*[65] is to be established by each Provincial Government which shall have the following functions:

- formulate the provincial disaster management policy obtaining the approval of the Provincial Commission;
- coordinate and monitor the implementation of the National Policy, National Plan and Provincial Plan;
- examine the vulnerability of different parts of the Province to different disasters and specify prevention or mitigation measures;
- lay down guidelines to be followed for preparation of disaster management plans by the Provincial Departments and District Authorities;
- evaluate preparedness at all governmental or non-governmental levels to respond to disaster and to enhance preparedness;
- coordinate response in the event of disaster;
- give directions to any Provincial department or authority regarding actions to be taken in response to disaster;
- promote general education, awareness and community training in this regard;
- provide necessary technical assistance or give advice to district authorities and local authorities for conveying out their functions effectively;
- advise the Provincial Government regarding all financial matters in relation to disaster management;
  examine the construction in the area and if it is of the opinion that the standards laid down has not been followed may direct the same to secure compliance of such standards;
- ensure that communication systems are in order and disaster management

[64] Section 10(3) of the Ordinance.
[65] Section 15 and Section-16(2)

drills are being carried out regularly; and

- perform such other functions as may be assigned to it by the National or Provincial Authority.

10.8. Provincial Plan[66] shall include:-

- the vulnerability of different parts of the Province to different forms of disasters;
- the measures to be adopted for prevention and mitigation of disasters;
- the manner in which the mitigation measures shall be integrated with the development plans and projects;
- the capacity building and preparedness measures to be taken;
- the roles and responsibilities of each Department of the Government of the Province in relatin to the measures specified in clauses (b), (c) and (d);
- the roles and responsibilities of different Departments of the Government of the Province in responding to any threatening disaster situation or disaster.

10.9. *DISTRICT DISASTER MANAGEMENT AUTHORITY*[67] under the Provincial Government shall have following functions:-

- prepare a disaster management plan including district response plan for the district;
- coordinate and monitor the implementation for the National Policy, Provincial Policy, National Plan, Provincial Plan and District Plan;
- ensure that the areas in the district vulnerable to disasters are identified and measures for the prevention of disasters and the mitigation of its effects are undertaken by the department of the Government at the district level as well as by the local authorities;
- ensure that the guidelines for prevention, mitigation, preparedness and response measures as laid down by the National Authority and the Provincial Authority are followed by all departments of the Government at the district level and the local authorities in the district;
- give directions to different authorities at the district level and local authorities

[66] Section 17
[67] section 18 & 20 of the Ordinance

to take such other measures for the prevention or mitigation of disasters as may be necessary;

- lay down guidelines for preparation of disaster management plans by the departments of the Government at the districts level and local authorities in the district.
- monitor the implementation of disaster management plans prepared by the Departments of the government at the district level;
- lay down guidelines to be followed by the Departments of the Government at the district level;
- organize and coordinate specialized training programmes for different levels of officers, employees and voluntary rescue workers in the district;
- facilitate community training and awareness programmes for prevention of disaster or mitigation with the support of local authorities, governmental and non-governmental organizations;
- set up, maintain, review and upgrade the mechanism for early warnings and dissemination of proper information to public;
- prepare, review and update district level response plan and guidelines;
- coordinate with, and give guidelines to, local authorities in the district to ensure that pre-disaster and post-disaster management activities in the district are carried out promptly and effectively;
- review development plans prepared by the Departments of the Government at the district level, statutory authorities or local authorities with a view to make necessary provisions therein for prevention of disaster or mitigation;
- identify buildings and places which could, in the event of disaster situation be used as relief centers or camps and make arrangements for water supply and sanitation in such buildings or places;
- establish stockpiles of relief and rescue materials or ensure preparedness to make such materials available at a short notice;
- provide information to the Provincial Authority relating to different aspects of disaster management;
- encourage the involvement of non-governmental organizations and voluntary

social-welfare institutions working at the grassroots level in the district for disaster management;

- ensure communication systems are in order, and disaster management drills are carried out periodically; and
- perform such other functions as the Provincial Government or Provincial authority may assign to it or as it deems necessary for disaster management in the District.

10.10. District Plan for every district shall also be prepared and a National Disaster Response Force shall also be established to cope with disasters.

10.11. Under section 26, National Institute of Disaster Management shall be constituted with the following functions;

- develop training modules, undertake research and documentation in disaster management and organize training programmes;
- formulate and implement a comprehensive human resource development plan covering all aspects of disaster management
- provide assistance in national level policy formulation;
- provide required assistance to the training and research institutes for development of training and research programmes for stakeholders including Government functionaries;
- provide assistance to the Provincial Governments in the formulation of Provincial level policies, strategies, disaster management framework and any other assistance as may be required by the Provincial Governments for capacity-building of stakeholders, Government including its functionaries, civil society members, corporate sector and people's elected representatives;
- develop educational materials for disaster management including academic and professional courses;
- promote awareness among stakeholders including college or school teachers and students, technical personnel and others associated with multi-hazard mitigation, preparedness and response measures;
- do all such other lawful things as are conducive or incidental to the attainment of the above objects; and

- undertake any other function as may be assigned to it by the Federal Government.

10.12. It is clear that inspite of the Ordinance promulgated in November, 2009, no material progress has been made regarding the development of an integrated flood management plan.

10.13. In the recent floods no strategic flood management policy was initiated by the NDMA. Infact NDMA has been found missing in developing a disaster management strategy during the floods of 2010.

10.14. There is no coordination between NDMA and the I & P department or for that matter with any of the other key departments mentioned hereunder.

10.15. Written paper submitted by the Director (Administration), National Disaster Management Authority before the Tribunal carries the minutes of 4th Pre-Monsoon Coordination Meeting held in 2010 under the auspices of National Disaster Management Authority in the Prime Minister, Secretariat, Islamabad. It is surprising that while Director (Administration) has submitted that scope of Flood Inquiry Tribunal does not directly relate to National Disaster Management Authority. On the other hand, National Disaster Management Authority headed the most important Pre-Monsoon meeting regarding the recent floods.

10.16. The contents of the minutes of the meeting reveal that the Director, National Disaster Management Authority explaining the purpose of the meeting stated that it is important to identify the gaps and weaknesses in the existing arrangements and to suggest corrective measures thereof to deal with any Monsoon related to the emergency situation. He also gave a brief account of NDMA experience in dealing with disaster including flood relevant agencies.

10.17. Chief Engineer, FFC shared the details of formation of the Flood Coordination Cell, at the FFC as well as instructions to relevant authorities for removal of encroachments at water-ways to deal with flood situation. Representative of Ministry of Health stated that Ministry of Health had prepared draft contingency plan which will be finalized on 10.07.2010 and also referred to the health emergency and preparedness and response (HEPR) Centre established at PIMS.

10.18. One of the decision taken at the conclusion of the meeting was as follow:

Decisions	Action by
It was noted that existing coordination between different civil and military agencies was not up to the mark. The concerned agencies (federal, provincial, district and military authorities) were asked to ensure synergized and coordinated relief operations, involving all stakeholders, in the event of a disaster situation at the respective levels	Action by NDMA, FFC, PDMA, Irrigation Departments, DDMA, Irrigation Departments, FFC, Engineering Directorate GHQ

10.19. The perusal of minutes shows that the representative of the various agencies had no knowledge of the ground realities e.g. the Director General, PMD simply made a theoretical presentation without realizing that the hydrology meteorological forecasting at the FFD is serious lacking. He also did not point out the radars which were not functioning and also various pockets in the country where there are no radars. The presentation of the PMD was therefore, perfunctory carrying no depth or seriousness. Similarly, Chief Engineer, FFC referred to the Flood Coordination Cell, as well as, instructions issued by the FFC to relevant authorities for removal of encroachments in water-ways. While appearing before the Tribunal, FFC had no comments regarding FFC and its performance during the recent floods. Instructions if at all issued for the removal of encroachments in water-ways had no effect as there was a Chinese Housing Colony in the water-way of the breaching section of Jinnah Barrage which was washed away in the recent floods. More importantly, nothing has been brought on record before us to show any effort done by NDMA in attending to the crises and disaster at Jinnah Barrage, Taunsa Barrage, Jampur Bund or Fakhar Flood Bund, not even to the level of coordination seems to be visible. From the record by NDMA which from the Ordinance appears an apex authority in the country holding maximum responsibility for attending to disaster management in the country. Absence of Irrigation Department, Punjab as well as lack of Provincial Disaster Management Authority, Punjab was also noticed with regret.

10.20. If future disaster in the country are timely handled, the institute dealing with flood have to become more serious, more academic, more rebuses and more real. The perfunctory/realistic pre monsoon made in National cavities will not reach to any final results unless the agencies representatives have done their home work and are well connected and well aligned with their key formations.

10.21. We have noticed that pre-flood preparedness by Irrigation Department, Punjab has been brutal disaster, however, same never got surface at the pre-monsoon meeting held on 28.06.2010. Absence of stone at Jinnah Barrage, quality of human resource heading the

barrages, lack of labour force for flood fighting, inadequacy of the flood fighting material, the emergent work downstream Jinnah Barrage, population in the active flood plain from a poor flood warning systems, poor human resource at the PMD, lack of monsoon centre in the country, non-wetting of bunds for the last two years, never pointed out in the meeting inspite of presence of the Irrigation Department and FFC. On the whole of the above, agencies are frauding the people of this country. We recommend the Provincial Government to sent a recommendation to all the above agencies including Prime Minister Secretariat so that the recent flood be considered as a awakening up call and the budget allocated for the above agencies are put to use the benefit of people of Pakistan especially those who are victims of the recent super floods.

10.22. We are of the view that NDMA can lead the way forward to develop flood management plan for the country as a part of the larger disaster management and the Provincial and the District Government can done, however, fine tune and details of the master flood management plan. We recommend that this exercise must begin immediately so that holistic integrated flood management plan before the commencement of the flood season 2011.

10.23. *PROVINCIAL DISASTER MANAGEMENT AUTHORITY:* Mr. Khalid Sherdil[68], Director General, PDMA, submitted that no PDMA has been created by the Punjab Government, however, surprisingly, he holds the post of Director General, PDMA for Punjab. He submitted that he never supplemented the efforts of the Relief Commissioner, constituted under the Punjab National Calamities (Prevention & Relief) Act 1958.

10.24. *ENVIRONMENTAL PROTECTION DEPARTMENT/ PROVINCIAL ENVIRONMENTAL PROTECTION AGENCY:*

10.25. Secretary Environment Protection Department in his Position Paper[68-A] submitted that the contents of the TOR of the Tribunal did not cause any responsibility on the Environment Protection Department and therefore no material, comments made regarding the recent floods. It was most disturbing to note that EPD under the Rules of Business is to lay down Policy for Environmental Protection in the Province and can play critical role in developing non-structural flood protections as a part of larger flood management plan, however, Secretary had nothing to submit regarding the floods or adaptation or mitigation of the same. Flood Management Plan of over the world are integrated with Ecological non-structural protection measures like development of Forest, Plantation, Reservoirs, Swamps and Water Sheds, but it appears that no such plan is on the ground as far as the Environment Protection Department Punjab is concerned. We recommend that more able person well versed in the field of Environment should lead the said Department, who can actively and materially contribute towards the development of Flood Management Plan for the Province. Training and harnessing water is an environmental question and so what maintenance of

[68] I.W.96
[68-A] Ex.IW-79/1

Pond Area, therefore, Environment Department can not shrug its responsibility from this key role.

10.26. Even the Secretary Environment was asked to go back and prepare a presentation on the relationship between floods and environment. He, however, requested the Tribunal that the said presentation be allowed to be made by the Director General of EPA Punjab and not by himself. Considering the level of knowledge of Secretary in the matters of Environment this concession was allowed. Dr. Shagufta Shahjahan, Director General, EPA, Punjab[68-B], Lahore appeared before the Tribunal and submitted that no work regarding flood is being done by the Department and there has been no flood policy paper either before or after the floods suggesting ecological steps in flood mitigation in the future. The Power Point Presentation[68-C] made by the said Director General leaves much to be desired.

10.27. *PAKISTAN RAILWAYS:* Secretary/Chairman, Pakistan Railways[69] submitted that there are three large bridges over river Indus in Punjab namely Attock, Khoshhal Garh and Kalabagh. All the bridges have a railway line. The railway tracks also across the Taunsa Barrage. The major breaches of the railways tracks were due to overtopping on account of hill torrents and the breach of LMB at Taunsa. There is no other damage reported in Punjab due to the recent floods. Average height of the embankments/railway tracks is 3 to 4 feet, however, closer to the barrage, the height of the embankment is raised around 35-feet. Cost of damage estimated in Punjab is Rs.1129 million and a length of 67-km of the railway track has been affected in the recent floods.

10.28. Pakistan Railways has an elaborate flood fighting mechanism which is to protect their own embankments carrying railway lines. Pakistan Government Railway Code, 1962[70], Pakistan Railways Way & Works Manual (1969)[71], Bridge Rules (1970)[72], Pakistan Railways Guide Book on Floods (1976)[73], carry material relating to flood fighting. Therefore, the rich experience and expertise of Pakistan Railways but it is not integrated with other flood managing institutions.

10.29. *HOME DEPARTMENT:* Home Secretary, Government of the Punjab[74] submitted that "the primary responsibility to attend to floods lies with the Irrigation & Power Department, as well as, the Relief Commissioner Board of Revenue. As for as the Home Department is concerned, it is to ensure law and order. Additionally, if need be, it requisitions the army in aid of civil power and acts as a coordinator between departments during emergency. The Department manages the Civil Defence and now after promulgation of Punjab Emergency Service Act, 2006, Emergency Rescue 1122 falls within its jurisdiction. Rescue 1122 carried out evacuation operations during the recent floods. Emergency Boards were also

[68-B] IW.100
[68-C] Ex.IW-100/1
[69] I.W.78
[70] Ex.I.W.78/3/3
[71] Ex.I.W.78/3/4
[72] Ex.I.W.78/1
[73] Ex.I.W.78/3/2
[74] I.W.11

constituted in order to carry out relief work under the Act.

10.30. From the Position Paper submitted by the Secretary, Home Department, it is reflected that the emergent meeting of emergency services was convened on 30.07.2010 when breach had already taken place at Jinnah Barrage. The District Emergency Board constituted under Punjab Emergency Service Act, 2006 also did not function.

10.31. We noticed that reference of letter[75] dated 29.07.2010 Commissioner Sargodha in the letter dated 30-7-2010[76] of the Home Department, Government of the Punjab requested for Army force for protection of LMB, Jinnah Barrage. The request was made by the Commissioner for service of 01 Company of Army alongwith three dozers, three hydraulic excavators and other necessary machinery. The Army had not been requisitioned when the breach had taken place on Jinnah Barrage. The Flood Fighting Plan & Guidelines clearly stipulate pre flood coordination with Pakistan Army and the civil administration.

10.32. Field formation of the Home Department, i.e. Punjab Emergency Services (1122) performed during the floods as a Directorate of Civil Defence (1204 volunteers alongwith power boats were mobilized). However, it appears that there is no coordination between Home Department and Irrigation Department or Emergency Services and the Irrigation Department.

10.33. *C & W DEPARTMENT PUNJAB, LAHORE:* Mr. Azam Suleman Khan, Secretary, Communication and Works Department, Punjab, Lahore[76-A] in his statement submitted that the role of C&W Department is different from Irrigation & Power Department when it comes to flood fighting. Practically the role of C&W Department is to safeguard the main structures i.e., Bridges and Culverts. The sole strategy is to make cuts in the roads, if need be. There is no other flood fighting strategy with the C&W Department.

10.34. According to the Secretary, one of the lessons learnt from recent flood is that C&W Department ought to have better coordination with the other sister Departments like I&P Department, HUD & PHE Department, N.H.A. and the District Administration/Local Government/Police. One of the proposed mechanism could be that a Core Flood Fighting Group could be developed having representation of Secretaries of all the important line Departments, which could then act as a hub to regulate/monitor the flood

10.35. Another issue is the capacity of the Department in terms of machinery, which during the recent floods was noticed and needs to be upgraded.

10.36. *LIVE STOCK & DAIRY DEVELOPMENT DEPARTMENT:* The department has a flood plan with the mission to save large and small animals as well as poultry population from contagious and infectious diseases before and during flood/ rainy season and to arrange

[75] Ex.I.W.11/1
[76] Ex I.W.11/1
[76-A] Statement of IW-8

fodder for the animals during the flood emergencies in the flood prone areas. The salient features of the flood plan[77] are:

- Curative and Prophylactic Vaccination, Control of Parasitic & other Diseases and Treatment of Sick and Wounded Animals
- Pre-flood Vaccination work.
- Curative work against parasitic and other diseases.
- Maintaining the Reserve of Dry Fodder and Stock of Animal Feed.
- Establishment of Emergency Cell at the Provincial Directorate for carrying out Pre-determined actions.
- Allocation of Reserve Quota of Medicines and Vaccines for flood Emergency.
- Village to Village coverage of the flood prone areas for preventive measures and advisory services.
- Treatment of wounded and sick Animals in Food affected areas and to take measures against spread of diseases.

10.37. It is encouraging to note that the department has a flood plan. However, it is still in isolation and without coordination with other departments.

10.38. *HOUSING URBAN DEVELOPMENT AND PUBLIC HEALTH ENGINEERING DEPARTMENT:* According to the Secretary of the Department[77-A], the Department performs the following functions:-

(i) Housing and Urban Development;
(ii) Urban water supply and sewerage / drainage schemes;
(iii) Rural water supply and sewerage / drainage schemes; and

10.39. Its attached departments are the Development Authorities[78] at Lahore, Faisalabad, Gujranwala, Multan and Rawalpindi, Public Health Engineering Department and Punjab Housing and Town Planning Agency (PHATA) established under the PHATA Ordinance, 2002. The Departments considers selecting the site for housing schemes which are not in the flood range, however, there is no coordination between Irrigation & Power Department regarding designing the housing schemes, keeping in mind the entire flood sector even the sewerage and drainage schemes designed by the Department has no co-relation with the

[77] i. No. of flood relief centers. 580
ii. Staff deputed:
Veterinary Officers 454
Veterinary Assistant 2494
Target for vaccination during flood-2009 14.81 M

[77-A] Ex IW.15/1

[78] Ex I.W.15/4

Drainage System laid down by the Irrigation & Power Department. The Department has no Flood Fighting Plan in coordination with Irrigation and Power Department or other Departments during the flood season.

10.40. From the presentation given by the Secretary[78-A], it once again appears that the response to the flood is reactive, which needs to change.

10.41. *INDUSTRIES DEPARTMENT :* Additional Secretary (Mr. Shahid Ahmad Bhutta)[79] failed to satisfy the Tribunal whether industries are allowed to be set up in Active Flood Plains. According to the written reply[80] of the Secretary Industries reference was made to notification[81] dated 30.09.2002 issued under Punjab Industries (Control on Establishment and Enlargement) Act, 1963, which states that "no industrial unit shall be set up in areas affected by flood flowing transversely in the strip of one mile of either side across the Grand Trunk Road from Shahdara Town to Muridke Town without prior permission of the Provincial Government." It also states that each District Government may declare a negative area for industries which shall be determined by the District Committee after consultation of all the stakeholders and the Government can preserve the right to refuse establishment of any industrial undertaking which is in contravention of the public interest, ecology or other law for the time being in force.

10.42. The general policy guideline to declare negative areas by each district government for establishment of industries mentions "flood effected areas" as one of the parameters for determining negative area.

10.43. Inspite of the Location Policy not to allow setting up of industries in flood affected areas, number of industries have been set up in the active flood plains. There is no strategy to deal with these industries during floods and no coordination between the I & P department and the Industries Department.

11. *RECOMMENDATIONS*

11.1. Key departments to gravitate around the Irrigation Department and develop a joint and an integrated flood management support system.

11.2. Flood Management Plan to assign specific roles to key departments so that departmental energies are amalgamated and flood preparedness and flood fighting response is simultaneous and in unison.

11.3. FFC & I & P Department to play a central role in bringing other departments together to attend to a common flood management plan.

[78-A] Ex.IW.15/1
[79] IW-19
[80] Mark-120
[81] No. AEA-III.3-9/91 dated 30-9-2002

RIVER INDUS
ARRAGE
JINNAH

CHAPTER 9

There is a need to launch a Blue Revolution ….water would thus be required to play even a more important role than it did in the so called Green revolution , which was driven primarily by agricultural expansion[1]

DEVELOPING AN INTEGRATED FLOOD MANAGEMENT PLAN - THE WAY AHEAD

- *Developing integrated & holistic Flood Management Plan*
- *Factoring Climate Change into Flood Management architecture*
- *Improving Pre Flood Preparedness, Flood Forecasting, Flood Fighting, etc*

1. INTRODUCTION

1.1. This inquiry has revealed that despite multiple flood sector related institutions, Province of Punjab (or the country as a whole) does not have an Integrated National Flood Management Plan. In other words, our country does not have a strategy to combat floods.

1.2. We have noticed that floods are being poorly managed. Except the ritualistic high powered pre-flood meetings and perfunctory departmental pre-flood inspections there is no PLAN or STRATEGY to combat floods. Reliance by the flood managers is on Barrage Regulations and the Flood Fighting Plan which fall short of an integrated and holistic inter departmental flood management plan. This inquiry shows that the flood managers are not fully conversant with the Barrage Regulations and have failed to follow them in the recent floods. Flood Fighting Plan, on the other hand, is a document generated by thoughtless cut and paste of the previous year's plan. There has been no up gradation or innovation in these plans over the years. Such poor regulation and planning can only lead to results we witnessed in the recent floods.

1.3. To us unprecedented flood peak is of little significance. The real worrying issue is the absence of STRATEGY AND AN INTEGRATED FLOOD MANAGEMENT PLAN. Mere reliance on Barrage Regulations and Flood Fighting Plans will not do. An Integrated Flood Management Plan is an immediate necessity, and must be put in place before the next flood season starts.

[1] (Draft) National Water Policy (Pakistan)

1.4. With dismay and displeasure we note that the Federal Flood Commission (an authority constituted for this purpose), Provincial Irrigation Department(s), Planning Commission and Planning & Development Department have failed to come up with a Water Resource Management Plan for the country and as a consequence have also miserably failed to develop an Integrated Flood Management Plan.

1.5. Floods are a blessing[2] and they ought to be welcomed with the confidence and ability of the flood managers to mitigate loss and to take advantage of the benefits floods bring.

1.6. Flood management is much more than minimizing economic losses and damages. It requires intelligent management of both the flood plains and water resources generated by floods. Doing this well can support development instead of preventing it. Separating the floods from the development and natural resources context in which they occur increases the risk that poverty alleviation and adaptation strategies fail[3].

1.7. Floods are part of a natural cycle that can never be fully controlled. "Flood control" is therefore a futile terminology and a counter productive mandate. It is time to move towards an integrated approach to flood management to save lives, increase resilience and take advantage of the bounty floods bring. Flooding supports ecosystems which provide services that are essential to human livelihoods.

1.8. When formulating a Flood Policy we need to take a more holistic view of the floods, one that goes beyond looking at the immediate misery that floods can cause. We need to move away from flawed strategies of "flood control" to more practical and achievable strategies of "Flood Mitigation" or "Flood Risk Management" or "Flood Resilience."

1.9. The flood managers need to understand the challenges before drawing up a Flood Policy. Population growth is perhaps the most important challenge. Rising population requires more food and in turn more agriculture. Most rain fed agriculture is in the arable land of the flood plains. Flood plain resources require planned management, more so in a country like Pakistan which has an agro-economy. With growing population, human settlements by the river increase flood risks and threaten human safety through deforestation and altering of the hydrological properties of the catchment area. This can lead to accentuation of flood peaks, hill torrents and increased sedimentation.

1.10. While flood managers in the past have focused on structural and non structural measures to protect and mitigate flood, a broader set of objectives need to put on the agenda. While structural safety of the barrages and training works is critical, human safety, protection of human shelters, safeguards for agriculture and fisheries, roads, ecosystems, health, and biodiversity need equal attention. This further requires a more holistic planning

[2] Enhancing agricultural productivity and water availability, if floods are properly managed.
[3] Mark 137 - article by Joachim Saalmueller, Associated Programme on flood Management Climate and Water Department, World Meteorological Organization (WMO).

pattern involving a number of connected departments and agencies.

1.11. A flood is perceived as an event best suited for the disaster and relief management agencies. This approach requires a fresh look. We need to develop our resilience, we need to accept floods as a bounty and learn to absorb them and live with them and enjoy its fruits. Our flood policy must then primarily revolve around land use zoning, flood plain management, watershed management, environment conservation and management, enhancing forest cover along the riverine belt, redesigning the architecture of human settlements in the flood plains, developing retention pools, learning to understand the morphology of the river and tampering little with nature and natural river flows unless necessary. Therefore, flood policy cannot only be a long list of structural embankments and levees. Thwarting nature will never provide a solution, it never has.

1.12. It is once again underlined that National Flood Management Plan cannot exist without a National Water Resource Management or National Water Policy/ Plan. Flood management is, therefore, weaved into a national water management plan, and any planning for the flood sector will flow from the water sector. We notice with deep concern that the National Water Policy is still a DRAFT and is awaiting approval since 2005. Additionally, the National Flood Protection Plan–IV (2008-2018) has not been approved. This governmental and perhaps bureaucratic inertness is most disturbing and can be listed as a cause behind the recent devastation.

1.13. Water and our future are deeply interlinked. Our future progress has a serious risk of being threatened if governments of the day do not put water, floods and droughts on their top agenda.

1.14. In the face of governmental inertia in devising a plan, we felt it obligatory to formulate policy recommendations for the development of an integrated flood management plan in the Province, as well as, the county.

2. EXISTING THOUGHT ON FLOOD MANAGEMENT

2.1. We draw strength from the local and international material on the subject. Relevant portions are reproduced hereunder as a guide for the flood managers and policy makers, who should waste no time in developing an Integrated Flood Management Plan VERY SOON.

2.2. INDUS BASIN IRRIGATION SYSTEM (IBIS)- AN OVERVIEW: Pakistan's economy is largely based on its agricultural produce. Water is therefore a critical resource for its sustained economic development. In order to fully utilize the river water resources, the IBIS has emerged as the largest contiguous irrigation system in the world. The IBIS comprises of three large dams, 85 small dams, 19 barrages, 12 inter river link canals, 45 canal commands. This network is the biggest infrastructure enterprise of Pakistan accounting for approximately US$ 300 billion of investment. The average annual flow of Western Rivers of Indus basin is approximately 142 million acre feet (MAF) with about 104 MAF diverted for

irrigation purposes and 35 MAF outflows to the Arabian Sea.

2.3. In addition to providing food security, the agricultural produce of IBIS constitutes 23% of GDP, 70% of total export earnings and 54% of employment of labour force. The IBIS is therefore essential in sustaining the agriculture sector and consequently economic well being of Pakistan. The Indus basin now serves as a breadbasket of Pakistan[4].

2.4. *VISION-2030 OF THE GOVERNMENT OF PAKISTAN[5]:* According to the Vision 2030 (August 2007), prepared by the Planning Commission, Government of Pakistan, natural resource will be severely depleted and stressed, especially water, land and forests, assuming that current water consumption patterns continue unabated. The projection shows that at least 3.5 billion people or 48% of the world's projected population will live in water stressed river basins in 2030 including Pakistan.

2.5. Integrated water resource management which aims at ensuring the most optimal use of water is a major strategy for overcoming the looming water scarcity. Pakistan has not managed its water resource with care and is now becoming increasingly water-stressed (less than 1000 cubic metres per capita). The country's current storage capacity at 9% of average annual flows is very low as compared with the world average 40%. However, on average, 35 MAF of water flows in the sea annually during the flood season. In addition, extensive damages result due to flooding. Without additional storage, the shortfall will increase by 12% over the next decade. The increasing storage capacity is thus an important part of the strategy.

2.6. *NATIONAL WATER POLICY 1987[6] (INDIA) :* There should be a Master Plan for flood control and management for each flood prone basin. In flood control and management, the strategy should be to reduce the intensity of floods by sound watershed management and provision of adequate flood cushion in water storage projects wherever feasible to facilitate better flood management of each flood prone basin. According to the Policy (for Flood Control and Management):

i. There should be a master plan for flood control and management for each flood prone basin.

ii. Adequate flood-cushion should be provided by water storage projects to facilitate better flood management.

iii. In highly flood prone areas, flood control should be given overriding consideration in reservoir regulation policy even at the cost of sacrificing some irrigation or power benefits.

[4] Mark 137
[5] Ex I.W. 137/5
[6] Reference in Mark 136 - NATIONAL WATER POLICY (India)(As adopted by National Water Resources Council in its 5th meeting held on April 1, 2002)

iv. While physical flood protection works like embankments and dykes will continue to be necessary, increased emphasis should be laid on non-structural measures such as flood forecasting and warning, flood plain zoning and flood proofing for the minimization of losses and to reduce the recurring expenditure on flood relief.

v. There should be strict regulation of settlements and economic activity in the flood plain zones along with flood proofing, to minimize the loss of life and property on account of floods.

vi. The flood forecasting activities should be modernized, value added and extended to other uncovered areas.

vii. Inflow forecasting to reservoirs should be instituted for their effective regulation.

2.7. *INDIAN EXPERIENCE*[7]*:* It has also been argued by some environmentalists that in order to control floods, the level of water in the reservoir of the dam should be kept at minimum level. However in order to generate hydro-electricity and bring more agricultural area under irrigation, the level of the water in the reservoir is kept high which leads to flooding in the upstream areas. Thus the measure that is often touted as a solution to the flood woes itself becomes a cause of it. Hence it is high time for the government to look for ecological measures that can help in the management of floods on a durable, long-term basis. Afforestation of the flood plains must be encouraged as trees not only absorb rainfall water but also obstruct its flow to the rivers. Construction activities on the flood plains should be stopped altogether. The flood plains, being very fertile, can be used for economic activities like agriculture. Those living in flood plains for these activities should have an efficient early warning mechanism that ensures their evacuation before the calamity strikes. With the advancement in space technology that India has achieved, remote-sensing should be effectively used for prediction of rainfall and floods. It is only with these comprehensive and holistic measures that an efficient management of floods can be ensured with least damage to life and property.

2.8. *BANGLADESH EXPERIENCE:* Options for flood management can include flood forecasting and warning, preservation of retention ponds, land use planning, flood zoning, emergency services, shelters, flood proofing, flood fighting and post-flood rehabilitation measures. Moreover, experiences from 1998 flood indicate that coordination between agencies responsible for flood protection and drainage of the city can significantly reduce the flood damage.

2.9. *PAKISTAN'S FLOOD POLICY*[8]*:* A number of Provincial and Federal Acts drive the flood policy in the country. The major Provincial Acts are Punjab Irrigation Act 1873, Sindh

[7] Indian National Water Policy
[8] Mark-134, (Indus Basin River System-Flooding and Flood Mitigation by H. Rehman and A.Kamal)

Irrigation Act 1879, NWFP Act 1873, Balochistan Ordinance 1980, Punjab Soil Reclamation Act 1952, Water Users Association Ordinance 1981, Provincial Irrigation and Drainage Authority (PIDA) Acts 1997, etc. At the federal level the relevant acts are WAPDA Act 1958, Indus River System Authority (IRSA) Act 1992 and Environment Protection Act 1997. Additionally, a Provincial Water Accord was signed in 1991 for apportionment of Indus River Waters between the four provinces.

2.10. None of the above laws provide a national or provincial flood management policy.

2.11. A recent report on disaster management policies in Pakistan (WCDR, 2005)[9], inter alia, highlights that Disaster Management in Pakistan basically revolves around flood disasters with a primary focus on rescue and relief. After each disaster episode the government incurs considerable expenditure directed at rescue, relief and rehabilitation.

2.12. *NATIONAL WATER POLICY*[10] *(Draft):* Draft National Water Policy prepared in 2005 addresses all the water related issues in the country, including the flooding issue. The Policy provides a framework whereby flood management in the country can be improved through necessary institutional and legal reforms. The National Water Policy is a landmark document and can go a long way in improving flood management in Pakistan.

2.13. The Policy acknowledges gaps in the existing policy framework and recommends rationalizing various pieces of legislature to minimize overlap and redundancy. It proposes to create a Federal Water Commission incorporating FFC, part of Planning Wing of WAPDA and Office of the Chief Engineering Advisor. It also recommends replacement of various water related provincial acts with a simple unified law that enables clearer understanding and subsequent application of the law.

2.14. The Policy has been prepared on modern lines and emphasizes all the necessary structural and non-structural measures for flood management. It emphasizes the need of stakeholder participation in the flood management process and enhancing flood awareness in the community.

2.15. A step forward would be to acknowledge the floods as a 'resource' and harness the numerous benefits that are associated with the regular flooding. In this regard flood mitigation measures need to be developed that acknowledge the floodwaters as a resource and ensure that the best possible outcome is achieved in terms of socio-economic and environmental benefits for any proposed structural measures.

2.16. The Policy also recommends strengthening of information management and research in the area of flood management. In this regard the Policy calls for promotion and support of public and private research in the fields of weather forecasting, rainfall predictions and flood forecasting.

[9] Mark 133
[10] Mark 142- Still a draft since 2005

2.17. *FLOOD MANAGEMENT.*[11] Draft National Water Policy provides the following flood management strategy

Issues	Policy	Strategy
■ Increase in flood peaks due to sedimentation of reservoirs. ■ Problem of inundation and land erosion. ■ Lack of proper maintenance of flood protection works. ■ Inadequate management of floods and flood forecasting and warning system. Flood Plain encroachments.	■ Greater emphasis on proper maintenance of the existing infrastructure. ■ To attenuate flood peaks, additional multi-purpose storages (including flood control) be constructed ■ Promote flood retardation structures ■ Promote Watershed Management and provision for sediment sluicing in new dams ■ Review the design and maintenance standards of existing flood protection structures, and make improvement where necessary to bring them to the level of functional capability and reliability ■ Encourage flood adaptability in riverine belts. ■ Improve flood forecasting and warning system ■ Towards better flood management, review and update Flood Manual and National Flood Protection Plan, Flood routing study be undertaken ■ Improvement of design and standards of flood protection interventions ■ Establish and promote flood zoning and enforce appropriate land use by avoiding growth of vulnerable developments in flood-hazard areas. ■ Develop River Laws to protect waterways and flood plains from encroachment, misuse etc. ■ Optimize reservoir operational rules to ensure efficient and prudent decisions to control floods, particular when reservoirs are near to maximum conservation level.	■ **Continue with the construction of additional flood protection facilities** ■ **Creation of public awareness education on flood related intervention** ■ **Support a special study to explore various methodologies such as dredging, flushing and/or removal of accumulated sediment from river beds, particularly in the lower reaches of Indus, to check the river levels from rising further** ■ **Promote and support research for better understanding of the monsoon systems** ■ **Strengthen Pakistan Metrological Department through modern weather forecasting equipment.**

[11] Mark 142

2.1.8. *FLOOD PROBLEMS*[12]*:* The main issues relating to flood works in the Punjab Province include the following:

i. Lack of strategic / master planning for flood management and implementation of flood protection works.

ii. Concerns related to planning, design and implementation of river training works, particularly with regard to the absence of objective / coherent selection criteria and repeated damages to the constructed facilities.

iii. Partial implementation of the identified interventions due to inadequate planning, delay in approval and funding, and delays in construction.

iv. Sustainability concerns with particular reference to lack of criteria / mechanisms for financing the O&M and restoration costs.

2.19. Mr. Asrar-ul-Haq[13], Chief Strategic Planning / Reform Unit, Irrigation and Power Department, Lahore deposed before the Tribunal that:

"…lessons learnt from the recent floods are as follows:

(i) To further develop the flood fighting plans which are currently merely reactive. The plan should include a plan "B" as well.

(ii) Various second defense bunds need to be repaired and brought up to the mark;

(iii) The system of embankments need to be improved and wetting channels may be provided for safety of embankments;

(iv) The system of flood embankments and structures need to be revisited on the basis of new benchmarks / high flood levels as experienced this year;

(v) Improvement of drainage infrastructure;

(vi) Location of relief cuts need to be identified by the department like the breaching sections, so that in an emergency there is no problem of their activation and the local community is also aware of the impacts of the steps being taken by the department;

(vii) Adequate funding for improvement / construction of flood protection

[12] Mark 107
[13] I.W. 141

infrastructure, as well as, for operation and maintenance of the flood infrastructure.

2.20. According to Naseer Ahmad Gillani[14], Chief (Water) Planning Commission, Government of Pakistan, Islamabad: "Planning Commission's view on the Flood Sector is covered in the Medium Term Development Framework ("MTDF") 2005 – 2010. In this regard, it is pointed out that the Working Group of MTDF on Flood Sector was also constituted with the primary purpose of developing an integrated Flood Management Plan, they have tendered their report. . . . The Planning Commission has worked on the Water Resources Management, however, as far as, Flood Management is concerned, it is the understanding of the Commission that this is the task to be undertaken by the FFC which is later on integrated into MTDF."

2.21. According to Mr. Asif H. Kazi in his paper Flood Control and Management[15], the following are the key issues that need to be appropriately addressed in order to ensure a proper flood management plan for the Province:-

i. Development in irrigation, drainage and other water management activities per se must interact with flood management. Planning for flood management must be regarded as an integrated and a continuous process which is not being done.

ii. Most structural planning is required in developing flood protection facilities rather than a local emergency approach which is more frequent.

iii. Design standards of existing flood protection works grossly fall short of the required levels. For instance, existing side slopes of protective embankments are rather too steep. The shanks of spurs are too long and spacing too large.

iv. The maintenance standards of the existing flood protection infrastructure are particularly deficient. Replenishment of eroded embankments, spurs and stone aprons, etc. is carried out inordinately late while adventurous risks are taken with the result that breaches/damages are not uncommon. This needs an asset management plan and assessment of liabilities.

v. Appropriate actions are lacking in the land use, and, therefore, growth of vulnerable developments in floodplain areas continue unabated.

vi. Old reservoir operational rules are not being upgraded to properly attenuate flood peaks despite better forecasting methodologies now available.

vii. Monsoon systems causing Pakistan's high-magnitude floods, including travel mechanisms of weather systems from Bay of Bengal and their interaction with

[14] I.W. 143
[15] Mark-134

westerly currents from Arabian Sea and Mediterranean, etc. vis-à-vis seasonal low pressure over Balochistan, Tibet Plateau pressures, wind velocities and other relevant factors are not fully integrated and understood. There are also many gaps in the coverage provided by the existing weather radars.

viii. Flood response plan lacks (1) level of awareness (2) flood warning time and (3) reliability of warnings.

ix. Implications of the vague terms currently used for Flood Warning such as "High Flood", "Very High Flood" or "Exceptionally High Flood" are not understood by even literate person, let alone the potential village affectees.

x. Progressive deposition of sediment on the river beds, particularly in the lower reaches of the River Indus, is proceeding unchecked. Current management of the problem by correspondingly raising of the dykes to contain the river every few years, is certainly not sustainable on a long-term basis.

2.22. According to Mr. Asif H. Kazi[16], urgent measures are required to ensure:-

(a) Sufficient and efficient transport system for mobility of staff.

(b) More effective patrolling of bunds and river training works.

(c) Strengthening of communication system by providing additional wireless equipment or use of internet in the flood affected areas.

(d) Shingle roadways be provided on the bunds for quick access and flood fighting.

(e) Old system of providing lanterns to patrolling staff be replaced with portable generators with poles and electric cables, if proper monitoring and timely remedial action is to be ensured to avoid breaches during floods.

NON-STRUCTURAL OPTIONS: various non-structural options are composed of the following:-

(f) *Watershed Management Practices* - As also stated earlier, watershed management, though a long-term activity, yields major flood mitigation benefits. The function of such measures is to reduce the velocity of flow and sediment generation, by providing/restoring afforestation cover in the catchment areas. In the face of scanty rainfall, the success of planting in the catchments of hill torrents, is generally possible only under strict prohibition against grazing. In other areas such as the

[16] Mark-134

upper parts of the Indus catchment, plantation is not possible because monsoon systems are unable to penetrate and thus there is hardly any rainfall to support vegetation. Mangla Dam watershed management has been under way for the last 45 years, and its positive effects became apparent some years ago when the annual silt load entering the reservoir was found to have reduced by almost half, thus doubling the life span of the reservoir. Prolonging the effective life of a reservoir indirectly helps in attenuating flood flows that are routed downstream. At the time of design and construction of Mangla Dam, the silt particles per million (PPM) were such that the annual sediment deposits in the reservoir were estimated as 60,000 acre feet which subsequently reduced to approximately 35,000 acre feet.

(g) Land-Use Restrictions, Cropping Patterns, etc. Flood damages are reduced by adopting modified land-use practices suitable to the local conditions. Furthermore, in flood-prone areas, development of infra-structure, residential colonies and industrial states have to be discouraged through proper legislation and only flood-resistant crops be sown, especially those spanning the flood season. In practice, there is very little work achieved under this option, and the land use/cropping patterns remain virtually unregulated, and the people continue to take risks freely. Any high-asset infrastructure has of course, to be provided with adequate flood protection.

(h) Soil and Water Conservation Techniques: Soil and water conservation practices are extremely useful if properly adopted in accordance with the catchment characteristics of river/hill torrent basins. This greatly helps in reducing erosion of otherwise productive soils, especially through storing flood waters for agriculture. In some hill torrent areas and in river catchments, conservation techniques including terracing, contouring, strip cropping, are being practiced very successfully. Such techniques significantly contribute in flood abatement, besides providing livelihood to the hilly area residents.

(i) Reservoir Operation Regulations: Pakistan has three large reservoirs, namely Tarbela and Chashma on Indus River, and Mangla on Jhelum River. These reservoirs are primarily meant for irrigation supplies, hydropower generation being the secondary purpose. However, the reservoirs also provide an opportunity in flood management by depressing flood peaks.

(j) In India, there exist five storage dams on rivers that eventually flow into Pakistan. On the Ravi River Thein Dam; on the Sutlej River Bhakara and Nangal Dams; and on the Beas River Pando and Pong Dams. These dams were constructed after the 1960 Indus Water Treaty. With these dams the Ravi and Sutlej Rivers in Pakistan, have become literally dry, except for occasional flood flow that enters Pakistan when the huge reservoirs in India, are already full or it is not otherwise feasible to store water.

(k) The power generation and irrigation requirements aim to fill the reservoir to

full capacity by the end of the monsoon in August each year, both in Pakistan and in India. In terms of releases, optimum power generation requires maintaining the high water level during the entire period of operation, while irrigation supplies require maximum level in August and minimum water level in June next year, thereby enabling full utilization of the stored water for agricultural purposes. If some degree of priority was to be given to flood, space would need to be reserved at a certain level below the full capacity. Another option would be to permit flexibility in operational regulations relying upon instant information that is now possible from the newly-installed telemetry and more efficient communication system; by storing flood peaks in the event when the reservoirs are full at the end of August and a flood is experienced (say) in early September. Under the current regulations no flood mitigation is possible in such circumstance just as it happened at Mangla in the year 1992. This aspect needs to be given serious consideration.

2.23. According to World Meteorological Organization (WMO)[17] the summary of an integrated plan is as follows:

Strategy	Options
Reducing flooding	Dams and reservoirs Dikes, levees and flood embankments High flow diversions Catchment management Channel improvements
Reducing susceptibility to damage	Floodplain regulation Development and redevelopment policies Design and location of facilities Housing and building codes Flood proofing Flood forecasting and warning
Mitigating the impact of flooding	Information and education Disaster preparedness Post-flood recovery Flood insurance
Preserving the natural resources of Flood Plains	Floodplain zoning and regulation

[17] Mark 146- Integrated Flood Management – concept paper – WMO no. 1047

2.24. According to *PAKISTAN WATER SECTOR STRATEGY*[18] the objectives for flood protection as based on the Draft National Water Policy are to:-

(i) Place priority for flood protection on areas of major human habitation and economic importance;
(ii) Prepare flood and drought management strategies, especially for major cities, key secondary cities and towns & major infrastructures;
(iii) Promote the delineation of Flood Risk Planning and Regulatory Zones to be adopted by all agencies as part of the planning process and for them to:

- identify consistent standards of service for differing land uses
- priorities areas for flood protection
- prepare plans in terms of areas for full, appropriate and non-structural measures
- regulate land use and development of floodplains
- Develop flood forecasting, warning and preparedness strategies for flood prone areas
- Implement effective recovery of operating and maintenance costs from beneficiaries of urban flood alleviation and stormwater drainage schemes.

2.25. FLOODING AND FLOOD MITIGATION[19]

2.26. Flood management in the Indus Basin is a multi-dimensional process that demands intensive resources and requires efficient coordination between various government agencies. However, even advanced flood management systems are no guarantee against flood disasters as has often been proved in the more developed countries. Pakistan being an agricultural economy cannot afford to risk its agricultural infrastructure consisting of dams, barrages and irrigation canals, which can be under severe stress in major flood events.

2.27. Currently, the flood management policy of the country is more reactive than proactive in dealing with the flood issues. However, with the preparation of National Water Policy, the situation is likely to change with far reaching effects on the flood management process in the country. The National Water Policy provides the necessary legal and institutional framework to improve the flood management process in Pakistan.

2.28. Although the National Water policy provides the necessary guidelines for flood management, there is a need for a separate national policy for flood management to deal specifically with the flood issues in the country. Such a policy may be called National Flood Policy that may outline the details of policy framework for flood management. It is worth noting here that a new paradigm in flood management that considers flood as a resource rather than a menace can be highly beneficial in achieving the environmental objectives of

[18]Pakistan Water Sector Strategy, Ministry of Water and Power, Chairman Federal Flood Commission (Mark 138)
[19]Mark 135- Indus basin River System- Flooding and Flood Mitigation - H. Rehman and A. Kamal.

the government, which are set under various international conventions to which Pakistan is a signatory.

2.29. It is envisaged that the flood forecasting capabilities would be improved considerably under the second Flood Protection Sector Project being undertaken by the Federal Flood Commission. The task of quantification of flood risk thorough detailed studies and subsequent measures required in minimizing the risk should be taken on priority basis.

2.30. BEST PRACTICE METHODS FOR VALUING FLOOD CONTROL BENEFITS[20]

- Flood events are a part of nature. They have existed and will continue to exist. As far as feasible, human interference into the process of nature should be reversed, compensated and, in the future, prevented.
- Flood strategy should cover the entire river basin area and promote the coordinated development and management of actions regarding water, land and related resources.
- Considering the evolution and trends, the approach to natural hazards requires a change of paradigm. One must shift from defensive action against hazards to management of the risk and living with floods, bearing in mind that flood prevention should not be limited to flood events which occur often. It should also include rare events.
- Transnational efforts should be intensified to restore rivers' natural flood zones in order to reactivate the ability of natural wetlands and floodplains to retain water and alleviate flood impacts.
- Flood forecasting and warning is a prerequisite for successful mitigation of flood damage. Its effectiveness depends on the level of preparedness and correct response.
- Human uses of flood plains should be adapted to the existing hazards. Appropriate instruments and measures should be developed for all flooding related problems: flooding, rising groundwater tables, sewage network disruption, erosion, mass deposition, landslides, ice flows, pollution, etc.
- Mitigation and non-structural measures tend to be potentially more efficient and long term more sustainable solutions to water-related problems and should be enhanced, in particular to reduce the vulnerability of human beings and goods exposed to flood risk.
- Structural measures (defence structures) will remain important elements and should primarily focus on the protection of human health and safety, and valuable goods and property. We will have to keep in mind that flood protection is never absolute, and may generate a false sense of security. The concept of residual risk, including potential failure or breach, should therefore be taken into consideration.
- A compensation system should support the victims of flood disasters to restore their economic basis and their living conditions in due time. Insurance solutions at the private or public level or subsidence

[20] Colin Green, Flood Hazard Research Centre, Middlesex University, U.K. - Best Practice Methods for Valuing Flood Control Benefits (Mark 136)

Therefore the responsible authorities should provide timely and reliable flood warning, flood forecasting and information.

- A specific preparedness to alert, rescue and safety measures should be planned and implemented at all levels, including the public, by maintaining regular basic information and continuous ongoing training actions. With appropriate and timely information, preparedness, everyone who may suffer from the consequences of flood events should be able to take –if possible- his/her own precautions and thus seriously limit flood damages.
- Solidarity is essential, one should not pass on water management problems in one region to another. The appropriate strategy consists of three steps: retaining, storing and draining (first make every effort to retain rainfall at the spot, store excess water locally, only then let the water be discharged to the watercourse). Flood prevention has also to be based on the precautionary principle.

by state, which reinforce solidarity, should be furthered.

- In flood-prone areas, preventive measures should be taken to reduce possible adverse effects of floods on aquatic and terrestrial ecosystems, such as water and soil pollution. It is necessary to distinguish between different kinds of flooding and the environmental conditions that contribute to the problem. For instance, there are significant differences between on the one hand sudden flooding in upstream or headwater areas where mitigating risk involves a wide range of innovative small-scale solutions and on the other hand lowland flooding where warning periods and the duration of flood events are longer and large-scale measures have to be taken. Therefore, the effectiveness of the best practices described in part II depends on among other hydrological and environmental circumstances.

2.31. FEDERAL FLOOD COMMISSION (MANUAL[21] OF DESIGN CRITERIA AND METHODOLOGY). NON-STRUCTURAL PROTECTION (SECTION 7) *General:* The non-structural protections should preferably be considered in conjunction with the planning and use of structural protection. However, at locations where structural protection are too expensive non-structural protection will be introduced. The selection of protection type will depend upon the site requirements. The most available and practiced types of non-structural protections are discussed in the subsequent sub-sections.

2.32. *FLOOD-PROOFING:* In general, people in all flood environments want the impact of flooding to be reduced, although there is a widespread acceptance of normal monsoon or other heavy rain conditions. The real concern of people is to reduce the effects of severe floods. Therefore, the flood-proofing needs and interests of local communities depend on the characteristics of the prevailing floods and local consultation and participation. Basically, five types of flood–proofing can be distinguished:

[21] Ex I.W. 103/2

i. Protection of infrastructure like roads, railways, water and gas pipelines, telecommunication, utility building and equipment.

ii. Protection of public buildings, industrial plants and private houses.

iii. Measures directed at emergency situations like creation of refuge areas including water supply, sanitation and flood storage facilities and access to refuge areas in a flood situation. The refuge areas have to be available close to the normal place of residence.

iv. Flood-proofing in agriculture such as the use of crops which are harvested before the flooding season starts, use of flood-resistant crops and food storage facilities for well stocking prior to flood season.

v. Drainage of flood water can be an important flood-proofing measure. It may prevent total flooding or for all cases lower the maximum floods levels and decrease the duration and extent of flooding.

2.33. *FLOOD-FIGHTING*[22]*:* Flood-fighting is an emergency measure which has the objective of mitigating flood impacts, particularly when flood protection and control structures and flood proofing measures have proved ineffective or failed. The measures and means of flood fighting are many and diverse, always requiring adaptation to local conditions. A brief description and requirements of flood-fighting is provided below.

i. Flood-fighting is an important element of non-structural measure for reducing flood hazards. Its important features are the preparedness of all potentially involved persons, availability of technical means and resources, support of respective authorities and cooperation of the public.

ii. Generally, flood-fighting is required for the failures of flood protection structures, such as:

1. Failure of dykes, flood walls and embankments The immediate causes could be scour, overtopping, piping, undermining, bank erosion, breaching and impact of floating debris.
2. Reduced capacity of river channels, flood ways and flood bypass channels; by obstructions of the flow particularly at channel constrictions, bridges and weirs.
3. Failure of weirs and barrages with consequent devastating flood waves.
4. Failure of land drainage systems causing flooding of agriculture land.
5. Failure of urban drainage systems causing flooding within protected urban area.

[22] ibid.

iii. Flood-fighting plans should be part of a well-designed flood management strategy, in which priority zones are clearly indicated and possible sacrifices of areas of lesser importance envisaged. Hence, flood-fighting plans are closely linked to the other emergency measures, such as evacuation of people to safe zones, emergency flood – proofing of structures etc. Flood-fighting plans cannot remain unchanged during longer periods and these should be kept abreast of area developments.

2.34. The flood-fighting measures should be based on clear plans, containing the following main elements:

a. Assessment of flood risk.

b. Zoning of protected or unprotected area according to flood risk.

c. Inventory of flood control or protection systems in the area.

d. Analysis of possible modes of failure of protection structures and technical means to counteract failure during floods.

e. Study of situations which may develop when parts of flood protection systems fail.

f. Planning of second, third and subsequent defence lines for the case of progressive failure of embankments, groynes, spurs etc.

g. Planning of measures for protection against flooding urban areas by closing gaps in flood banks and flood walls, closing sewer outlets etc.

h. Planning of successive measures of retreat; sacrificing less important areas and defending more important areas. In critical situations, the most difficult decision is to sacrifice a certain area in order to relieve the pressure from other areas or to abandon flood-fighting. While the detail of such situations cannot always be foreseen in the flood fighting plans, this contingency must be anticipated.

2.35. Flood-fighting actions are varied, depending upon the development of the flood, the area endangered, the protection structures and available means. For flood-fighting the typical measures are:-

a) Closing of gaps in flood walls or groynes etc. by sand bags or other available methods.

b) Protection of river banks by sand bags, stone, or other available methods.

c) Counteracting piping which is the main cause of collapse of embankment and dykes etc.

d) Protection of bridge piers, weirs, barrages and dams against erosion by rockfill, sand bags and other available methods.

e) Construction of temporary non-structural protection measures to prevent the propagation of flood on non-protected land.

f) Construction of second and future "defence structures", according to the flood-fighting plan.

g) Cutting of embankment, dykes etc. in order to allow flooding of less important areas, and thus to save other more important areas, according to the flood-fighting plan.

h) Removing obstacles from active or potential flood ways, relief and flood bypass channels.

i) Protection of structures exposed to strong wind wash action.

j) After the flood is over, the flood-fighting will enter the follow-up stage. The flood-fighting system should not be demobilized until the valuable experience gained during the flood has been recorded for later analysis and application for improving flood-fighting methods for the next flood event.

2.36. *PROVINCIAL PLANNING COMMISSION- CHAIRMAN[23], P&D BOARD:* The Chairman deposed that the department does not have a holistic master plan for flood management in the Province. The flood sector projects are not totally integrated, however, they have their own strength and benefit the local areas. The Planning Commission, Federal Government, does the over all vision regarding planning and development. P&D uses a master plan of the Planning Commission and does further planning on a provincial level. P&D works within the parameters of the master plan prepared by the Planning Commission (referred to as the White Paper[24]). He admitted that there is no over all vision pertaining to water management or flood management within the White Paper.

2.37. P&D Department does not have a follow up mechanism regarding the approved flood sector projects. In the last two years, the said department has initiated third party validation (TPV). For success or failure of the project the parent department is responsible and it is the parent department alone to monitor the said projects. " I realize that there is a need for going to the drawing board and developing an integrated flood management plan for the province[25]."

[23] I.W.137
[24] Ex.I.W.137/6 and 7
[25] I.W.137

2.38. There are two main streams of funding for the flood sector. One is by the Federal Government and the other is by the Provincial Government. The Public Sector Development Programme (PSDP) is funded by the Federal Government. "the practice is that the MNAs obtain tacit approval from the Federal Government and then press the Provincial Government to initiate flood sector projects/schemes pertaining to their areas against the said fund."

2.39. At the provincial level the funding is through the Annual Development Plan (ADP). The resource allocation for ADP is around 90% from the Federal Government (under the NFC Award) while the provincial contribution to the fund is around 10%. At times, foreign loans and borrowing from the Commercial Banks are also taken which contributes around 10% of ADP.

2.40. Projects (flood sector) are initiated by the respective departments which are scrutinized by the P&D Department (mainly regarding the budgetary limits of the projects) are included in the Annual Development Plan.

2.41. According to the Medium Term Development Framework (MTDF-2009-2012)[26] as well as the Development Programme 2009-2010, the sector has been described in the following manner:

"Irrigated agriculture is the major determinant of economic growth potential of the province as it accounts for 26 percent of the GDP and caters for over 40 percent of the province's work force. Over 90 percent of agricultural output in Punjab comes from farmlands irrigated by one of the largest contiguous irrigation systems in the world. The colossal irrigation conveyance network is serving 21 million acres (8.4 million hectare) cultivable command area with cropping intensities generally exceeding 120 percent. The vast irrigation system in the province, however, faces major irrigation and drainage challenges with serious economic, environmental and social implications. Hydraulic infrastructure has deteriorated and large deficits in O&M maintenance have led to sub-optimal service delivery levels characterized by low water conveyance efficiencies and inequitable water deliveries. Replacement costs for Punjab's irrigation infrastructure including barrages and conveyance network is estimated as Rs.1600 billion whereas the estimated cost for rehabilitation and deferred maintenance needs is Rs.170 billion. Consequently, development in the sector needs to enshrine rehabilitation, improvement and modernization of infrastructure coupled with holistic reforms aiming at integrity and sustainability of the system through improved management and service delivery levels."

2.42. *INTERNATIONAL EXPERTS:*

[26] Ex.I.W.137/2/2

2.43. *JOHN BRISCOE*[27], Gordon McKay Professor of the Practice of Environmental Engineering, Harvard University Schools of Engineering and Applied Sciences, Public Health and Kennedy School of Government, USA submitted to the Tribunal that:

> "The flood problem cannot be tackled in isolation without attending to the overall area of water resource management. Any flood management plan without the isolation of water resource management is erroneous.
>
> The authority dealing with water management in Pakistan is supposed to deal with flood management. The whole challenge is to weave "flood management" in the over all water management context, e.g., if we take Tarbela and reduce its storage prior to the floods, it raises a corresponding issue of hydropower and irrigation security, therefore, flood management and water management are inseparable. For example, the Three Gorges Dam on the Yangtze River in China, which produces 20,000 MW of hydropower, reduces its productivity during the flood season in order to make space for flood water. Such an operating rule can work only because China has redundancy in its power generation system. Pakistan does not have this redundancy and therefore Tarbela cannot be operated in this way. This again illustrates the fact that flood management is part of a bigger picture – not just of water management but energy and food security, too.
>
> As a conclusion there can be no Flood Plan without a Water Plan. The landmark 1968 study on Water and Power Resources of West Pakistan by Lieftinck said that Pakistan should build a dam the size of Tarbela on the Indus every 10 years. However, nothing has been built in the last 40 years. The result is that there is a massive underinvestment in storage on the Indus. Consider the comparison with major rivers in arid areas of the US and Australia. On both the Colorado and the Murray Darling dams have been built which can store about 1000 days of average flow of those rivers. Tarbela can store only 30 days of average flow of the Indus. All measures of infrastructure development point in the same direction. Whereas rich countries have developed over 70% of their economically viable hydropower potential, Pakistan has developed just 10%. Whereas the US and Australia have over 5000 cubic meters of storage capacity per person, and China has 2,500, Pakistan has only 120. The bottom line is that there can be no security – food security, energy security or water security – without major and continuous investments in infrastructure on the Indus. There is 40 years of underinvestment in infrastructure on the Indus.
>
> Of course infrastructure alone does not solve the problem. Water management walks on two legs – infrastructure plus institutions. There are also major institutional issues – legal, regulatory, organization, human resources and knowledge

[27] John Briscoe spoke with the Chairman of the Tribunal over phone from USA and got recorded the above statement. On his visit to Lahore he also met the other members of the Tribunal on 6-12-2010. The above statement is transcribed from the recording made over the phone. The statement was sent to Mr. Briscoe over email which was confirmed with slight modifications on 24-12-2010. Therefore, there is no signature on the statement.

—that have to be addressed, too. Investments in modern institutions must go hand-in-hand with investments in infrastructure. When we did our book on water in Pakistan we commissioned a very good paper on floods. I annex an extract of what we wrote on "living with floods" which is highly germane to [this] inquiry:

> "Flood management is characterized by 'short bursts of feverish activity stimulated by a flood event followed by long periods of complacency… as the memory of flood fades into the past, the motivation for action also passes away'. *(Briscoe and Qamar, page 60).*
>
> While this flood was and is a horrendous event, the reality is that the endemic problem of drought looms very large. As the endemic reality of drought again takes hold, floods will fade away from people's memory. The context is therefore floods, drought, and productivity, agriculture, energy all integrated. As in many countries, attention to floods is episodic and goes into hibernation during periods of drought, with devastating consequences (as witnessed in the recent drought-ending floods in Balochistan)[28].
>
> Pakistan has a long-standing and sophisticated understanding of flood management, and has long emphasized both 'hard' solutions (such as dams, embankments, and drainage works) and 'soft' solutions (such as watershed management, land use planning and flood warning systems).
>
> There are a number of factors—including declining storage capacity in the major reservoirs, and the increased flows likely as a result of glacial retreat—which indicate that Pakistan is likely to be entering an era of increased flooding.
>
> Flood management always involves difficult trade-offs. Embankments and drains and other protective structures cannot realistically be built to such a level that there is no threat of floods. And so when floods do occur, they should not be seen as 'a failure' of the system, but rather as an inevitable part of the uneasy balance which is struck when man lives in very large numbers in a hazardous environment. In addition, populations move into the Indus flood plain, which sustains a productive shallow-tubewell-based agriculture. Priority must be given to structural protection of high-value infrastructure assets, the failure of which would be catastrophic. This obviously includes the barrages, where there is both need for urgent structural attention (witness Sukkur Barrage) and attention to bypass floodways that need to be properly demarcated and channelized, and from which encroachments need to be removed. There are some major structures, such as the Alexandra Railway Bridge over the Chenab, that need to be extended to avoid choking and flood

[28] Briscoe and Qamar, Pakistan's Water Economy – Running Dry- Oxford (World Bank) - 2006: "living with floods" - page 59

ponding upstream that causes frequent inundation of towns and villages. A major problem is that maintenance of the existing flood protection infrastructure is deficient, with the result that breaches/damages are not uncommon. As for all other infrastructure (discussed in more detail in the next section), there is a need for an asset management plan, and assessment of liabilities and mechanisms for regular funding of these. While the concept of flood hazard land-use planning is well understood, the fact is that there is little enforcement, and growth of vulnerable developments in flood-vulnerable areas continues unabated. Post-dam records are long enough to give a fairly good indication of the effect of the reservoirs, but the quality of regulation is not being improved by extending the period of record by simulating reservoir operation for the pre-dam periods. There is a need to review the magnitude of Probable Maximum Flood (PMF) for major facilities.

Flood response plans exist but implementation is weak, with specific priority items being the need to raise the level of awareness, and to the timing and reliability of warnings and how they are understood by the general population.

Progressive deposition of sediment on the river beds, particularly in the lower reaches of the Indus, is proceeding unchecked. Current management of the problem by correspondingly raising the dykes to contain the river every few years is certainly not sustainable on a long-term basis.

Flood management is characterized by ‘shortbursts of feverish activity stimulated by a flood event followed by long periods of complacency… as the memory of flood fades into the past, the motivation for action also passes away’.

The lack of maintenance is a very serious institutional and financial issue. 'Since 1958, with the transfer of major development works to WAPDA, provincial irrigation departments' functions were reduced mainly to the operation and maintenance of the systems. PID managers have not been finding these functions sufficiently challenging, and over the years have lost much of their initiative, innovativeness, and morale. The PIDs' attention remains almost exclusively focused on the irrigation distribution network. Let alone the flood protection works, even the river barrages have been in a state of neglect. Whenever a major problem of a catastrophic nature takes place on a barrage or a flood protection embankment, lack of adequacy of maintenance funds is given as a standard cause which in several cases would be valid while in others not quite so. Deferred maintenance has become a routine practice with PIDs, which eventually results either in a disaster or in a major repair and restoration undertaking in the shape of an independent project.'

> In summary, there is a long tradition of excellent professional flood management capability in Pakistan. But the great challenges are those of making explicit but difficult trade-offs, financing, implementation, maintenance, and institutional performance—in short, the fundamental problems of development.

Finally, while it will be tempting to look for scapegoats in an enquiry on the floods, in my view this should not be the focus. The roots of the tragedy are in the failures of all – not least the Government of Pakistan and the donors who have supported Pakistan – for 50 years. The tragedy is the result of these accumulated failures to make good decisions: both political (especially in building transparency and trust among the provinces) and on both infrastructure and institutions. But there are some good signs –some important reforms in some provinces, for example. Pakistan is at a fork in the water road. It can continue down the path of stagnation, or it can build a new consensus on water, it can end the self-destructive bickering and start building a solid basis of infrastructure and institutions for water, energy and food security.

2.44. *ADIL NAJAM,*[29] Director and the Frederick S. Pardee Professor of Global Public Policy, Boston University,[30] USA deposed before the Tribunal that "although the current focus is on floods because of the tragedy of 2010, focusing on the Indus Water System as a whole is important because future water related disasters by climate change could include not only floods but also sever droughts. Therefore it is important to focus on water system as a whole and the water management systems that can be more feasible both in case of water and extreme drought conditions."

2.45. NESPAK's RECOMMENDATIONS[31]: The flood management and protection systems need to be accorded high significance. The systems are required to be upgraded and strengthened to a high level so that upgraded system are able to sustain high magnitude events as experienced in the 2010 floods. In this context the following areas have been identified where major improvements and major upgrades are required.

i. Improving and extending the Flood Forecasting System to include the upper Indus above Tarbela, Kabul river system above Nowshera and Indus river below Thatta-Sajawal bridge up to coastline of the Arabian Sea.

ii. Development of the flood passage guidelines for Tarbela reservoir so as to enhance its flood mitigation role.

iii. Implement evacuation of the people living in the reservoir areas up to the level of designed highest flood level so that the reservoir operators can implement

[29] I.W. 150
[30] The Frederick S. Pardee Center for the Study of the Longer-Range Future 67-Bay State Road Boston, Massachusetts -02215
[31] Ex I.W. 101/A/1

the SOPs of flood passage through the reservoirs without any constraint.

iv. Capacity building/training for enhancing the technical capability of PMD technical staff and operators of the dams and barrages is required so that they can perform their roles in an efficient and effective manner.

v. Identification of the future reservoirs that would have high flood mitigation role in addition to their agriculture and hydropower benefits and developing flood passage guidelines through them to achieve the desired flood mitigation role.

vi. Identification of flood release channels/escape channels to desert areas / off channel storages that would provide major reduction in flood peak discharge in the main rivers.

vii. Flood Plain Mapping/Zoning along all the Indus river and its tributaries for identifying high and medium flood risk areas for permanent settlements

viii. Identification of low flood risk areas for future cities, towns and villages, industrial areas and other vital installations etc.

ix. Formulation of requirements for legislation for restricting the development of permanent settlements in high and medium flood risk areas

x. Resettlement/relocation of the villages in the flood plains to safe areas outside the flood bunds

xi. Review and revise the flood design criteria of barrages, bridges, bunds and communication infrastructure on the Indus River System, and implement up-gradation where required.

2.46. *SUBMISSIONS OF WWF (WORLD WIDE FUND FOR NATURE):* Mr. Ali Hassan Habib, Director General, WWF, Pakistan in his Position Paper[32] submitted that the recent floods are consistent with the types of events that have been projected from human-induced climate change and such extreme events are occurring with more frequency and with greater intensity or severity according to the latest IPCC report. Therefore, it can be expected that a greater number of intense floods and droughts will be occurring as a result of climate exchange.

2.47. Deforestation has led to increase peak flow of floods. According to the State of the World's Forests 2009[33], the total land area of Pakistan has only 2.5% forest cover and even that is decreasing at an alarming rate. According to this FAO report, Pakistan is losing forests

[32] Ex.IW-81/1

[33] Bradshaw CJA, Sodi NS, Peh KSH, Brook BW (2007a) Global evidence that deforestation amplifies flood risk and severity in the developing world. Global Change Biology, 13, 2379-2395

at an annual rate of 2.1% and no other country in Asia/Pacific region has a higher rate for deforestation.

2.48. According to "Deforestation in Himalayan Forest watersheds and floods": For centuries it has been traditionally believed that forests provide natural protection against flooding. The role of forests in sustaining water supplies, in protecting the soils of important catchments and in minimizing the effects of catastrophic floods and landslides has long been discussed and debated by scientists.

2.49. A recent study published in the journal Global Change Biology by Corey Bradshaw and colleagues details the first global-scale and empirical evidence linking loss of natural forest cover to increased flood risk and severity in developing countries. Researchers from Charles Darwin University (Australia) and the National University of Singapore analysed 10 years of flood data from the Dartmouth Flood Observatory to monitor flood frequency at a country scale. "Our empirical results indicate that halting deforestation or reducing the rate of natural forest loss should be beneficial in alleviating the incidence and severity of floods that ultimately cause undesirable disruption and damage to human life and property", says Corey Bradshaw, the first author of the publication.

2.50. The extent of forest cover in Pakistan in 2005 was 1,902,000 hectares (ha) which is 2.5% of its land area. The annual rate of change of forest cover during 1990 –2000 was –1.8% while during 2000—2005 it was –2.1%. No other country in the Asia/Pacific region has a higher rate of deforestation, according to the country tables provided in this FAO report (FAO, 2009 State of the World's Forests).

2.51. The recent floods in Pakistan started from the catchment areas of the River Kabul, in Afghanistan and River Swat, in Pakistan. These catchments have lost vast areas of forest over the past few decades.

2.52. A recent study on forest cover assessment over the last eight years (2001-2009) of Swat and Shangla Districts highlights that in Swat ~ 7,300 ha of forest has been damaged which is 13% of the forest cover in 2001 and in Shangla ~ 2860 ha of forest has been damaged which is 11% of the forest cover in 2001.

2.53. This degradation has been attributed to institutional failure and lack of law enforcement leading to exploitation of forests by local communities and timber smugglers.

2.54. Mr. Ali Hassan Habib further submitted that most areas in the flood plains or sailaba areas were inundated by floodwater. Historically, Indus River used to flow in the *katcha* area which is about 5 to 25 kilometers wide. Now, one can see encroachments, human settlements, villages and extensive areas under agriculture in this floodplain. We feel this is not wise long-term management of floodplains. More sensible and long-term flood management allows inundation of pond areas, depressions along the floodplains during high flood.

2.55. The Director General of WWF further contended that management of our water resources is widely viewed as unsustainable, inefficient and inequitable. Weather extremes and climate change underscore the need for us to reform our water management practices. He suggested reliance only on building of more reservoirs, such as upper-catchments, small dams, on-farm storage, micro-hydels, localized self help dams, etc. This may also include reconnecting certain natural depressions and pond areas within the broader floodplains of our rivers. A more efficient land use management regime is needed for floodplain management including collaboration of local communities and warning systems supported by smart infrastructure.

2.56. Zoning of areas with respect to vulnerability to floods will need to be done. In cities, flood channels and storm water drainage systems should be separated from sewage systems to eliminate solid waste clogging these channels. Overlapping responsibilities of PMD, FFC, IRSA, PIDA, NDMA and District Governments needs to be eliminated. It is high time that Integrated River Basin Management (IRBM) be applied in letter and spirit. Projected areas like forests, national parks, mangroves, natural depressions, marine ecosystem can play very important role as buffer zones and biological corridors which can act as disaster risk reduction measures. Hence, the role of projected area system be included in the comprehensive flood management plan. National Water Policy needs approval which also supports flood management initiatives in the country.

2.57. *[SIND] BUND MANUAL*[34] also provides for flood management, which is instructive. Key extracts are as under:

2.58. *PROPOSALS FOR WETTING BUNDS (PARA 28) :* Adequate arrangements for soaking are an essential pre-requisite of a safe bund, for the consolidation or compaction of a bund depends on the soaking, which helps settlement and discloses faults which can be repaired or leaks which can be filled before the main rise of the river. Therefore, every proposal for a new bund or a loop bund is incomplete without the attendant proposals for sufficient arrangements for early wetting and consolidation of a bund, unless the bund is likely to get automatically soaked with the early levels obtained in the river on account of low-lying and near the bund on the river side.

2.59. In case of existing bunds, wherever arrangements do not already exist, proposals should immediately be made for their efficient wetting wherever necessary. The two principal ways of wetting bunds in Sind are:

[34] Mark-38 Government of Sind, Public Works Department, Central Designs Division, Mechanical & Research Circle, Karachi Printed at the Sind Government Press 1954. Introduction: Following the breach in the Sukkur Begari Bund and the consequent floods of 1942, there was constituted by the Sind Government a Court of Inquiry into matters connected with the floods, under the Public Inquiries Act, 1940. There was, also, a Technical Inquiry into the causes of breaches in River Bunds in Sind and steps required to minimize the danger of a recurrence. The Court of Inquiry remarked that though now regarded as a complete guide in all matters pertaining to the construction and maintenance of bunds, the Bund Manual manifestly required revision. It considered that there were doubtless matters in which the Manual can be improved and that it required re-editing and keeping upto date. The recommendation to revise the Bund Manual, made both by the Court of Inquiry and the Technical Inquiry, was accepted by the Indus River Commission at their meeting on 26th October, 1943. They suggested that an officer on Special Duty may be appointed to revise the Bund Manual. The present edition of the Bund Manual is the result of that decision.

(a) Wetting channels, and
(b) Flooding of a compartment through a bund sluice in the front bund.

2.60. While method (a), wetting channels, can be used for soaking both front and loop bunds, method (b) is available only for wetting the loop or retired bund. In other words, while the loop bunds can be wetted by either method, the only arrangement possible for wetting front bunds is by means of wetting the channel.

2.61. Wetting channels are of two kinds:-

2.61.1. Gravity channels excavated from the river lip (which is generally higher than the other ground) to the bund along the lowest contours, to lead flow water early against the bund, in advance of the sudden over-topping of the higher ground near the river edge causing a rush of flow against the bund.

2.61.2. High level artificial wetting channels, made by adding a trench bund to a main bund (see Chapter IX para.99). In rare cases, it may be possible to get flow water in these channels with the river levels obtaining at the beginning of the season; but generally, water is lifted into the wetting channels by means of pumps. A centrifugal pump worked by a suitable engine is placed on some canal, or special channel from the river and water pumped thence into the wetting channel.

2.62. The Indus River Commission have, therefore, enjoined that:-
" In all cases of front bunds the river water should be brought to the bunds sufficiently early through leading channels. Where, in case of important bunds this is not possible wetting trench bunds should be provided."[34-A]

2.63. *PRESENCE OF MAINTENANCE ESTABLISHMENT REQUIRED ON BUNDS (PARA 103):* The principal maintenance of bunds comes during high water when the safety of the bund is threatened. Frequent inspections, particularly in case of new bunds or dangerous sections of old bunds, and constant attendance on the bunds, within their charge, by everybody from the humblest beldar to the Executive Engineer are essential.

2.64. Patrolling by beldars commences as soon as water comes against a bund. From that time onwards, until water has finally left the bund, all the establishment engaged on the maintenance of bunds, from the beldar upto the Sub-Divisional Officer, must be present on the bunds within their jurisdiction.[34-B]

2.65. UNREMITTING PATROLLING DURING HIGH ABKALANI ESSENTIAL (PARA 105) : The first line of defense, when the river is in floods, requires close and constant patrol and

[34-A] Bund Manual, Government of Sind, Public Works Department, Central Designs Division, Mechanical & Research Circle, Karachi Printed at the Sind Government Press, 1954
[34-B] Bund Manual, Government of Sind, Public Works Department, Central Designs Division, Mechanical & Research Circle, Karachi Printed at the Sind Government Press, 1954

unremitting supervision, both by day and night, by adequate, trained staff. A stitch in time saves nine : timely warning and timely action, which efficient, unremitting patrolling alone can provide, will save a dangerous situation while complacency born of a false sense of security following a series of low rivers, may lead to disaster. Continuous vigilance in patrolling everywhere is, therefore, enjoined on all the staff, particularly during the night and in the early hours of morning when breaches most frequently occur with the slackening of supervision.

2.66. The temporary headquarters of the Overseer, Sub-Divisional Officer and Executive Engineer should, as far as possible, be in the centre of the active bund line in their charge. Katcha landhis should be constructed for the overseer in the center of his section, if no pucca landhi exists. The Executive Engineer and the Sub-Divisional Officer should, whenever necessary and as far as possible, patrol frequently at night[34-C].

2.67. *WETTING OF FRONT BUNDS AND LOOP BUNDS WITH WETTING CHANNELS (PARA 110):* The wetting of the bund is an essential process in the maintenance and in the safety of a bund, particularly in the excessively dry climate of Sind. However carefully the bund may have been constructed, with thorough clod-breaking, ramming, and rolling, perfect compaction, so that there will be not cavities or no settlement, however small, cannot be expected, unless the soil is also ideal for bund construction, since the clayey soils ordinarily met with in Sind are liable to expand and slide when wet and to shrink and crack when dry. The kalarish soils are even more treacherous, leading to hollows in the bund as the salts in the soil dissolve. The conditions to which bunds in Sind are exposed, alternating between excessive and sudden soaking by the river in the flood months and complete dryness during the rest of the year, make the gradual wetting of the bund in advance of the river floods impinging upon a dry and unprepared bund a vital necessity.

2.68. The purpose of wetting a bund is to consolidate the bund and render it watertight by enabling leaks to be closed, as the contact of water with the bund during the progress of wetting reveals them, so that they may not develop into breaches.

2.69. The relative merits of different methods of wetting of bunds have been set out, while dealing with proposals for wetting of bunds (para.29 Chapter IV). During maintenance, whatever artifice is available at hand has to be made use of to the fullest advantage.

2.70. A bund has to be wetted throughout its entire length if the wetting is to serve its designed purpose, *since a bund is only as strong as its weakest portion.* The plan for wetting should be carefully thought out so that the wetting of the whole length of bund is completed before the rise of the river.

2.71. First of all, water is to be led to the front bund. If the katcha and pucca foreshore on

[34-C] Bund Manual, Government of Sind, Public Works Department, Central Designs Division, Mechanical & Research Circle, Karachi Printed at the Sind Government Press, 1954

the river side of the bund slopes towards the bund, all that may be necessary is to give cuts to the lip at the river edge, which is generally somewhat higher. If there is low-lying land near the bund on the river side but there is high land between the river and the bund, low level gravity channels have to be constructed along the lowest contours from the high river edge to the bund. If wetting by flow water is not possible, sufficiently in advance of the rise of the river, artificial wetting is possible by lifting water into previously constructed wetting channels (see Chapter IV para.28) by means of pumps; a certrifugal pump worked by a suitable oil engine is placed on some canal or special channel from the river and water pumped into the wetting channel. About 1 cusec per mile of wetting channel is required and more while the bund is new.

2.72. Wetting engines should begin to operate about the beginning of May or in sufficient time to enable the water to get to the end of the reach concerned before the water touches the bund and not later than the end of May. As, however, the canals are not generally opened till the beginning of May, in the case of water being taken from a canal, a pipe of sufficient capacity in the bunds, at the heads of the canals, will be required and/or a trench about 3 or 4 feet wide in the center of the canal, with bed level corresponding to suitable river level.

2.73. At any rate, pumping should be commenced as soon as water can be obtained from canals or through connecting channels from the river so that the bund may be soaked gradually and the establishment may have sufficient time to consolidate the surface of the slopes of the main and trenching bunds by sprinkling or splashing water over them and also to close any leaks which may develop. As there may be a considerable depth of water in the trench and as it is constructed in made-earth, leaks from the slopes or from the bed are likely to occur. Unless there is some arrangement to arrest it, the whole of the water contained in the trench may then be washed down through the leak and cause much damage. The wetting channel should therefore be provided with temporary bundas at short intervals, say every two furlongs or less, so that if a big leak occurs and the establishment is unable to detect or close it at once while the pumping engine is working, the water in the channel can be held up at the bunda next above the site of the leak. After water is held up at the bunda, the leak can be properly opened and repaired.

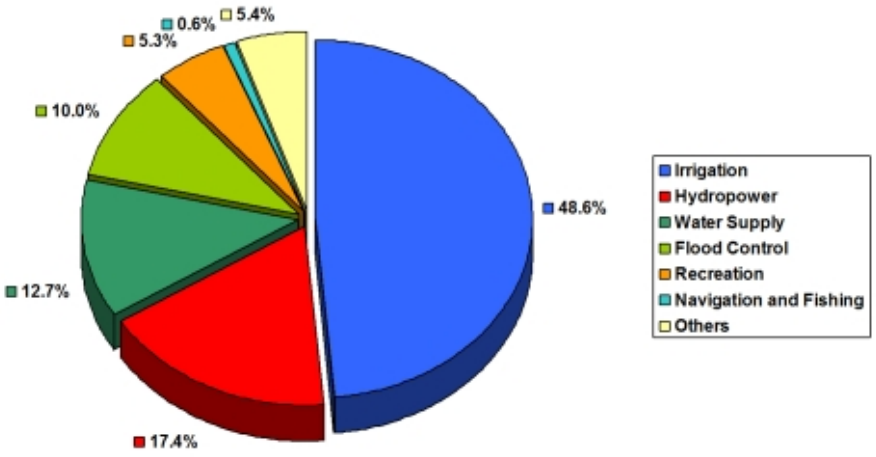
2.74. The pumps should work throughout the period of rising river. The ideal condition would be that the water level in the trench should always be about 1 foot higher than river water level against the bund while the river is rising and the bund must be wetted artificially at least 6 inches higher than the D.H.F.L. to meet any possible rise in the D.H.F.L. Gauges are provided in the wetting channel opposite every gauge in the front line, their zeroes at 4½ feet below D.H.F.L. (vide para. 48)[34-D]

[34-D] Bund Manual, Government of Sind, Public Works Department, Central Designs Division, Mechanical & Research Circle, Karachi Printed at the Sind Government Press, 1954

2.75. *ROLE OF DAMS- Flood Protection Benefits of Dams*[35] As water is not evenly distributed in spatial and temporal scale all round the world, reservoirs created by dams are necessary to even it out. The reservoirs so created are helpful in providing the water when it is in short supply and in avoiding the water it is available in excess. A majority of the dams built in the world are multipurpose in nature (as below), but irrigation is the largest user of the waters withdrawn.

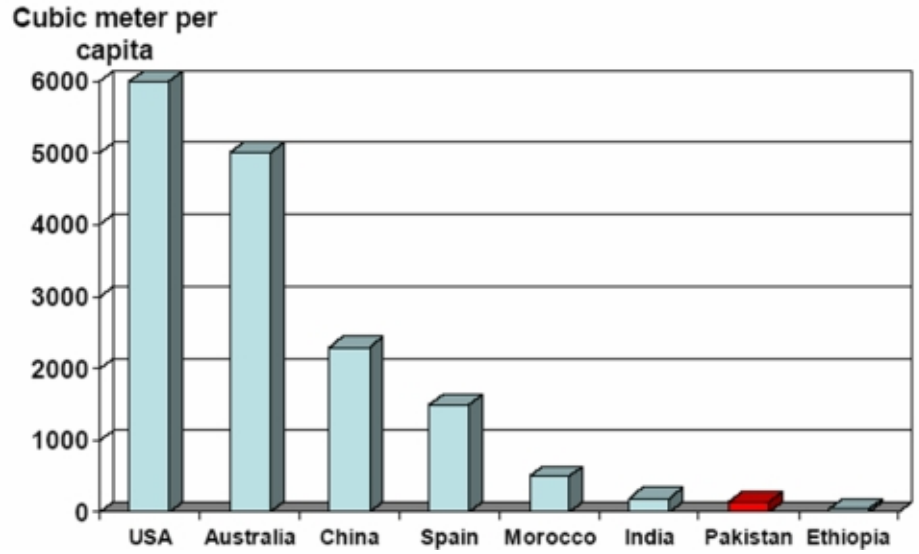
a. Irrigation for agriculture (food supply)
b. Flood control
c. Hydropower
d. Inland navigation
e. Recreation

2.76. Primary benefit of dams/reservoirs in the world is supply of water. Other major benefits are: Out of more than 45,000 large dams around the world, 10% are constructed with the major objective of flood control, as shown in figure below.



2.77. Dam reduces the total quantum of flow and size and frequency of peak floods in the flood season, reducing flood hazard due to inundation of land, crop and property which might result into economic upheavals. Dams, reservoirs, flood levees, embankments, and river training works constitute structural measures for better flood management. Intensive economic developments have been realized, for instance in the areas of Damodar, Mississippi, Missouri, Nile, and Tennessee rivers, only because of flood protection by the dams.

[35] WCD (2000), WCD Case Study: Tarbela Dam and related aspects of the Indus River Basin Pakistan, Islamabad, Pakistan. website: http://www.dams.org E-mail: info@dams.org, ICOLD (1998), Register of Large Dam by International Commission on Large Dams, WAPDA (2007), Presentation by the Chairman WAPDA, April 2007. ICID (2000), Role of Dams for Irrigation, Drainage and Flood Control, ICID Position Paper. S K Sinha and Rishi Srivastava (2010), Role of Large Dams in Flood Moderation Case Studies. Patrick Hawker and Halcrow, UK, A Review of the Role of ams and Flood Managemen



2.78. Developed countries has constructed major dams to harness their water availability, as shown in figure below, while Pakistan has fallen short of constructing dams as shown in figure below. There are about 150 (technically) large dams in Pakistan, while the USA has more than 6,000 large dams. In India, Damodar Valley Reservoirs achieve flood moderation of about 75% in case of high floods, Bhakra Dam, even though not specifically designed for flood moderation, achieves a moderation of about 70% in case of very high floods and Pong Dam achieves about 90% flood moderation.

2.79. Countries which each have more than 10 registered dams with an exclusive or partial flood control function are listed in Table 1 and account for some 95% of the approximate 4400 total registered in these categories. In terms of global distribution: Some 2100 (nearly half) of the registered dams with a flood control function are in the USA; China, Japan and Korea between them have nearly 1100 such dams; Europe is also well represented, with 535 such dams spread among 12 countries; Australia is poorly represented and there are no countries in the Indian sub-continent or in sub-Saharan Africa with more than 10 registered flood control dams of the USA flood control function registered dams, nearly half are exclusively for that purpose; elsewhere, some 25% of registered flood control dams are exclusively for that purpose;

2.80. Summary of Countries with more than 10 Dams Whose Purpose Includes Flood Control (Source: ICOLD World Register of Dams, 1998)

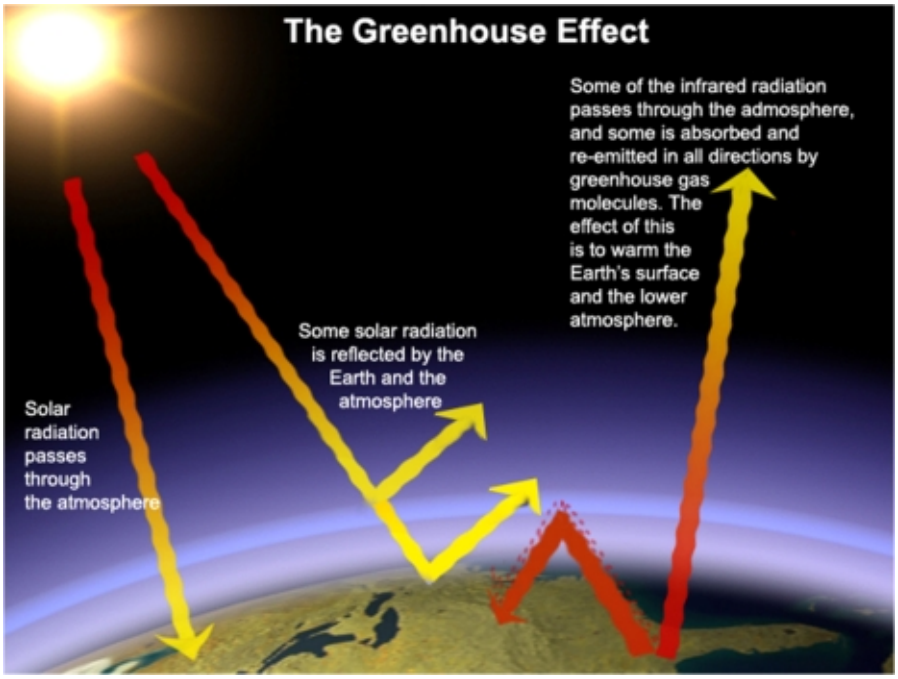
Region	Country	Single Purpose Flood Control Dams (No)	Multi-Purpose Dams incl Flood Control.
America N	Canada	21	53
	USA	988	1099
America Central	Mexico	20	61
America S	Argentina	5	35
	Brazil	168	44
	Venezuela	0	25
Africa North	Libya	2	8
	Morocco	5	9
Africa Sub-Sahara			
Asia-Middle East	Saudi Arabia	13	0
	Turkey	2	65
Asia-Central			
Asia-Indian SC			
Asia-Far East	China	25	488
Australasia	Australia	9	13
Europe	Austria	1	22
	Bulgaria	3	8
	Croatia	4	15
	Czech Republic	7	48
	France	11	32
	Germany	57	117
	Italy	3	10
	Poland	0	36
	Romania	24	75
	Slovakia	0	25
	Spain	17	9

2.81. Although flood protection was not the major purpose of the Tarbela Dam constructed in 1976. In addition to recovering its costs of construction through provision of cheap electricity and water for irrigation, it has also helped in attenuation of high flood peaks during the filling period of June through August.

2.82. *Chinese Experience*[36]*:* The most significant function of the dam is to control flooding, which is a major problem for the seasonal river of the Yangtze. Millions of people live downstream of the dam, with many large, important cities like Wuhan, Nanjing, and Shanghai situated adjacent to the river. Plenty of farm land and China's most important industrial area are built beside the river. The reservoir's flood storage capacity is 22 cubic kilometres (18,000,000 acre ft). This capacity will reduce the frequency of major downstream flooding from once every ten years to once every 100 years. The dam is expected to minimize the effect of even a "super" flood.

3. FACTORING CLIMATE CHANGE IN FLOOD MANAGEMENT ARCHITECTURE

3.1. Climate Change is “the greatest challenge facing the world at the beginning of the century” World Economic Forum Davos, Switzerland 2000[37].



3.2. *Temperature Trends over Pakistan*[38]

3.3. The decadal changes in the mean annual temperature over Pakistan during the

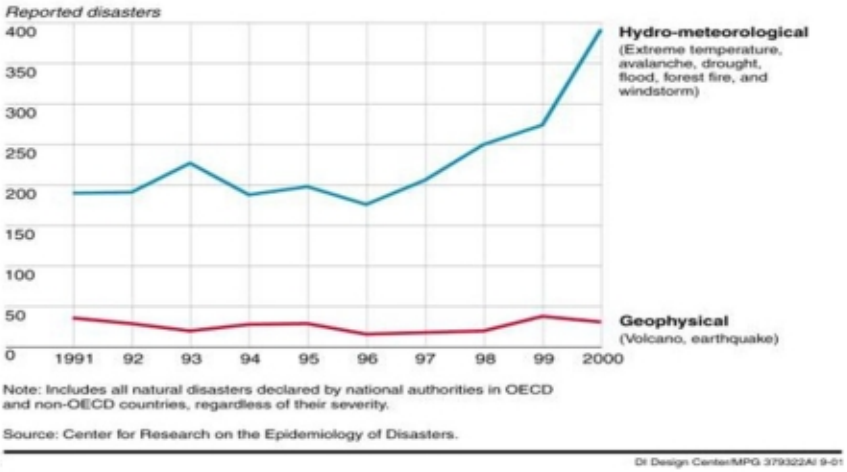
[36] Wikipedia
[37] Ex I.W.134/1
[38] Ex I.W. 135/1

periods are shown as under:

1901-2000	0.06 °C per decade (GCISC)
1960-2007	0.24 °C per decade (PMD)
1981-2000	0.27 °C per decade (GCISC)
1991-2000	0.76 °C per decade (GCISC)

3.4. Temperature changes during the previous century (1901-2000) over Pakistan using the CRU data has shown an increase of 0.6 degree centigrade and +25% in precipitation

3.5. The past global trends of hydro-meteorological disasters clearly point to the likelihood of increased frequency and intensity of floods with increase in average temperature.



3.6. Some Recent Precipitation related Extremes in Pakistan

2010	Heavy rains during July, 2010 leading towards a major flood in most parts of Pakistan bringing in its wake huge devastation to life and property
2010	A Cyclone named Phet of Cat-4, the second strongest storm ever to develop in the Arabian Sea after Gonu, had a landfall along Makran Coast west of Karachi during June, 2010 and brought serious damages in its wake
2009	Karachi received 205 mm of rain on July 18 & 19. Heaviest prior rainfall event recorded at Karachi was 207 mm on July 1, 1977. The normal rainfall at Karachi for the periods 1961-1990 is 85.5 mm
2007	Record heat wave gripped Pakistan during June, 2007. 48°C temperature was recorded on June 9 at Lahore, a record repeated after 78 years. Earlier it was recorded on June 8, 1929

2007	Two super cyclones namely Gonu (02A) of Cat-5 and Yemyin (03B) of Cat-1 developed in the Arabian Sea during June 2007 and hit Makran Coast and adjoining countries. The history of the Arabian Sea at least during the previous century shows no such events occurring twice in a month
2001	620 mm rainfall in Islamabad during 10 hours in the month of July (on 23rd of July); it caused flooding in Lai nullah
1998-2001	History's worst drought gripped southern parts of Pakistan and parts of surrounding countries
1996	438 mm rain in Lahore in 72 hours in August 1996 the wettest month on record
1992	Previous century's worst flood in Jhelum river

Source: Global Change Impact Studies Centre, Islamabad

3.7. Flows at Tarbela during July 2010 show that despite the mega flood due to the heavy rains during 27-30 July, 2010, the average flows during the month remained close to 216,000 Cusecs which is less than the normal value of around 247 000 cusecs during July. Base flows or the contribution due to glacier melting is seen decreasing, consequently the glacier melting did not contribute to the floods as reported in some press media[39].

3.8. *El Nino and La Nina, effects on the rainfall pattern:* Studies done at GCISC reveal that rains are mostly deficient during the El Nino years. Monsoonal systems developing over the Bay of Bengal either dissipate around Bangladesh or over India and do not reach Pakistan in most of the cases.

3.9. La Nina events are mostly seen as the reverse to El Nino episodes causing heavy rains in the country. NASA studies attribute the occurrence of the July 2010 mega flood to tropical monsoon moisture coupled with a strengthened La Nina that dominate this region's weather patterns.

3.10. Additionally, "a massive heat wave in Russia during July, 2010 and the devastating flood in the same month in Pakistan can be linked by the unusual behaviour of the Jet stream, some scientists now believe. The jet stream is the high altitude wind that circles the globe from west to east. It is held by the Rossby waves that normally produce its distinctive wave-like pattern. A blocking event (still an enigma to be solved) during July brought the jet stream to a halt and made weather patterns stationary and trapped the weather systems that were caught between the meanders of the jet stream. The dry air brought from east Africa right up to Russia also observed the halt and caused heat wave to continue. Monsoonal rains in July prevailed in the country[40]."

3.11. Major CLIMATE CHANGE related concerns[41] for Pakistan are:

[39] GCISC Ex I.W. 135/1
[40] GCISC Ex IW-135/1
[41] GCISC

- Increased variability of Monsoon;
- More rapid recession of HKH Glaciers threatening IRS Flows;
- Increased risks of floods and droughts;
- Severe water- and heat- stressed conditions in arid and semi-arid regions leading to reduced agricultural productivity;
- Health Risks, Increase in Deforestation; Risk to Coastal Areas; Loss of Biodiversity

3.12. According to Dr Arshad Muhammed Khan, Executive Director, GCISC[42] "there is no joint research activity or interaction between R & D Division of PMD and the Centre regarding monsoon or monsoon prediction. One of the tasks of the Centre is dissemination of information and knowledge regarding climate change, however, so far our focus has been on policy makers and we have not integrated with the various provincial departments especially the I & P department which could have benefited from our knowledge on climate change."

3.13. Adil Najam[43], Director and the Frederick S. Pardee Professor of Global Public Policy, Boston University[44], USA deposed before the Tribunal:

> "While it is very difficult to make a direct co-relation between climate change and a particular flood our knowledge about climate change science including in the South Asian Region, particularly based on recent IPCC studies is making it increasingly clear that climate variability in this region is going to be (a) high (b) is likely to increase the incidence of extreme climate events particularly those dealing with water in the South Asian Region. While our ability to predict particular events at particular places or particular times remained highly uncertain, our general understanding of global climate model is making it clear that more such events are likely to happen with greater frequency as we move to the future.
>
> It is not particularly useful to figure out how much of a particular event is because of human induced human change and how much of it is because of historic weather patterns. What is important is that climate change is likely to increase the likelihood of climatic disaster; therefore, the need to prepare for the likelihood of greater number of events as well as events of greater severity is becoming increasingly clear from climate science.
>
> Within South Asia and particular within Pakistan the existing literature suggests that extreme events are more likely to be water related including the possibility of greater

[42] I.W. 134
[43] I.W. 150
[44] The Frederick S. Pardee Center for the Study of the Longer-Range Future 67-Bay State Road Boston, Massachusetts -02215

floods not only because of changing weather patterns but also because of the changing hydrology of the water system specially as it is driven by the glacial melting in the Himalayan region.

While the floods of 2010 were not related to glacial melting, the possibility of future change in the water system of the Indus because of glacier changes should also be kept in mind for designing future water management and flood management strategy.

Although the current focus is on floods because of the tragedy of 2010, focusing on the Indus Water System as a whole is important because future water related disasters by climate change could include not only floods but also sever droughts. Therefore it is important to focus on water system as a whole and the water management systems that can be more feasible both in case of water and extreme drought conditions.

It is important to understand that the key issue based by climate change lies in the increasing variability of climate patterns. These patterns are already very difficult to project or predict even in the best cases and the scientific consensus that it is going to become increasingly difficult to project and predict because of the new levels of variability added by climate change.

For this reason to strengthen our currently weak Meteorological capabilities and adding new capabilities to include climate change science becomes a major priority in the future and will require close collaboration between different centers of a relevant knowledge going beyond the currently narrow focus on immediate weather patterns that is already insufficient and will become increasingly more challenging.

While it is important for the future to improve the quantity of data generated, it is probably more important to strengthen the institutional abilities to analyze the data in time and over time. The current structures of data calculation and dissemination related to extreme climatic events such as floods are disbursed in multiple institutions which have not had a history of effective coordination or communication amongst them. Improving the analytical capacity and the ability for cross institutional connections is a key challenge in this regard. Within this challenge the role of the Irrigation Department is particularly important not only as a recipient of Meteorological Department from the PMD but also as a partner in the analysis of real time use of that data.

Bench marking with best international practice within our region and internationally would be an important first step particularly in two areas: (a) Meteorological data calculation and analysis; and (b) Water System Management with a special focus on flood management."

4. POLICY RECOMMENDATIONS

4.1. *INTEGRATED FLOOD MANAGEMENT PLAN*[45]

4.2. *Suggestions and recommendations made above* may be considered as an integral part of these Policy Recommendations.

4.3. *The new paradigm:* Floods are part of a natural cycle that can never be fully controlled. "Flood control" is therefore a futile terminology and a counter productive mandate. The future is to think of "Flood Mitigation" or "Flood Risk Management" or "Flood Resilience." Our flood managers should consider this new paradigm as a starting point in developing an integrated flood management plan.

4.4. *Broader set of objectives:* While flood manager in the past have focused on structural and non-structural measures to protect and mitigate flood, a broader set of objectives need to put on the table. While structural safety of the barrages and training works is critical, human safety, protection of human shelters, safeguards for agriculture and fisheries, roads, ecosystems, health, and biodiversity need equal attention.

4.5. *Non-structural measures* Ecologically friendly non-structural measures for flood mitigation measures like afforestation of the watershed and the riverine belt, developing and effectively using lakes, depression and retention pools along the river.

4.6. *Flood Forecasting:* Better flood forecasting is required. Hydro-meteorological forecast needs to assess floods on the basis of precipitation- in the air. Radars and other equipment which was missing this year needs to be immediately procured so that the upper catchment area of River Indus is fully covered.

4.7. *Early warnings* by PMD need to be relayed on TV , radio and website. Early warnings must also be in vernacular so that it is understandable and effective.

4.8. *Land use and Flood Plain Management:* Flood plains are the hardest hit during the floods. Still there is no land use or flood plain management regulation. As population increases, human settlements and agriculture in flood plain will increase and so will loss to human life and property. The regulations for proper land use and other related issues in flood plains should be made on priority basis with the consent of stakeholders. Emphasis should be laid on proper implementation of these regulations in letter and spirit.

4.9. *Managing Flood Protection Structures:* Structural measures such as embankments suffer from neglect and poor maintenance. More vigilant structural management is required involving participation of the local community. Proper Embankment Maintenance Manual to

[45] This chapter gives valuable foundational inputs for the policy and flood managers to successfully draw up a Flood Management Plan for the country.

be developed that carries out a regular check of the embankments round the year. Encroachments from embankments to be removed. All major embankments to be GIS mapped and monitored through remote sensing. Design criteria of the embankments to be ensured according to the latest design manual prepared by FFC.

4.10. *Developing detailed flood regulations or FLOOD MANUAL*

4.11. *Pre-flood preparedness* is the bedrock of any successful flood management plan. The wisdom in Sind Bund Manual, FFC Manual and series of loose leaf guidelines which are mostly unavailable are unknown to many officers and must be developed into a proper MANUAL and religiously followed by the zone during the flood season EVERY YEAR WITHOUT FAIL.

4.12. *Asset management,* environmental protection and health care must be built into the pre flood preparedness manual.

4.13. *The Flood Fighting Plan* must be enforced strictly, with strict penal consequences for non-observance.

4.14. Flood Fighting Plan must be an *integrated plan* worked out with key related departments e.g., Health, C & W, Food, Agriculture, Environment, Wildlife, Civil Administration, Army, Civil Defence, Home Department, 1122, etc.

4.15. *Localized Ownership:* Nazims, DCOs and respectable residents of the Districts to be made a part of the Integrated Flood Management Plan to broaden its ownership and effective implementation.

4.16. Other than the *Breaching Section* on the right side, shadow breaching sections and emergency relief cuts must be chalked out in the plan and clearly visible in the Flood Emergency Map which should be a part of the Flood Fighting Plan. Locals of the area must be included in the preparatory discussions so that their ownership is present at all times.

7.17. This year it was noticed that the morphology of the river changed and the flow of the water was on the left side rather than on the right side. This necessitates to rethink the breaching sections located on the right side only. Should there be breaching sections on both the sides ? (e.g., Taunsa Barrage this year used the left side)

4.18. *FACTORING IN CLIMATE CHANGE*

4.19. The most recent IPCC report states that climate change will be inevitable as present mitigation efforts will not be enough. Therefore, adaptation to climate change is required. As climate change will likely increase the variability of weather, Flood Management Plan should be adaptive to future floods rather than strictly preventive.

Immediate future action

4.20. It is expected that the Provincial Government will immediately set out to develop an Integrated Flood Management Plan, so that the first phase of the Plan can be operationalized in the coming Flood Season-2011[46].

[46] Integrated Flood Management Plan requires constant upgrading and updating and should be considered to be a live document that is improved every year by incorporating the post flood lessons learnt.

CHAPTER 10

One glance at the Indus and, without seeing them, we must believe in the immensity of the …Himalaya: one glance at the Indus…it is impossible not to venerate the river.[1]

CONSOLIDATED RECOMMENDATIONS

Recommendations at the end every Chapter have been reproduced hereunder as an easy and ready reference for the flood managers and the policy makers:

1. JINNAH BARRAGE (Chapter- 3)

1.1. The breach of LGB at Jinnah Barrage can be attributed to poor flood preparedness, failure to observe the regulation, absence of reserve stone, continuance of emergent work on the loose apron downstream, closure of weir gates and abuse of para 2.89. It also brings to fore the premature operation of the breaching section, conflicting statements of the officers regarding procurement of reserve stone during the critical dates and poor capacity of human resource employed at the barrage especially the XEN. This resulted in a loss of Rs 417 million[2] to the public exchequer, which could have been avoided.

We therefore **recommend** as follows:

Penalties

1.2. The competent authority to initiate departmental disciplinary proceedings against Secretary I & P[3], under relevant service rules for inefficiency.

1.3. To initiate departmental proceedings against C.E[4], C.E (D&F)[5], S.E[6], XEN[7] & SDO[8] under PEEDA, 2006 for misconduct and inefficiency.

1.4. Till the conclusion of the departmental inquiry Mr. Rab Nawaz, Secretary I & P be

[1] G.T. Vigne, Travels in Cashmir , Ladakh, etc
[2] Ex IW-5/3 Headwise list of flood damages, Sargodha Division, Restoration works 2010. (Page 793 Appendix 9)
[3] Mr. Rab Nawaz
[4] Rao Irshad Ali Khan
[5] Rafiq Ahmed
[6] Khalid Iqbal
[7] Muhammed Afzal
[8] Nawazish Ali

immediately replaced, so that the Department does not face the next flood season (2011) under his stewardship.

1.5. In order to conduct an impartial and transparent departmental proceedings and in order to avoid further loss and damage, the above named C.E, C.E (D&F), S.E., XEN & SDO be placed under suspension and a fresh team of able and competent officers be appointed at Jinnah Barrage for the upcoming Flood Season, 2011.

11.6. To initiate criminal proceedings against the above named C.E., S.E., XEN & SDO under sections 166, 167, 283, 322, 427 and 431 of the PPC. The competent Authority on the basis of the inquiry and findings above as well as the damages recorded in chapter 7 below initiate criminal proceedings against the above named C.E., S.E., XEN & SDO under section 166, 167, 283, 322, 427, and 431 of the PPC.

1.7. NAB (National Accountability Bureau) to hold an inquiry to verify the alleged procurement of reserve stone from private quarries, stone allegedly procured for the emergent work on the downstream loose apron, the quantity of stone recouped from the RGB, reserve stone of stock maintained at the Barrage, if any and the source of reserve stone made available for flood fighting between 30th July, 2010 to 2nd August, 2010.

Reforms

1.8. *Pre Flood Preparedness* must provide for the following:

i. Proper Pre-flood Inspection of the headworks including training works. Other departmental representatives must also be included and the reports put up on the website.

ii. An inspection check list needs to be developed, showing in detail the areas to be covered in the inspection. The said check list to be filled out by the inspection team and duly submitted with the C.E. and C.E. (D &F). The entire pre flood inspection to be videographed.

iii. The pre inspection to be counter checked by the C.E and C.E. (D & F) separately and independently of each other.

iv. Total stoppage of works (U/S or D/s) on the barrage during the flood season.

v. Severe penalties attached if there are lapses on pre flood preparedness.

vi. I & P to develop a proper procedure of using Para 2.89 of the PWD code. A new emergency clause of the I & P Department can be developed and incorporated in the Flood Management Plan.

vii. The officers posted out on a barrage must carry out the pre-inspection and should remain posted till the close of the flood season so that they can take ownership of the barrage during the flood season and effectively flood fight and coordinate with other departments.

viii. There is also no effort on analyzing climate change and its effects. The I & P Department will have to develop its capacity to read the new trends in weather and climate change and be able to predict and forecast more intelligently. It is now common knowledge that due to global warming there will be extreme weather which could result in heavy and super floods and also severe droughts. This common knowledge wasn't available at the I & P Department and was never discussed during any pre flood meeting.

1.9. The *Flood Fighting Plan* must include:

i. Quantity of Reserve Stone required under para 6.39 M.I.P. at every barrage. The Flood Fighting Plan must specify the Reserve Stone required.

ii. Location must marked for stacking the said stones- and a map showing such locations shall form part of the Flood Fighting Plan.

iii. Duty roster per camp- clearly giving out names of officers.

iv. List of Flood Fighting Material carries outdated items which are not required in this time and age. This list needs a proper revision after need assessment.

v. List of Machinery (dumpers, trucks, etc) for flood fighting required to be specified according to the flood levels. The said machinery to be available through out the flood season. There is no mention of the machinery in the flood fighting plan or its procurement mechanism from the Machinery Division.

vi. Personnel of Army and Civil Administration to conduct rehearsals with the officers of the I & P Department and should remain standby through out the flood season. Civil Administration and the Army must depute a point person on the Barrage who shall assist and facilitate the C.E or the XEN to arrange manpower and any other assistance as per flood fighting plan.

vii. Flood Fighting camps and stations must be clearly demarcated on a site map.

viii. Chief Engineer to closely monitor, supervise and manage the entire flood season, especially at the Barrages.

ix. Emergent works should not generally be allowed to continue during the flood season. This requires to be clearly provided in the Flood Fighting Plan.

x. Flood Fighting Plan has to be put in motion at the start of the Flood Season with weekly reporting to Flood Emergency Cell at Lahore.

xi. The data pertaining to the management of the Barrage must be on line during the flood season so that the efforts made by the I & P Department are available to the public on the Flood Website of the I & P Department.

xii. Complete Flood Fighting drill to be carried out before the Flood Season.

xiii. Sensitive and high risk areas to be marked during the pre flood preparedness – so that flood fighting is based on a well thought out strategy.

1.10. *Breaching Section.*

i. The Breaching sections must be ready to be operated.

ii. Explosive should be housed near the barrage rather than 4 hours away in Sargodha Cantt. The explosives for the breaching section should be housed on the barrage at the start of the flood season so that there are no transportation delays. Army and Civil Administration needs to deploy a point person who shall be deputed at the barrage for immediate coordination.

iii. Critical Gauge of RL 701 at RD 5000 needs to be revisited and its accuracy verified by IRI in close consultation with the I & P Department.

iv. The Flood Fighting Plan must clearly spell out the number of breaching sections and the time lag involved in utilizing all the sections.

v. The regulation setting down procedure for invoking the breaching section must be provided in the Flood Fighting Plan. Regulations spread into loose leaf circulars and notifications has also weakened the structure of governance. Without the majority of the members of the Breaching Committee being witness to the Critical Gauge, the breaching section should not be operated.

vi. Water Course of the breaching section must be a no go area and must be kept clear at all times.

vii. The delay in activating the breaching sections is also disturbing and in this aspect of the matter the I & P Department is directed to take up the matter in detail with the Pakistan Army.

1.11. *Pakistan Meteorological Department (PMD)*

The Tribunal recommends the following to the Federal Government:

Penalties

1.12. Departmental action for inefficiency and misconduct be initiated against the Chief Meteorologist[9] FFD of PMD for inefficiency under the relevant service rules.

1.13. Departmental action against ex-D.G[10], PMD for inefficiency and misconduct under the relevant service rules for failing to procure radars for upper catchment area of River Indus, failure to raise this as an urgent issue with the Federal Government and also in the Pre Flood Meetings held with other stakeholder organizations, failure of PMD to issue weather forecast with confidence on 26th July, 2010 when an unusual stagnation of the two weatherly systems had become clear to PMD, to issue timely forecast and issue coloured coded alerts when the monsoon moved into Pakistan on 24th July, 2010 and also in failing to issue correctly worded forecasts (strictly in terms of WMO) that could have rightly communicated the severity of the weather and the urgency and importance of the forecast.

1.14. Chief Meteorologist, FFD (PMD) be placed under suspension till the final conclusion of the departmental disciplinary proceedings.

1.15. The Federal Government should carry out an audit /assessment of PMD, particularly looking at the human resource as well as the infrastructural capacity of PMD and put the house in order before the next flood season. Four areas of concern are:

i. Technological capacity- more QPM radars to cover the upper catchment of KPK and the Hill Torrents within Punjab.

ii. International bench marking of the quality of Human Resource and weather models employed at PMD.

iii. Upgrading the Research Division. PMD must lead cutting edge research in monsoons and climate change.

iv. Ensure meaningful utilization of existing resources/ model/ equipment available with PMD and fixing responsibility / penalties in case of non-functioning of existing models acquired at heavy cost.

Reforms

11.16. Monsoon Research Centre to be set up under the auspices of PMD to develop more depth and understanding of Monsoons in Pakistan.

11.17. The human resource at PMD has to be upgraded and at the same time QPM Radar at Cherat has to be fixed and made functional. New and latest radars and other equipment to be installed for the catchment areas of Indus as well as the hill torrents.

[9] Mr. Hazrat Meer
[10] Dr. Qamar uz Zaman Ch.

11.18. We feel that PMD has to seriously buckle up if the extreme weather is to be predicted in future. On the whole, we feel that the PMD has failed in its responsibilities as the only forecaster in the country. As all the institutions have to react on the information disseminated by PMD, it takes a central role. It was also disturbing to note that inspite of the Research and Development Division within PMD, no material research has come out on monsoons or the climate change. PMD requires more internal coordination and more robust and dynamic approach towards weather and flood forecasting.

11.19. We recommend that Ministry of Defence must seriously revisit the structure as well as capacities of PMD specially FFD and stream line the same.

11.20. Better-qualified, trained, experienced and paid human resource is employed so that proper forecasts are generated at the right time. The infrastructure regarding purchase of new Radars and other equipments must be immediately attended to so that MET Office is always in the best state of preparedness at all times

11.21. According to the data supplied the human resource employed at the PMD has just one person at the FFD holding M.S. Meteorology while rest of the staff has degrees in Physics and Mathematics.

11.22. PMD has to revisit its forecast terminology. The terms used by WMO must be incorporated. “Widespread rain or showers” must be replaced by “violent or exceptional rain” (where necessary) so that the sense of emergency can be properly conveyed.

FWC & I & P Department

11.23. I & P Department needs to revamp its flood warning centre (FWC). There is no coordination between the FWC and the Department.

11.24. The lag/travel time from Tarbela to Jinnah Barrage is 16 hours and from Tarbela to Chasma is 20 hours and from Tarbela to Taunsa is 36/37 hours. If the pre flood preparation is up to the mark, flood fighting plan can be set in motion in 16 hours at Jinnah and certainly in 36 hours at Taunsa. All the emergency cells ought to do is to keep a track of gauges at Tarbela and Khairabad as a second line of defence even if the PMD fails to deliver, as it partly did this year.

2. TAUNSA BARRAGE (Chapter-4)

1.1. On the basis of the inquiry and findings discussed in this chapter we **recommend** as follows:

Penalties

2.2. The Competent Authority to initiate departmental disciplinary proceedings against Secretary I & P Department[11] under relevant service laws for inefficiency.

2.3. The Competent Authority, on the basis of the inquiry and findings above, initiate process to terminate the contract of employment of Head PMO[12]. The competent authority to initiate civil proceedings for recovery of damages against Head PMO for the loss caused to the life and property of the people of District Muzzafragarh and the loss caused to the Barrage.

2.4. Competent Authority to initiate departmental disciplinary proceedings against XEN[13] under PEEDA ACT, 2006 for misconduct and inefficiency.

2.5. Competent Authority on the basis of the inquiry and findings above and the damages recorded in Chapter 7 (below) to initiate criminal proceedings under sections 166, 167, 283, 322, 427 and 431 of PPC against the above named Head PMO and XEN.

2.6. Till the conclusion of the departmental inquiry Mr. Rab Nawaz, Secretary I & P be immediately replaced, so that the Department does not face the next flood season (2011) under his stewardship.

2.7. To immediately suspend the above named XEN till the departmental action and the criminal proceedings are concluded.

2.8. That all the current assignments of Head PMO be withdrawn immediately and the role of PMO to be reconsidered by the Provincial Government. We recommend that the active management of the Barrages must remain with the C.E.'s concerned and the role of PMO should be restricted to rehabilitation work subject to the undermentioned recommendations.

2.9. Detail audit / third party validation of the Taunsa Rehabilitation Project to be conducted to assess the following in particular;

2.9.1. Whether, as planned, PMO gained experience and capacity during Taunsa Rehabilitation Project and is fully able to handle future Rehabilitation Work (at

[11] Mr. Rab Nawaz
[12] Ghulam Hussain Qadri
[13] Mr. Muhammed Munir Anjum

Jinnah and other Barrages) independently without reliance on outside consultants If not, why

2.9.2. Whether the taking over of the Rehabilitation Project from the contractors by PMO was in accordance with the contract whether the control room was taken over after due diligence and verifying the performance of the control room If the audit reveals that there have been lapses, Government of Punjab to take strict action against the delinquents.

2.9.3. To verify and assess the purpose, reasons and results of the expenditure incurred on O & M of LMB and Sanawan Bund. If it is discovered that the said funds were squandered and did not serve any useful purpose the senior management incharge of the Barrage at the time be criminally prosecuted under the law.

Reform

2.10. A detail Post Flood Report along with all the post flood surveys and maps must be prepared so that a proper flood management strategy can be evolved for the next flood season.

2.11. Flood Manual (as a subset of an Integrated Flood Management Plan) be developed including instructions from the exiting flood fighting plans, Guidelines, Manual of Irrigation Practice (M.I.P), Sind Bund Manual and other related instructions available on the record. The flood managers to be put through proper training on the Flood Manual and all the flood managers to have a copy of the Flood Manual at all times.

2.12. Proper training and pre-flood rehearsals as instructed by the new Flood Manual shall be mandatory so that the flood fighting strategy is practical and functional prior to the actual floods.

2.12.1. I & P Department to develop an online Flood Website that gives real time details of the pre-flood preparation, flood forecasts, early warnings, flood fighting preparation and the flood relief work as it takes place. This will act as a good self-regulating tool for the I & P department and will be beneficial for the people.

2.13. Bund Management to be introduced. One option is to divide the long bunds into manageable segments and the vigilance and supervision of the said segments be delegated to the local residents who have their land abutting to the said embankment. These locals, having stake in the life and health of the said bund, can be officially nominated as “Bund Watchers” under law or policy, creating obligations and corresponding incentives. Obligations to regularly watch the health of bund (in their area) and regularly report to the Department. During flood season, be part of the flood fighting team of the I & P Department. Timely inform the department of any emergency so that breaches can be avoided. In return, the Bund Watchers can be given incentives in the shape of crops, etc

alongwith necessary communication tools (cell phones) so that they can timely inform the Department during floods and also act as early warning centres. Without local participation of the key stakeholders no effective monitoring can take place as I & P Department does not have the capacity to police bunds that run in several kilometers as has become evident in the Floods under inquiry.

Pond Area & Belas

2.14. I & P Department to develop in association with Wildlife & Fisheries Department, detailed POND AREA & BELAs Regulations for its management and supervision. POND AREA & BELAs to be properly mapped (through GIS) and additionally monitored through remote satellite sensing with the assistance of SUPARCO, WWF or the Urban Unit (P & D Department).

2.15. Revenue Record of the area to clearly identify and show the said areas to be POND AREA in use by the Wildlife and Fisheries Department. The Pond Area should be handed over to the Wildlife & Fisheries Department, who with the help of WWF and other reputable NGOs[14] should develop the Pond Area into a wildlife sanctuary.

2.16. Encroachments in the Pond Area should not be allowed at any cost and must be immediately cleared. These environmental pockets (Pond Area) must be protected and encouraged to support the growth of biodiversity and wildlife in the country. Pond Area can showcase a rich and wide range of wildlife, which needs to be encouraged. Technically, POND AREAS must remain free from human settlements and must be well regulated so that their service to the Barrage for maintaining the required pond level is never impaired.

2.17. I & P Department and the Wildlife and Fisheries Department will also allow public access to the Pond Areas (subject to regulation). This will encourage students and researchers from Universities and NGOs to carry out research of this rich biodiversity and multiple ecosystems.

2.18. Belas may be used as Eco-public parks (during limited hours and months) so that public can enjoy healthy entertainment and also get to know and learn from their rivers. Pond Areas and Belas to be incorporated in the Integrated Flood Management Plan.

2.19. The zamindara bunds or private bunds in the pond area to be immediately demolished so that there is no resistance to river water flowing into the pond area.

2.20. Provincial Government and in particular I & P Department shall vigilantly attend to W.P. 4919/2009 pending at the Multan Bench, of the Hon'ble Lahore High Court, so that the petition is decided in accordance with law before the start of the next flood season i.e., 15th June, 2010. The urgency in the matter shall be placed before the Hon'ble Lahore High Court,

[14] working in the related field.

Multan Bench by the I & P Department through an appropriate application by making reference this recommendation of the Report.

PMO

2.21. PMO barrages should not be allowed to manage and operate barrages which should remain within the exclusive domain of the C.E. of the respective zones.

2.22. We also recommend a detail audit (as mentioned above) of the expertise and knowledge gained by PMO during its experience at Taunsa Barrage. It needs to be ascertained with certainty if the PMO has gained any such valuable expertise and will the PMO be able to handle rehabilitation of Jinnah Barrage and other barrages without placing substantial reliance on outside consultants. This audit is essential to frame the future course of action for rehabilitation of barrages.

Political Intervention

2.23. No evidence has come to fore to establish that LMB was breached due to political pressure or intervention in order to save the proposed breaching sections at Taunsa Barrage. The lands of Khosas were identified after detailed scrutiny of the revenue records and their location was plotted on the GIS map of the area - the said lands are far away for the Right Marginal Bund and in no way fall within the water way if at all the identified breaching sections on the right side of Taunsa Barrage were to be operated. The allegation that breach at LMB was induced due to political influence in order to protect the Lands of Khosas is not established by the record before us.

2.24. It is also not established that the XEN appointed at Taunsa Barrage or the transfer of the earlier XEN was under any political pressure.

2.25. Influential's of the area (also having political background) have however, encroached upon the Pond Area of Taunsa Barrage and have to be immediately removed from the Pond Area as recommended above before the start of the next flood season.

3. JAMPUR FLOOD BUND AND FAKHAR FLOOD BUND (Chapter-5)

Penal

3.1. The encroachments on the embankments and the repairs identified by the Report of the Departmental Pre-Flood Inspection Committee were never plugged or attended to. It was the responsibility of the Secretary I & P[15], C.E[16], C.E.(D & F)[17] and XEN[18] to have ensured the compliance of the Pre Flood Inspection Report. None of the officers bothered to do so. We, therefore recommend initiation of disciplinary departmental proceedings against the abovementioned officers for inefficiency under the relevant service laws.

3.2. The XEN[19], SDO[20] and S.ENGs[21] did not implement the Flood Fighting Plan. There were no watching huts, no machinery deployed and there was no evidence that flood fighting material was brought to the bund to fight the flood on 2-8-2010. We therefore recommend the competent authority to initiate disciplinary departmental action against the above officers for misconduct and inefficiency under PEEDA Act, 2006 on the basis of the inquiry and findings of this Report.

Reform

3.3. The entire concept of flood fighting relating to embankments has to be revisited. The existing "cut and paste" flood fighting plan from yesteryears will not do.

3.4. A detailed exercise has to be undertaken to develop innovative ways of flood fighting on long embankments. The option discussed in the recommendations under Taunsa Barrage (Chapter-4) may be read as an integral part of these recommendations.

3.5. The embankments ought to be GIS mapped and constantly monitored with the help of SUPARCO in addition to the on spot physical supervision of the locals.

3.6. The embankments must provide for wetting channels alongwith the necessary infrastructure to keep the said channels functional.

3.7. The embankments must be brought in conformity within the design criteria laid down by FFC.

3.8. Flood Fighting Material and machinery must be shifted to vulnerable points at the start of the flood season so that it can be speedily operationalized in the hour of need. Huts

[15] Rab Nawaz
[16] Mehr Muhammed Amin
[17] Rafique Ahmed
[18] Abid Rashid
[19] Abid Rashid
[20] Sh Saifullah.
[21] Tufail Rizvi, Muhammed Bilal Ali, Ejaz Hameed, Muhamemd Ali, Asif Mehmood Fida and Muhammed Rafique Gabol

or sheds for housing the said materials and machinery on the strategic spots along the embankments must be clearly mapped and set up in every flood season.

3.9. Flood fighting rehearsals must be undertaken every year at the start of the flood season.

3.10. Appropriate number officers corresponding with the length of the embankment must be posted on each bund.

4. LMB OF GUDDU BARRAGE (Chapter 6)

4.1. I & P Department shall immediately[22] take up the issue of removal of *Zamindara* Bund, the illegal pipes and other ancillary matters with I & P Department, Sind so that the LMB is properly repaired, *Zamindara* bund and other impediments should be removed before the start of the flood season 2011. This is essential for the security for the people of Rahim Yar Khan and for the safety of their assets.

4.2. I & P Department to keep an active liaison with the I & P Department, Sind as well as with the administration/management of Guddu Barrage so that a joint flood fighting strategy can be developed for the LMB extending into Punjab.

4.3. A mechanism[23] between the two Irrigation Departments to be evolved for the future so that issues get expeditiously resolved.

[22] before the start of this flood season
[23] by constituting an Inter provincial committee or panel of Irrigation officers and experts.

5. SYSTEMIC CAUSES OF BREACH (Chapter 8)

5.1. *Absence of Flood Plain Management.*

5.2. Government should urgently develop Flood Plain Management Plan as a part of the larger integrated Flood Management Plan.

5.3. Flood Plains must be clearly zoned and demarcated. Inhabitants and built up structures within the flood plains be subjected to special regulation which ensures extra protection for their life and property.

5.4. Construction in the said area to be regulated and special building codes to be developed. Architecture and design within flood plains need to adapt to frequent flooding. One option can be of raised structures, preferably stilted (or built on stilts) to withstand the heavy flood discharge.

5.5. Towered Emergency centers or shelters can also be of huge benefit to the resident population that is invariably displaced and finds shelter on the dry tops of the embankments or high roads. One suggestion can be that the architecture of the government schools and basic health units in the area can be such that they are used as emergency shelters and also act as early flood warnings centers. Local schools and hospitals carry more credibility amongst the local population than the seldom seen irrigation officers and might take early warnings more seriously than they do now[24]. One of the reasons being poor trust and confidence in the flood managers.

5.6. Provincial Government through legislation or executive order must provide for the following :

- Demarcation of the flood plains duly GIS mapped.
- No future construction to be allowed in the flood plain
- Flood Plains be allowed for agriculture with proper advice on the kinds of crops to be sown.
- Provide regulations to control/manage deforestation and use for livestock grazing.
- Flood Insurance to be encouraged in the flood plains for agriculture.
- Converting existing structures into flood resistant structures. Stilted or raised architecture to be used.
- Government schools or government hospitals within the flood plains to be made flood resistant by raising their structures and using them as shelters and early warning centres during floods.
- Local participation to be encouraged in decision making and reform process.

[24] During our inquiry we discovered on location that flood warnings issued by the I & P Department did not move the people.

5.7. *Hill Torrents Management*

Immediate Action

5.8. It is recommended that the Government sets up Hill Torrent Management Policy, as soon as possible and preferably before the start of the Flood season 2011. This will not only act as flood mitigation measure but will also bring agriculture and prosperity to the "barani" area in the foothills of the Suleman Range.

5.9. A detail audit be conducted before the next flood season to assess the allocation and utilization of funds and verify the results achieved through various heavily funded hill torrent projects done till date. The audit must give elaborate reasons why these projects failed. The audit report must be put up before the Chief Minister of the Province so that firm action be taken against the delinquents and road to flood and hill torrents management in this country be paved in stone, once and for all.

Reform

5.10. Large quantity of fresh water resource that comes down as hill torrent is not being tapped and harnessed. In the modern water scarce world this passes for criminal neglect. There can be no other national or provincial priority more urgent and pressing than finding ways and means of conserving fresh water resources of our country. The sustainability of our future generations depends on the water management and planning we do today.

5.11. Any future Flood Management Plan will be incomplete without Hill Torrent Management. Detailed planning and mechanism is provided in FFC's Manual. Government needs to start implementation.

Additional Recommendation (even though outside our TORs)

During our inquiry we visited[25] the hill resort of Fort Munro[26]. The climate, beauty and serenity of the resort left an impression on us. We were informed that several such peaks exist in the Suleman Range which can be developed into wonderful hill resorts of the likes of Murree. Any development in this direction can provide a huge economic uplift to the less prosperous districts of Punjab and provide healthy entertainment to the people of Southern Punjab. It will also open multiple avenues between Baluchistan and Punjab, which will further cement national development and cohesion.

5.12 *Weak I & P Department*

5.13. In order to proudly manage the "World's largest contiguous irrigation network," I & P

[25] On a private visit for the members of the Tribunal and its secretariat which was completely funded by the Chairman of the Tribunal in his personal capacity.
[26] an hour and half drive from D G Khan.

department requires immediate reengineering and reform. It has to be the flagship department of the Government of the Punjab.

5.14. "Water" being the most valuable resource of the future (not so distant future) – Irrigation Department must procure and acquire the best of the best human resource available within the Provincial bureaucracy. Able, educated and well trained officers need to fill this department. The current state of affairs is destined for a disaster if nothing is done soon.

5.15. Irrigation department must be known for its technical ingenuity and *avant garde* research capabilities. Irrigation in the modern world by any measure is a highly technical field requiring constant innovation and research besides selection of the best minds.

5.16. Our economy rests on Agriculture and cannot progress unless complimented by a robust, modern and innovative irrigation system. I & P Department cannot be equated with just any other department and therefore requires immediate reform and uplift.

5.17. The administrative Secretary has been most useless in the recent floods. The top managerial structure needs a rethought. A Secretary and a special secretary team might be more effective, with the special secretary being a technical irrigation person.

5.18. The historic Irrigation research Institute must be strengthened and its lost glory be restored. Reliance on consultants must be successively reduced. Development must be sustainable, driven by passion and must factor in homespun wisdom.

5.19. Irrigation Department must closely work with the engineering universities of the country to attract its best minds and be current with the recent developments in science, climatology, irrigation and agriculture.

5.20. Best officers (civil engineers only) must be posted on the Barrages. This field formation must be immediately revisited so that a team of abler men is holding guard at the barrages before the start of the Flood Season 2011.

5.21. The job description of various engineering cadres must be clearly defined (if not already done) alongwith required minimum qualification. No officer should be posted to any position without having requisite minimum qualification (for example Mechanical Engineer to be posted on post suited for a civil engineer and vice versa).

5.22. We noticed that XEN appointed at Taunsa Barrage to be on LOOK AFTER charge and holding other charges as SDO. Secretary I & P Department deposed that most of the officers have adhoc promotions. Munir Anjum held the posts of SDO Headworks and Bunds besides a look after charge as an XEN. This needs to go. Proper Service Rules need to be introduced and team heading Barrages must be confirmed and duly promoted officers holding just one charge. Officers appointed must not be transferred or disturbed during the Flood Season.

The suspension of the XEN at Taunsa Barrage on 1-8-2010[27] during the height of the flood season by the Chief Minister, Punjab on a complaint of a local is deprecated.

5.23. Postings on the Barrages must be incentivized and made more attractive.

5.24. XENs and SDOs on Barrages must pass the Fit And Proper Test.

5.25. Continuing local and international training/ capacity building in Barrage regulation and flood management be conducted.

5.26. Severe departmental penalties to be provided for gross negligence in managing floods.

5.27. Vacant posts of engineers must be filled immediately through Punjab Public Service Commission and process should be regularized in future so that there should not be discontinuity for any trained engineer on the job.

5.28. *INEFFECTIVE FFC*

5.29. The current Chairman and the previous Chairmen are accountable for their failed stewardship of the Commission since 1977. The country does not have an Integrated Flood Management Plan - this omission is criminal and the Chairmen must be held accountable for it. We recommend the Federal Government to hold a detail audit of FFC by panel of experts including members of the civil society to assess the performance of FFC since its inception. Why has FFC failed to develop a Flood Management Plan and how and why has the FFC continued to approve localized flood sector schemes[28] without first assessing their need in the larger context of the Flood Management Plan ?

5.30. FFC needs to be pulled out of its cocoon – it is not to act as a lame secretariat or a post office for the PIDs but must immediately assume its real role of a principal flood sector authority of the country. It is recommended that Federal Government must ensure that FFC develops the first ever National Flood Management Plan before the start of the next flood season and shares it with the flood managers of the provinces. In doing so, FFC is to have a participatory approach and should involve the local residents of the area. FFC must display the said PLAN on its website for wider dissemination.

5.31. Federal Flood Commission has to be made accountable for failing to develop a National Flood Management Plan since its inception in the year 1977.

5.32. Federal Flood Commission simply rubber stamps flood sectors schemes prepared at the end of every flood season by the zonal officers of the irrigation department. This is not

[27] when the Barrage was faced with exceptionally high flood.
[28] mostly driven or supported by the local politicians.

the role of FFC. Federal Government must immediately pull up this apex flood sector institution to perform its role under the law.

5.34. FFC must also place on its website all the schemes approved along with their budget so that flood sector work remains within public domain and subject to open criticism.

5.35. *INTERGATION AND COORDINATION WITH OTHER KEY DEPARTMENTS.*

5.36. Key departments to gravitate around the Irrigation Department and develop a joint and an integrated flood management support system.

5.37. Flood Management Plan to assign specific roles to key departments so that departmental energies are amalgamated and flood preparedness and flood fighting response is simultaneous and in unison.

5.38. FFC & I & P Department to play a central role in bringing other departments together to attend to a common flood management plan.

6. DEVELOPING AN INTEGRATED FLOOD MANAGEMENT PLAN (Chapter-9)

6.1. *INTEGRATED FLOOD MANAGEMENT PLAN*[29]

6.2. *Suggestions and recommendations made above* may be considered as an integral part of these Policy Recommendations.

6.3. *The new paradigm:* Floods are part of a natural cycle that can never be fully controlled. "Flood control" is therefore a futile terminology and a counter productive mandate. The future is to think of "Flood Mitigation" or "Flood Risk Management" or "Flood Resilience." Our flood managers should consider this new paradigm as a starting point in developing an integrated flood management plan.

6.4. *Broader set of objectives:* While flood manager in the past have focused on structural and non-structural measures to protect and mitigate flood, a broader set of objectives need to put on the table. While structural safety of the barrages and training works is critical, human safety, protection of human shelters, safeguards for agriculture and fisheries, roads, ecosystems, health, and biodiversity need equal attention.

6.5. *Non-structural measures* Ecologically friendly non-structural measures for flood mitigation measures like afforestation of the watershed and the riverine belt, developing and effectively using lakes, depression and retention pools along the river.

6.6. *Flood Forecasting:* Better flood forecasting is required. Hydro-meteorological forecast needs to assess floods on the basis of precipitation- in the air. Radars and other equipment which was missing this year needs to be immediately procured so that the upper catchment area of River Indus is fully covered.

6.7. *Early warnings* by PMD need to be relayed on TV , radio and website. Early warnings must also be in vernacular so that it is understandable and effective.

6.8. *Land use and Flood Plain Management:* Flood plains are the hardest hit during the floods. Still there is no land use or flood plain management regulation. As population increases, human settlements and agriculture in flood plain will increase and so will loss to human life and property. The regulations for proper land use and other related issues in flood plains should be made on priority basis with the consent of stakeholders. Emphasis should be laid on proper implementation of these regulations in letter and spirit.

6.8. *Land use and Flood Plain Management:* Flood plains are the hardest hit during the floods. Still there is no land use or flood plain management regulation. As population increases, human settlements and agriculture in flood plain will increase and so will loss to

[29] This chapter gives valuable foundational inputs for the policy and flood managers to successfully draw up a Flood Management Plan for the country.

human life and property. The regulations for proper land use and other related issues in flood plains should be made on priority basis with the consent of stakeholders. Emphasis should be laid on proper implementation of these regulations in letter and spirit.

6.9.. *Managing Flood Protection Structures:* Structural measures such as embankments suffer from neglect and poor maintenance. More vigilant structural management is required involving participation of the local community. Proper Embankment Maintenance Manual to be developed that carries out a regular check of the embankments round the year. Encroachments from embankments to be removed. All major embankments to be GIS mapped and monitored through remote sensing. Design criteria of the embankments to be ensured according to the latest design manual prepared by FFC.

6.10. *Developing detailed flood regulations or FLOOD MANUAL*

6.11. *Pre-flood preparedness* is the bedrock of any successful flood management plan. The wisdom in Sind Bund Manual, FFC Manual and series of loose leaf guidelines which are mostly unavailable are unknown to many officers and must be developed into a proper MANUAL and religiously followed by the zone during the flood season EVERY YEAR WITHOUT FAIL.

6.12. *Asset management,* environmental protection and health care must be built into the pre flood preparedness manual.

6.13. *The Flood Fighting Plan* must be enforced strictly, with strict penal consequences for non-observance.

6.14. Flood Fighting Plan must be an *integrated plan* worked out with key related departments e.g., Health, C & W, Food, Agriculture, Environment, Wildlife, Civil Administration, Army, Civil Defence, Home Department, 1122, etc.

6.15. *Localized Ownership:* Nazims, DCOs and respectable residents of the Districts to be made a part of the Integrated Flood Management Plan to broaden its ownership and effective implementation.

6.16. Other than the *Breaching Section* on the right side, shadow breaching sections and emergency relief cuts must be chalked out in the plan and clearly visible in the Flood Emergency Map which should be a part of the Flood Fighting Plan. Locals of the area must be included in the preparatory discussions so that their ownership is present at all times.

6.17. This year it was noticed that the morphology of the river changed and the flow of the water was on the left side rather than on the right side. This necessitates to rethink the breaching sections located on the right side only. Should there be breaching sections on both the sides ? (e.g., Taunsa Barrage this year used the left side)

6.18. *FACTORING IN CLIMATE CHANGE*

6.19. The most recent IPCC report states that climate change will be inevitable as present mitigation efforts will not be enough. Therefore, adaptation to climate change is required. As climate change will likely increase the variability of weather, Flood Management Plan should be adaptive to future floods rather than strictly preventive.

Immediate future action

6.20. It is expected that the Provincial Government will immediately set out to develop an Integrated Flood Management Plan, so that the first phase of the Plan can be operationalized in the coming Flood Season-2011[30].

[30] Integrated Flood Management Plan requires constant upgrading and updating and should be considered to be a live document that is improved every year by incorporating the post flood lessons learnt.

CHAPTER 11

The Indus is a foul and perplexing river.[1]

PICTORIAL TOUR

[1] Lieutenant John Wood, 9 February 1836.

Aerial view of Upstream Taunsa Barrage (Muzaffargarh and DG Khan Canals) (22---09---2010)

Aerial View Downstream Taunsa Barrage (22---09---2010)

Aerial View of water entering Kot Mithan from the breached Bund (22---09---2010)

Aerial view of water approaching the city of Kot Mithan (22---09---2010)

Briefing to Tribunal at Jinnah Barrage (01---11---2010)

Downstream view of the gates of the Jinnah Barrage (01---11---2010)

Tribunal examining the destruction of LGB at Jinnah Barrage (01---11---2010)

Small portion of LGB still intact at Jinnah Barrage (01---11---2010)

Damaged quarters of Chinese engineers near RMB Jinnah Barrage, Mianwali (01-11-2010)

Tribunal at Nawab of Kalabagh's guest house damaged by the recent floods, Mianwali (01- 11-2010)

Water Marks of flood inside Nawab Kalabagh's Guest House–Mianwali (01-1-2010)

View of rail cum road bridge from Nawab Kalabagh's Guesthouse-Mianwali (01-1-2010)

Tribunal sitting in the courtyard of Nawab Kalabagh's Guesthouse-Mianwali (01-11-2010)

Probable Flood Levels marked at Nawab Kalabagh's Guesthouse- Mianwali (01-11-2010)

Tribunal getting a briefing at Chashma Barrage (03---11---2010)

Tribunal visiting the structure of Chashma barrage (03---11---2010)

Water flowing through the gate of Chashma barrage (03---11---2010)

Tribunal at Chashma Hydro power station (03---11---2010)

Breached LMB at Taunsa Barrage. (5---11---2010)

Taunsa Barrage – aerial view (22---9---2010)

Tribunal carrying out proceedings at Taunsa barrage (05---11---2010)

Tribunal examining the breached embankment at Abbas Wala (Taunsa Barrage) (05-11-2010)

Breached portion of the embankment at Taunsa (05---10---2010)

View from the Ring Bund of the un-pitched portion of the breached embankment at Taunsa (05---10---2010)

Destructed Road Near Taunsa Barrage (05---11---2010)

Destructed Rail Track near Taunsa (05---10---2010)

Constructed house on embankment near breached portion of Jampur flood bund (06---11---2010)

Tribunal examining the breached Jampur Bund from the Ring Bund (06---11---2010)

Tribunal at Fakhar Flood Bund Mithan Kot (natives) (06---11---2010)

Native showing Flood water marks at Mithan Kot (06---11---2010)

Tribunal at Mishori Bund–off Fakhar Flood bund, Mithan Kot (06---11---2010)

The Secretariat L to R: **Irfan Ahmad Saeed**, Registrar **Shahid Shafi,** Staff Officer **Muhammad Zubair Chughtai**, Civil Judge Kot Adu **Justice Syed Mansoor Ali Shah**, Chairman **Iqbal Hanif**, P.A. **Muhammad Tahir**, P.A. **Syed Zubair Hussain Shah** P.S. **Farukh Ameen**, Qasid

Chairman Flood Tribunal (centre) at Irrigation research institute (IRI) Nandipur

Tribunal at Irrigation research institute (IRI) Nandipur (23-11-2010) observing physical model of LGB breach at Jinnah Barrage.

Tribunal Members at Taunsa Barrage (05---10---2010)